MIS Quarterly

RESEARCH ARTICLE

MOTIVATING EMPLOYEES TO EXPLORE COLLABORATION TECHNOLOGY IN TEAM CONTEXTS[1]

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Firms are increasing their investments in collaboration technologies in order to leverage the intellectual resources embedded in their employees. Research on post-adoption use of technology suggests that the true gains from such investments are realized when users explore various system features and attempt to incorporate them into their work practices. However, the literature has been silent about how to promote such behavior when individuals are embedded in team settings, where members' actions are interdependent. This research develops a multilevel model that theorizes the cross-level influence of team empowerment on individual exploration of collaboration technology. Further, it identifies two cognitions—intention to continue exploring and expectation to continue exploring—that are oriented toward exploring ways to incorporate implemented technology into daily work routines over time. A 12-month field study of 212 employees in 48 organizational work teams was conducted to test the multilevel research model. The results provide support for the hypotheses, with team empowerment having a positive cross-level influence on intention to continue exploring and expectation to continue exploring and these, in turn, mediating the cross-level influence of team empowerment on individual exploration of collaboration technology.

Keywords: Collaboration technology, IT exploration, extended use, multilevel theory, cross-level mediation, teams, technology use, empowerment, post-implementation, post-adoption use

Introduction

Information technology (IT) investments continue to account for a significant proportion of spending in organizations (Gartner 2014) and collaboration technologies, in particular, have experienced a sharp increase in such investment. For instance, Pfizer invested in collaboration technology to enable its employees to share new product ideas as well as innovative solutions to key business problems (Computer World 2010). A report by Deloitte Consulting (2011) suggests that firms are realizing productivity increases as a result of their collaboration technology investments. Given the significant amounts of investment involved, organizations naturally want to realize returns and this is largely achieved through usage of the technology by employees (Burton-Jones and Straub 2006).

Recent research emphasizes that the true benefits from IT investments accrue from behaviors that users perform in the post-adoption phase of system introduction (e.g., Hsieh et al. 2011; Thatcher et al. 2011). Post-adoption behaviors constitute the technology-related behaviors that users engage in once the system has been implemented (Jasperson et al. 2005). One particular line of inquiry on post-adoption

[1]Sue Brown was the accepting senior editor for this paper; Mike Morris also served as a senior editor during review stages. J. J. Po-An Hsieh served as the associate editor.

The appendices for this paper are located in the "Online Supplements" section of the *MIS Quarterly*'s website (http://www.misq.org).

behavior has focused on technology exploration, in which users expand the scope of system features that they use in their work and attempt to find new ways to incorporate the technology in their tasks (Ahuja and Thatcher 2005; Hsieh et al. 2011; Sun 2012). The focus on post-adoption exploration of technology has been motivated by a recognition that (1) users generally tend to employ a fairly narrow set of features in their work, resulting in significant under-utilization (Jasperson et al. 2005) and (2) the full benefits of a system are more likely to be realized when users explore and take advantage of a broader range of system features to support their work (Ahuja and Thatcher 2005; Hsieh et al. 2011). Despite the growing interest in users' exploration behavior, there remain several opportunities to improve our understanding of the phenomenon.

One important observation of the extant literature on user exploration of technology is that empirical studies have focused exclusively on individual-level interventions (e.g., Ahuja and Thatcher 2005; Magni et al. 2010; Sun 2012). This has provided a useful basis for understanding user technology exploration. However, this extant corpus of work does not provide much guidance on how to promote such behavior in the case of collaboration technology. This is significant for two reasons. First, collaboration technologies are deployed to support teamwork (Alnuaimi et al. 2010; Brown et al. 2010; Maruping and Agarwal 2004) and a majority of organizations now use teams to manage their operations (Ilgen et al. 2005). In such settings, individual members' tasks tend to be intertwined such that the ability of one team member to accomplish his/her task assignment is dependent on the actions of other team members (Ilgen et al. 2005). Additionally, collaboration technologies are social in nature and the effect of their use extends beyond the individual (Brown et al. 2010; Maruping and Agarwal 2004). Therefore, exploring the incorporation of collaboration technology features into task accomplishment can benefit the team as a whole (Zhang et al. 2011) and individual decisions about exploration of collaboration technology need to be considered within the boundaries of the team. Although research recognizes that team-level influences are important in shaping how individuals relate to technology *within* team contexts (e.g., Gallivan et al. 2005) the emphasis has primarily been on the initial adoption decision, leaving no guidance regarding post-adoption use (Maruping and Magni 2012).

Second, because each team will differ in how it incorporates the collaboration technology into its functioning, managers cannot adopt a one-size-fits-all approach to promoting exploration. Therefore, managers need to create conditions that are targeted toward teams while also allowing each individual the latitude to make decisions about performing such activity. Indeed, Markus and Robey (1988) have underscored the need for a multilevel perspective in the study of users' technology behavior, noting that strictly macro-level approaches ignore the individual mental processes that drive technology-related behaviors, while strictly micro-level approaches ignore how macro-level context shapes individual interactions with technology. In team contexts, employees rely on cues from their teammates to develop appropriate attitudes and understand expectations concerning their usage behavior and its consequences (Gallivan et al. 2005; Kang et al. 2012). Thus, considering team-level and individual-level factors is likely to be useful in understanding post-adoption behaviors such as technology exploration in teams.

With these considerations in mind, the objective of this research is to bridge the meso-micro gap in the technology post-adoption domain by examining how the team environment promotes sustained exploration of collaboration technology by individuals in team settings. The management literature suggests that individuals are more likely to proactively engage in performance-enhancing activities when they experience a sense of task motivation (Spreitzer 1995). Spreitzer (1995) shows that empowered individuals are more likely to engage in innovative behaviors in their work. Similarly, prior individual-level information systems (IS) research has suggested that empowering users (e.g., through autonomy) represents an effective approach to promoting exploration and use of technology (e.g., Ahuja and Thatcher 2005; Sun 2012). For the reasons stated earlier, the nature of collaboration technology necessitates a team-level focus in examining empowerment. The organizational literature has evolved to consider empowerment at the team-level (Kirkman and Rosen 1999; Kirkman et al. 2004). A team-level focus on empowerment is more suitable because of the inherent interactive nature and features of collaboration technology. Thus, in this research we examine how instilling a sense of empowerment at the team level can enable individual team members to explore collaboration technology.

In seeking to link team empowerment to individual collaboration technology exploration, we draw upon recent research on behavioral intention and expectation to use a system (see Venkatesh et al. 2008), to identify the cognitions underlying users' exploration of technology, as suggested by Markus and Robey (1988). This effort advances the literature in two ways. First, we extend the literature by examining intention to continue exploring (ICE) and expectation to continue exploring (ECE) as two complementary cognitions about exploration of technology. Second, by taking into account the cross-level mediation mechanism of ICE and ECE, we provide a better understanding on the individual mechanisms through which team empowerment is translated into individual users' exploration of collaboration technology.

Theoretical Background and Hypotheses

Post-Adoption Cognitions and Technology Exploration

Post-adoption refers to

> the myriad feature adoption decisions, feature use behaviors, and feature extension behaviors made by an individual user *after* an IT application has been installed, made accessible to the user, and applied by the user in accomplishing his/her work activities (Jasperson et al. 2005, p. 531).

While this view outlines a variety of underlying factors that affect users' behavior at the post-adoption stage, two main aspects stand out. First, Jasperson et al. (2005) note that at the post-adoption stage, individuals' usage patterns become more complex than simply more use (e.g., longer duration, greater frequency). Therefore, a focus on exploration provides theoretically useful information about *how* individuals make use of the technology in their work rather than simply how long or how frequently they use it (Burton-Jones and Straub 2006). Users may seek to explore the system to see what other system features are available (Sun 2012) and how those features might affect their ability to execute work tasks (Hsieh et al. 2011).

Second, the long-term viability of any system is dependent on users' behaviors over time. This has been well-recognized in the technology use literature beginning with work conducted by Bhattacherjee (2001) on IS continuance. Bhattacherjee argues that organizations only realize value from their IT investments when users engage in ongoing behaviors rather than sporadic use at the post-adoption stage. Subsequent work has sought to identify determinants of IS continuance intentions across a variety of technology platforms including the web (e.g., Limayem et al. 2007; Venkatesh et al. 2011) and mobile technologies (e.g., Hong et al. 2006; Venkatesh et al. 2012). Such a focus on cognitions directed toward ongoing technology-related behavior is particularly well-suited for understanding post-adoption behaviors such as exploration and can lead to insights about how to promote sustained behavior. Given our emphasis on cognitions related to exploration of collaboration technology we integrate this continuance view of users. This is particularly useful because system exploration and use is an ongoing process and, as such, it involves a continuous cycle of interacting with different features, incorporating them into work routines, and then examining additional features (Hsieh et al. 2011; Maruping and Magni 2012; Sun 2012).

Intention and expectation represent two distinct cognitions that drive behavior (Venkatesh et al. 2006). Given our focus on sustained post-adoption behavior, we extend the notion of intention and expectation into the continuance domain. We conceptualize *intention to continue exploring* (ICE) as a user's motivation to engage in sustained exploration of a system to find potential work uses over time. *Expectation to continue exploring* (ECE) is conceptualized as a user's subjective probability of sustaining the exploration of the system and finding potential use based on his or her appraisal of the volitional and non-volitional behavioral determinants. Although ICE and ECE are each expected to influence technology exploration, they do so based on fundamentally different orientations as explained next.

As an intention, ICE reflects a user's internally formulated desire and plan to engage with the technology over a period of time. Intentions generally tend to focus on the *internal* beliefs and motivations that drive behavior (Venkatesh et al. 2006). Like other intentions, this also means that it is driven by volitional factors (Warshaw and Davis 1985a, 1985b). Prior work has suggested that post-adoption behaviors such as exploration tend to be volitional in nature (Ahuja and Thatcher 2005; Magni et al. 2010) although not exclusively so (Jasperson et al. 2005; Thatcher et al. 2011), and it is influenced by internally oriented cognitions (Magni et al. 2010). Similarly, ICE has an internal orientation that emphasizes an individual's desires and motivations to explore a technology.

Jasperson et al. (2005) note that post-adoption behaviors, such as technology exploration, can also be driven by non-volitional factors—particularly in interdependent work contexts. In team contexts, consideration of non-volitional determinants is especially relevant because of the task and outcome interdependence issues discussed earlier and also because collectively held views are likely to have an influence over and above individual volitional factors (Sarker and Valacich 2010). In recognition of the potential influence of non-volitional influences, we introduce ECE which, compared to ICE, has more of an *external* orientation that emphasizes contextual elements in the environment that can promote or impede one's objective over time (Venkatesh et al. 2006). As a subjective probabilistic assessment, ECE involves an individual's use of mental heuristics (e.g., simulation, extrapolation) in estimating the realistic likelihood that one will actually explore the technology over time (Venkatesh et al. 2008). In doing so, the individual considers all of the available information in the environment about the factors that would increase the likelihood of exploring the technology as well as the factors that would reduce that likelihood. For example, although an individual may form an intention to continue exploring the technology, her consideration of the

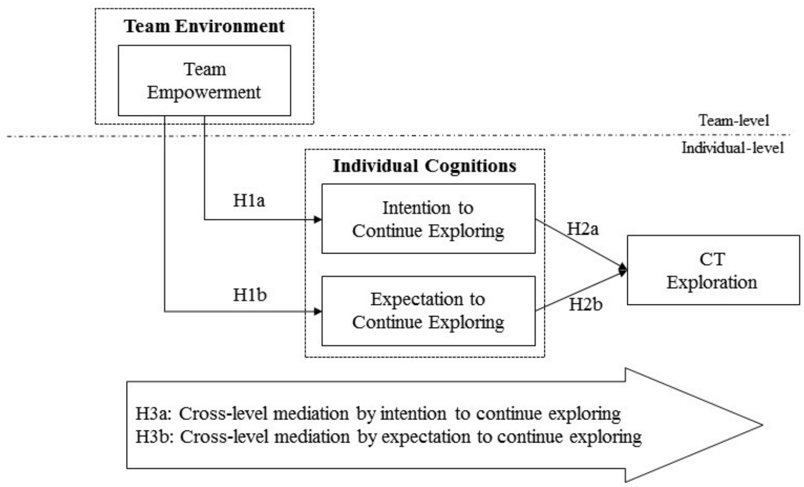

Figure 1. Research Model

external environment might suggest that there are several major projects with aggressive deadlines looming. Therefore, even though she has an intention to explore the technology, she realizes that, realistically, the probability is quite low that she will actually follow through given her anticipated workload.

Taken together, ICE and ECE represent complementary cognitions that drive behavior. The research model is shown in Figure 1.

Cross-Level Influence of Team Empowerment

Team empowerment is defined as the collective motivational state experienced by team members as a result of a positive orientation toward the work environment (Kirkman and Rosen 1999; Mathieu et al. 2006). Team empowerment has four dimensions: potency, meaningfulness, autonomy, and impact (Kirkman and Rosen 1999). Potency represents the extent to which a team believes that it can be effective in anything it sets out to accomplish (Kirkman and Rosen 1999). Meaningfulness reflects team members' experience of their task assignments as being important and worth pursuing (Hackman and Oldham 1980; Spreitzer 1995). As a collective perception, it reflects the extent to which team members develop and share their experiences of task meaningfulness (Kirkman and Rosen 1999). Autonomy refers to the amount of freedom the team, as a whole, has to manage its work-related assignments (Kirkman and Rosen 1999; Thomas and Velthouse 1990). Finally, impact is the degree to which team members feel that the output of their effort has significant implications beyond the team's boundary (Thomas and Velthouse 1990). These properties of team empowerment provide a useful way of assessing motivational drivers at the team level of analysis which may stimulate individual exploration of a technology.

We expect team empowerment to have a cross-level influence on the ICE of individuals embedded in the team. Through a shared sense of potency, team members collectively develop a "can do" attitude toward the individual activities necessary to accomplish the team task (Hu and Liden 2011). Although potency refers to the general task, it necessarily translates to the constituent subtasks (including collaboration technology use) that make up the general task (Mathieu et al. 2006). To the degree that collaboration technology constitutes a means to achieve team task activities, this sense of potency should translate to team member interactions with such technology as well. Individual team members are therefore motivated to explore its features and experiment with ways to incorporate its use into their work practices so that the team can be successful. Research shows that potency motivates people to be proactive in experimenting with actions that improve performance (Kirkman and Rosen 1999; Spreitzer 1995). Prior research also shows that collective perceptions of potency can be contagious, causing individuals embedded in such an environment to act with confidence (Chen and Kanfer 2006). In this case, individuals embedded in such a context should have greater ICE with regard to the collaboration technology because it will enable the team to perform more effectively in the long-run.

When team members collectively experience their work as being meaningful, they are more likely to consider ways to enhance their ability to conduct that work (Mathieu et al. 2006). When the general task is experienced as being meaningful, team members take great care in the specific activities that make up that task. As such, use of collaboration technology to execute task activities should be informed by the sense of task meaningfulness. Team members are motivated to be proactive and persist in identifying how the various features might enhance the team's completion of its tasks. Moreover, each individual has the internal motivation, via ICE, to engage in such exploration on a continuous basis because they know it is meaningful to the team as a whole. Magni et al. (2010) found that expectations about how new technology would affect their ability to do their work positively influenced users' intention to explore. Similarly, in a study of physicians adopting a new computerized order entry system, Liang et al. (2010) found that an orientation toward the importance of the task fueled expectations that the system would improve physician task performance. In contrast, in team contexts where meaningfulness is low, individuals are less likely to form ICE with respect to the technology beyond the basic features already in use because they perceive that other team members view this as unimportant and a waste of time and effort.

Autonomy has been identified as an important precursor to employees' ability and willingness to explore ways to creatively incorporate technology use into their work (Ahuja and Thatcher 2005; Sun 2012). At the team level, autonomy means that the team is free to decide how to make use of the collaboration technology. Such autonomy has been argued to be an important aspect of the environment that encourages individuals to engage in experimental endeavors such as technology exploration. For example, Ahuja and Thatcher (2005) argued that employees embedded in work contexts that provide autonomy were more likely to try to innovate with technology compared to employees embedded in work contexts with little or no autonomy. Consequently, we expect that team members embedded in teams that experience autonomy would be more willing to engage in ongoing efforts to explore the technology.

Finally, when teams feel that their work has a significant influence on the organization's ability to achieve its objectives—via impact—they are more likely to experience a sense of responsibility for playing their role to support the organization (Kirkman and Rosen 1999). Viewed from an instrumental perspective, the collaboration technology represents a means for enhancing the team's ability to impact the organization through its output. Research has shown that use of collaboration technology enhances the team's impact (Zhang et al. 2011). Prior research shows that exploration intentions are fueled by productivity-enhancing, instrumental motivations (e.g., Magni et al. 2010; Nambisan et al. 1999). As such, individuals embedded in teams that experience a sense of impact are more likely to develop ICE because it enables members of the team to identify ways of leveraging the technology to enhance the team's impact through its outputs.

> *H1a: **Team** empowerment will have a positive cross-level influence on **individual** intention to continue exploring (ICE) collaboration technology.*

We expect team empowerment to shape individual team members' ECE. In contrast to ICE, however, the underlying arguments for ECE are associated with externally oriented considerations that affect the self-estimated probability of engaging in the behavior. Previous research shows that potency motivates members to behave with tenacity and persistence in the face of obstacles and difficulties (Bandura1986), stimulating their expectation of overcoming such obstacles. This generalized potency motivates actions taken on each of the specific subtasks that make up the team's general task (Mathieu et al. 2006). To the extent that the collaboration technology represents a means to achieving greater effectiveness in team work (Zhang et al. 2011), and considering exploration of technology as a behavior that goes beyond members' duties, individuals embedded in teams with shared potency should estimate a high probability of executing the exploration behavior that will enable the team to achieve that end, despite any potential barriers that might exist (Venkatesh et al. 2008). In essence, because the team environment supports the outcome of such behavior, individuals embedded in the team environment should estimate a greater likelihood of being able to successfully engage in the behavior (Venkatesh et al. 2006).

Exploration of technology requires individual team members to take time out of their work schedules to engage in such activity. Other job responsibilities could potentially impede individuals' efforts to explore the technology. A shared sense of performing meaningful task activities is likely to enhance the persistence and tenacity needed for technology exploration, thereby increasing team members' expectations of system exploration. By factoring in potential external environmental contingencies, team members who are embedded in teams that experience their tasks as meaningful are willing to persist in the face of impediments that may otherwise prevent them from taking time to explore the new technology (Venkatesh et al. 2008). Individuals develop ECE because they know that exploration of the technology's features is a path to fulfilling the team's meaningful work.

When the team has autonomy to decide whether and how it will utilize the collaboration technology, individual team members expect to be able to explore the technology. Individual engagement in exploration of the technology gives them the opportunity to shape just how the team will utilize the technology to support its activities. Additionally, team autonomy ensures that individuals are embedded in a context where the probability of being able to self-determine how the technology will be incorporated is higher. Indeed, prior research suggests that the probability of individuals engaging in creative activities, such as innovating with technology, is correlated with their perception of the freedom and opportunity to do so (e.g., Ahuja and Thatcher 2005). Therefore, individual team members in autonomous teams should develop higher ECE compared to individuals embedded in less autonomous teams.

Finally, a sense of team impact should enhance individual team members' ECE. To the degree that team members believe that their team's work has an influence throughout the broader organizational environment, any solutions that enhance the team's ability to complete work that has a broader organizational impact should be seen as desirable. In fact, since they are the recipients of the team's output, external constituents may encourage and support the team's effort to explore value-adding uses of the technology by creating resource facilitating conditions (Brown et al. 2010; Sun 2012). The impact of the team's output and the associated organizational support for efforts to enhance such output should give individual team members an increased expectation of being able to engage in ongoing efforts to explore the technology in service of this overall objective.

> *H1b: **Team** empowerment will have a positive cross-level influence on **individual** expectation to continue exploring (ECE) collaboration technology.*

Effects of Intentions and Expectations to Continue Exploring on Technology Exploration

Intentions serve as an important precursor to users' behaviors (Davis et al. 1989; Venkatesh et al. 2003; Venkatesh et al. 2008; Venkatesh et al. 2006). This link between intentions and behavior has been demonstrated across a wide variety of behaviors (Warshaw and Davis 1985a, 1985b) including technology use (Venkatesh et al. 2003; Venkatesh et al. 2008). Drawing on these prior findings, we argue that individuals who develop ICE will engage in exploration of the collaboration technology. When individual team members formulate such plans, they take the time to explore the system when the opportunity presents itself. Through ICE, individual team members experiment with features to support coordination of tasks with their teammates, sharing of information with teammates, searching for information, integration of data, and communication with teammates. Incorporating such features enables individual team members to be more effective in managing their interdependent work—an important factor in team settings (Burton-Jones and Gallivan 2007; Zhang et al. 2011). Therefore, ICE enables individual team members to explore and expand the repertoire of collaboration technology features that are used to support work in team contexts.

> *H2a: Intention to continue exploring (ICE) will positively influence collaboration technology exploration.*

Similar to intention, behavioral expectation serves as an important precursor to behavior in general (Warshaw and Davis 1985a, 1985b) and system use in particular (Venkatesh et al. 2008; Venkatesh et al. 2006). Individual team members with greater ECE form an appraisal of the team environment that makes engaging in exploration highly probable. It reflects a realistic assessment of whether the individual will indeed be able to engage in exploration of the collaboration technology. Given the probabilistic assessment that underlies ECE, individual team members with high ECE are more likely to engage in exploratory activities with the system. This is likely to be driven by expectations of the task requirements in a team setting. In team contexts, the activities associated with collaboration technology broadly tend to relate to collaboration, coordination, and communication (Zhang et al. 2011). Thus, ECE will tap into the likelihood that an individual team member explores and expands her use of collaboration technology to support these activities because the team environment necessitates such activities.

> *H2b: Expectation to continue exploring (ECE) will positively influence collaboration technology exploration.*

Cross-Level Mediation Effects

ICE and ECE are expected to mediate the cross-level effects of team empowerment on individual exploration of collaboration technology (i.e., they are the mechanism through which team empowerment translates into technology exploration behavior). Although team empowerment represents the collective motivation experienced in the team, individual team members are the ones who make the decision on whether, and how, to act. As much of the technology adoption and use literature has demonstrated, individual cognitions play a critical role in driving user behavior and associated outcomes (Venkatesh et al. 2003). Further, recent research suggests that team empowerment itself does not yield outcomes. Rather, it is the proactive behaviors that such collective motivation promotes that yield outcomes (e.g., Mathieu et al. 2006; Seibert et al. 2011; Zhang and Bartol 2010). In the context of collaboration technology, team empowerment promotes greater exploration by prompting individual team members to engage with the technology—via ICE and ECE—in an effort to integrate more of its features into their work. Given the divergent orientations of ICE and ECE, these represent two distinct theoretical mechanisms that link team empowerment to individual collaboration technology exploration.

Team empowerment taps into the internal motivational orientation of ICE in shaping individuals' collaboration technology exploration. The motivational underpinnings of team empowerment help to shape the motivations and beliefs reflected in ICE. Such reasoning is consistent with prior work regarding the internal motivations behind technology exploration (Li et al. 2013; Magni et al. 2010). This represents an internal pathway through which team empowerment affects individual collaboration technology exploration.

> H3a: *Intention to continue exploring (ICE) will mediate the cross-level influence of* ***team*** *empowerment on* ***individual*** *collaboration technology exploration.*

While ICE represents the internally oriented mediating mechanism that links team empowerment to individual collaboration technology exploration, ECE represents the externally oriented mediating mechanism. Team empowerment simultaneously represents the task motivation experienced by the team as well as the nature of the team environment in which an individual is embedded. As a reflection of the team environment, team empowerment serves as an external contextual factor that promotes collaboration technology exploration. According to Venkatesh et al. (2008), such external environmental factors should affect individuals' ECE. Through ECE, individuals recognize that their team environment—via team empowerment—is supportive of innovative behaviors, such as collaboration technology exploration, which have the potential to enhance the team's ability to accomplish its work tasks.

> H3b: *Expectation to continue exploring (ECE) will mediate the cross-level influence of* ***team*** *empowerment on* ***individual*** *collaboration technology exploration.*

Method

Sample and Participants

To test our research model, we conducted a field study in two large firms. Both firms had recently implemented a new collaboration technology. The system was introduced to support integrated management of all technology-mediated communications and coordination among employees. While use of the system was strongly encouraged and represented the official system for technology-mediated communication and coordination, there was no policy in place for noncompliance making system use voluntary. In each of the participating firms, employees were organized into teams to accomplish work tasks.

Across the two firms, a total of 810 employees comprising 129 teams were targeted for participation in the study. Data were collected in two waves. In the first wave (time 1), 410 usable responses from 69 teams were received. In the second wave of data collection (time 2), which occurred several months after the first wave, 269 usable surveys from members of 48 teams were completed, yielding individual-level and team-level response rates of 33 percent and 37 percent, respectively.[2] In order to assess the appropriateness of our sample for the study of exploration continuance, we examined respondents' exploration behavior between the time 1 and time 2 measurement periods (Hsieh et al. 2008). A total of 212 respondents (approximately 78% of the 269 respondents who completed time 1 and time 2 surveys) reported having done some exploration since receiving training on the system, albeit to varying degrees. Hence, we dropped the 57 respondents who did not engage in exploration behavior and focused our analysis on the 212 who had engaged in exploration behavior during this period.

[2]In order to assess whether nonresponse bias was a concern, we compared employees who participated in both waves of data collection with employees who only participated in the first wave and found no significant differences in demographics including age ($t = 1.89$, $p > .10$), gender ($t = 1.47$, $p > .10$), and organizational tenure ($t = 0.44$, $p > .10$). The analyses and hypothesis tests are based on the sample of employees who responded to both time 1 and time 2 surveys. Further, in order to assess nonresponse bias among those in the sampling frame of 810 employees, we compared early responders to late responders. Prior work suggests that those who respond to the survey late are likely to be more similar in profile to nonresponders than to early responders (Armstrong and Overton 1977). Mean comparisons of late and early responders did not reveal any significant differences in age ($t = 1.74$, $p > .10$), gender ($t = 1.35$, $p > .10$), and organizational tenure ($t = 1.07$, $p > .10$).

Table 1. Sources and Reliabilities for Main Constructs in the Model

Construct Name	Source	Reliability
Collaboration technology (CT) exploration	We adapted Nambisan et al.'s (1999) scale for intention to explore by asking participants about their actual CT exploration behavior. Based on this adaptation, the scale captures the extent to which individuals explored the system for application in their work.	α = .75
Intention to continue exploring (ICE)	We employed Nambisan et al.'s (1999) three-item scale. The scale captures the extent to which individuals have formulated plans to explore the technology as part of their ongoing routine activity in interacting with the system, reflecting their willingness to continue to examine ways in which the technology can be incorporated into their work.	α = .96
Expectation to continue exploring (ECE)	We used a three-item scale.† The scale captures the user's subjective probability of exploring the technology for application in their work on an ongoing basis. The scale was adapted from Venkatesh et al.'s (2008) behavioral expectation measure and was adapted to reflect continued technology exploration as the referent behavior.	α = .84
Team empowerment	We measured team empowerment using a 12-item scale from Kirkman et al. (2004) to capture the four dimensions of team empowerment: potency, meaningfulness, autonomy, and impact.	α = .93

Notes: 1. At the individual level we controlled for gender, age, organizational tenure, perceived usefulness, personal innovativeness in IT (PIIT), facilitating conditions and training.
2. At the team level we controlled for task interdependence, geographic dispersion and team size. A list of the measurement items and scale reliabilities is included in Appendix A.

†Although Venkatesh et al.'s (2008) scale for behavioral expectation includes four items, we dropped one item ("I will continue exploring other ways that [system name] may enhance my work effectiveness") that appeared to overlap with the conceptual definition of intention to explore. It was preferable to drop the item in the interest of avoiding ambiguity between the ICE and ECE constructs.

Measurement

The constructs in the model were operationalized by using existing scales. The sources and reliabilities for the scales used to measure the main constructs in the model are shown in Table 1. Team empowerment was conceptualized at the team-level of analysis. However, the construct was measured from individuals within each team by employing a referent-shift consensus method in wording the items for the team-level construct (see Chan 1998). Given this approach, it was necessary to aggregate the individual-level scores to create a team-level score for team empowerment. Thus, we report on the within-group agreement index ($r_{wg(j)}$), and intra class correlation coefficients (ICC) in justifying aggregation of individual-level scores to the team level for team empowerment. The $r_{wg(j)}$ indicates the extent to which team members' responses to the survey questions converge greater than would be expected by chance (James et al. 1984). The ICC(1) reflects between-team variance in individual responses and the ICC(2) indicates the stability of the team-level means (Bliese 2000). In field research, ICC(1) values as low as .06 and ICC(2) values greater than .50 have been deemed acceptable (e.g., Liao and Chuang 2004).

The mean $r_{wg(j)}$ for the team empowerment scale is .93, exceeding the commonly accepted threshold of .70 and indicating strong agreement (James et al. 1984; Klein and Kozlowski 2000). A one-way ANOVA using team membership as the factor was conducted to determine whether there were significant differences in ratings of team empowerment across teams. Results of the one-way ANOVA indicate significant differences across teams in reported levels of team empowerment ($F_{48, 210} = 3.65$, $p < .01$). The ICC(1) and ICC(2) values for this scale are .17 and .68, respectively, suggesting adequate between-team variability and stability of team-level means in responses about team empowerment. Taken together, this information suggests that it is appropriate to aggregate the individual scores. Thus, we averaged the individual team empowerment scores within each team to compute a single team-level score. Although there is general empirical support for treating team empowerment as a unidimensional construct (e.g., Polities et al. 2012; Seibert et al. 2011), we believe there is some value in assessing the influence of each subdimension in this new context of collaboration technology use in teams. Hence, we conducted supplementary analyses on which we report in Appendix D.

Table 2. Correlations and Descriptive Statistics

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Individual Level															
1. CT exploration$_{T2}$	**.75**														
2. Intention to explore (ICE)$_{T2}$	.51***	**.96**													
3. Expectation to explore (ECE)$_{T2}$	.44***	.63***	**.84**												
4. Organizational tenure	.02	-.10*	-.02	-											
5. Age	-.05	-.09	-.05	.59***	-										
6. Gender	-.04	.04	.07	.08	-.04	-									
7. Perceived usefulness	.15*	.16*	.09	-.12*	.00	.03	**.88**								
8. Facilitating conditions	.23**	.36***	.36***	-.01	-.05	-.04	.19**	**.70**							
9. PIIT	.26***	.29***	.44***	-.12*	-.12*	.12*	-.04	.12*	**.85**						
10. Intention to explore$_{T1}$	.23**	.06	.14*	-.12*	-.13*	.11*	.23***	-.05	.17*	**.94**					
11. Training	.34***	.21**	.26***	.05	.08	-.01	.07	.19**	.08	.07	**.86**				
Team Level															
12. Team empowerment	.06	.29***	.23***	-.09	-.16**	.01	.02	.34***	.01	.02	.04	**.93**			
13. Team size	.02	.03	.04	-.01	.12*	-.06	-.02	-.03	-.13*	-.02	.01	-.08	-		
14. Task interdependence	.15*	.20**	.15**	-.12*	-.09	.06	.03	.19**	.05	.02	.03	.42***	.11	**.82**	
15. Team dispersion	.07	.08	.09	.05	.14*	.03	-.01	-.01	-.04	.01	.14*	-.27***	.50***	-.15*	-
Mean	3.34	3.24	3.24	6.5	41.8	0.57	2.87	3.18	3.05	3.94	2.88	3.44	8.85	3.11	2.84
Standard deviation	1	0.87	0.83	0.96	8.76	0.5	0.8	0.82	0.55	0.68	0.85	0.36	5.19	0.35	1.74
Average variance extracted (AVE)	0.61	0.88	0.64	-	-	-	0.59	0.54	0.58	0.84	0.62	0.56	-	0.61	-
Square root of AVE	0.78	0.94	0.8	-	-	-	0.77	0.73	0.76	0.92	0.79	0.75	-	0.78	-

Notes:
1. n = 212 (individual level), n = 48 (team level).
2. T1 = time 1 (1.5 months post-implementation) and T2 = time 2 (13.5 months post-implementation).
3. Gender is dummy coded (0 = women, 1 = men).
4. Bolded values along the diagonal are construct reliabilities.
5. *p < .05, **p < .01, ***p < .001.

Results

Tests of Cross-Level and Within-Level Direct Effects

A confirmatory factor analysis of substantive variables in the model suggested that there was sufficient convergent and discriminant validity to the measures. Specifically, all items had higher loadings on their respective constructs and lower cross-loadings on other constructs (Chin 1998). In addition, the average variance extracted (AVE) for each of the constructs is above the recommended threshold of .50. Finally, the square root of the AVE for each construct is greater than the inter-construct correlations, providing further support for discriminant validity. Results of the factor analysis are shown in Appendix B. The correlations and descriptive statistics are shown in Table 2.

Given the multilevel nature of our research model and hypotheses, as well as the hierarchically nested structure of the data, it was necessary to use a random coefficient modeling (RCM) technique to test the model. RCM enables researchers to model and examine relationships that span levels of analysis and can meaningfully partition the variance components in outcome variables (Raudenbush and Bryk 2002). In multilevel analysis, it is presumed that some of the variance in the outcome variable of interest can be attributed to between-team differences while some of the variance is attributable to within-team (between-individual) differences (Raudenbush and Bryk 2002). This is accomplished by estimating an unconditional model (where there are no predictors) and examining the variance components (Raudenbush and Bryk 2002). The proportion of variance that is attributable to between-team differences is determined by dividing the team-level variance by the total variance.

Table 3. Results of Multilevel Analyses Predicting Exploration Intentions, Exploration Expectations and Collaboration Technology (CT) Exploration

Variables	Intention to Continue Exploring	Expectation to Continue Exploring	CT Exploration	
Individual Level: Controls				
1. Company	.01 (.15)	.01 (.15)	.16 (.13)	.17 (.13)
2. Organizational tenure	-.03 (.06)	.02 (.06)	.14† (.08)	.12† (.07)
3. Age	-.01 (.01)	-.01 (.01)	-.02* (.01)	-.01 (.01)
4. Gender	.18* (.08)	.16* (.08)	.24* (.12)	.24* (.11)
5. Perceived usefulness	.15* (.07)	.03 (.06)	.10* (.04)	.05 (.07)
6. Facilitating conditions	.22** (.07)	.22** (.06)	.17* (.08)	.04 (.08)
7. PIIT	.39*** (.10)	.61*** (.09)	.38*** (.08)	.16* (.08)
8. Intention to explore$_{Time1}$	.02 (.05)	.12* (.05)	.27** (.09)	.26** (.08)
9. Training	.12* (.06)	.15* (.06)	.30*** (.07)	.23** (.07)
Individual Level: Predictors				
10. Intention to continue exploring **(H2a)**				.23** (.07)
11. Expectation to continue exploring **(H2b)**				.17* (.08)
Team Level: Controls				
12. Team size	-.01 (.01)	.01 (.01)	.02* (.01)	.02* (.01)
13. Team dispersion	.08* (.04)	.06* (.03)	-.03 (.03)	-.03 (.05)
14. Task interdependence	.18* (.08)	.08* (.03)	.38* (.19)	.30† (.17)
Team Level: Predictors				
15. Team empowerment **(H1a, H1b)**	.50** (.17)	.40* (.16)	.10 (.08)	.14 (.10)
R^2	.28	.36	.30	.40
F	5.93***	8.64***	5.96***	9.35***
χ^2	38.35*	30.05*	39.05**	42.17**
Deviance	613.01	500.10	731.56	709.22

Notes:
1. Individual-level n = 212; team-level n = 48.
2. Standard errors are reported in parentheses; tests of coefficients are one-tailed as hypotheses are unidirectional.
3. Gender is dummy coded (0 =women, 1 = men) and company is dummy coded (0 = firm 1, 1 = firm 2).
4. †p < .10, *p < .05, **p < .01, ***p < .001.

To conduct these analyses and test our model, we used the nonlinear and linear mixed-effects (nlme) package within the open source statistical software R (Bliese 2012; Pinheiro and Bates 2000). ICE had an ICC(1) of .12 (χ^2[48] = 70.22, p < .05), ECE had an ICC(1) of .10 (χ^2[48] = 53.40, p < .05), and CT exploration had an ICC(1) of .17 (χ^2[48] = 51.01, p < .01). This suggests that an adequate proportion of the variability in these individual-level (level-1) variables could be attributed to between-team differences and that multilevel analysis is appropriate. The results of the RCM models are presented in Table 3.

As the results in Table 3 show, the model predicting user ICE explained 28 percent of the total variance (χ^2[44] = 38.35, p < .05).[3] In H1a, we predicted that team empowerment would have a positive cross-level relationship with ICE. Consistent with this hypothesis, the coefficient for team empowerment is positive and significant in predicting ICE (γ = .50, p < .01). The model predicting ECE explained 36 percent of the total variance (χ^2[44] = 30.05, p < .05). H1b posited a positive cross-level relationship between team empowerment and ECE. As the results show, the coefficient for team empowerment is positive and significant in predicting ECE (γ = .40, p < .05), providing support for H1b.The model explained 40 percent of the variance in CT exploration (χ^2[44] = 42.17, p < .01). H2a stated that ICE would positively influence CT exploration. As the results in Table 3 indicate, ICE has a positive and significant relationship with CT exploration (β = .23, p < .01), providing support for H2a. H2b predicted a positive relationship between ECE and CT exploration. This hypothesis is supported, with ECE having a positive and significant relationship with CT exploration (β = .17, p < .05).

Tests of Cross-Level Mediation

H3a and H3b were cross-level mediation hypotheses. We posited that ICE (H3a) and ECE (H3b) would mediate the cross-level effects of team empowerment on CT exploration. Because our research model involved multiple mediators (ICE and ECE), we used the multiple mediator analysis advocated by Preacher and Hayes (2008). This approach has several advantages that are well-suited for testing our model. First, the multiple mediator approach is able to estimate indirect effects for each mediator while accounting for covariance between the mediators. Second, this approach relies on bootstrapping and, therefore, does not require large sample sizes (Preacher and Hayes 2008; Shrout and Bolger 2002).[4] Third, since indirect effect estimation involves product of terms, they tend to have a skewed sampling distribution. The confidence intervals (CI) computed by the bootstrapping approach are robust to such non-normal distributions (Wood et al. 2008). To assess the robustness of the multiple mediator analysis to multiple levels, we also performed meso-mediation testing in which the independent variable and the dependent variable reside at different levels of analysis (Mathieu and Taylor 2007). Results are reported in Appendix C.

Following Preacher and Hayes, we estimated the indirect effects using 5,000 bootstrap samples. The results of the multiple mediators test are presented in Table 4. Coefficient estimates of the indirect effects are statistically significantly different from 0 when the CI does not include 0. H3a predicted that team empowerment would have a positive indirect effect on CT exploration through ICE. As the results in Table 4 show, the indirect effect of team empowerment on CT exploration through ICE is positive and significant (indirect effect: .24, bias corrected 99% CI: .06, .50). Therefore, H3a receives support. Similarly, the results in Table 4 show that team empowerment has a positive indirect effect on CT exploration through ECE (indirect effect: .10, bias corrected 99% CI: .01, .27), providing support for H3b. Results from Mathieu and Taylor's (2007) meso-mediation test yielded a similar pattern of results (see Appendix C).

[3]It is important to note that RCM does not provide a statistic equivalent to R^2 in ordinary least squares regression (Snjiders and Bosker 1999). Instead a deviance statistic is supplied, which indicates model fit, with lower values suggesting greater model fit. Snijders and Bosker (1999) developed a Pseudo-R^2 (~R^2), which uses the proportional reduction in level-1 and level-2 error variance (from an unconditional model) when predictors are entered into the model (a conditional model). However, Snijders and Bosker and others acknowledge that this approach is tenuous as it is prone to under- or over-estimating true effect sizes of cross-level relationships. Use of the total R^2 computed using the cross-level operator (CLOP) analysis approach developed by James and Williams (2000) has been argued to provide a better estimate of the variance explained. Consequently, in Table 3 we report the total R^2 based on the James and Williams approach.

[4]Our cross-level mediation model involves mediators and an outcome variable at the individual level. One potential issue is that the relationship between the mediators and the outcome variable could vary across teams (i.e., the relationship could be stronger in some teams and weaker or of opposite direction in other teams) and it can result in inconsistent indirect effects across teams. This is often a concern in 2-1-1 mediation models (Zhang et al. 2009). We determined the extent to which this could be a concern in our mediation analysis by comparing a model in which the slopes for ICE and ECE were treated as fixed effects with a model in which the slopes were allowed to randomly vary. The results show that the slope variances for ICE (coeff. = .04, p > .10) and ECE (coeff. = .02, p > .10) were not statistically significantly different from 0 and the random slope model was not a statistically significantly better fit to the data than the fixed slope model ($deviance_{fixed}$ 719.87 versus $deviance_{random}$ 718.44, χ^2 = 1.75, p > .10). Therefore, we have confidence that between-team differences were not a threat to our cross-level mediation results.

Table 4. Results of Cross-Level Multiple Mediator Analysis Predicting CT Exploration

Independent Variable (IV)	Mediator	Indirect effect	Bias corrected 99% CI for indirect effect		Contrast	Bias corrected 99% CI for contrast		IV → Mediator	Mediator → Dependent variable
			Lower	Upper		Lower	Upper		
Team empowerment	ICE **(H3a)**	.24 (.09)	.06	.50	-.14 (.04)	-.41	-.06	.50**	.48***
	ECE **(H3b)**	.10 (.04)	.01	.27				.40**	.24**
Autonomy	ICE	.19 (.05)	.01	.45	-.11 (.03)	-.37	-.08	.41**	
	ECE	.08 (.02)	.01	.25				.35**	
Potency	ICE	.19 (.07)	.03	.39	-.11 (.02)	-.33	-.05	.40**	
	ECE	.08 (.03)	.01	.21				.32**	
Meaningfulness	ICE	.13 (.04)	.01	.30	-.08 (.02)	-.25	-.01	.27**	
	ECE	.05 (.01)	.01	.17				.22**	
Impact	ICE	.23 (.05)	.08	.43	-.15 (.09)	-.38	-.03	.47**	
	ECE	.08 (.02)	.01	.22				.34**	

Notes: 1. ICE = intention to continue exploring, ECE = expectation to continue exploring, IV = independent variable.
2. Bias corrected confidence intervals (CI) for indirect effects and contrasts are based on 5,000 bootstrap samples.
3. In each model control variables were entered as covariates.
4. Standard errors are shown in parentheses.
5. $^{\dagger}p < .10$, $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

To probe the indirect effects further, we followed Preacher and Hayes and contrasted the strength of the indirect effect of team empowerment through ICE versus ECE. The contrast is performed by constructing CIs around the difference between the indirect effects using bootstrap estimates. The difference between two indirect effects is statistically significantly different from 0 if the CI does not include 0. As the results in Table 4 show, there is a difference of .14 (.24 – .10) between the indirect effect of team empowerment through ICE versus ECE. The bias corrected 99% CI indicates that this difference is statistically significantly different from 0 (bias corrected 99% CI: -.41, -.06). This result suggests that team empowerment operates more strongly through ICE than it does through ECE in affecting CT exploration.[5]

Discussion

Theoretical Contributions and Implications for Research

This research makes several important contributions to theory. First, we contribute to the post-adoption use literature by examining the determinants of collaboration technology exploration in a team context. Recent research has been drawing attention to the importance and benefits of such post-adoption use behavior (e.g., Hsieh et al. 2011; Li et al. 2013; Magni et al. 2010; Sun 2012), but these efforts have been focused exclusively at the individual level. Yet, as we noted at the outset, examinations of collaboration technology in team settings require consideration of the team environment as well as the individual cognitions that shape post-adoption behaviors such as exploration. We identified team empowerment as an important team-level determinant of increased collaboration technology exploration. Specifically, we found that individuals embedded in teams with high levels of empowerment tended to engage in greater exploration of the collaboration technology for application in their work activities compared to individuals embedded in teams with low levels of empowerment. These results show that the collective motivation reflected in team empowerment helps to shape individuals' post-adoption behavior and underscores the important role of team context in shaping how individual users utilize technology at the post-adoption stage. It further reinforces Orlikowski and Robey's (1991) argument that people do not work in a vacuum, but instead are influenced by properties of the context in which they operate.

Second, this research contributes to the post-adoption literature on exploration of technology. Prior research on exploration intentions has called for research to identify antecedent conditions that facilitate its development (e.g., Nambisan et al. 1999; Magni et al. 2010). Similarly, in

[5]Results of the supplementary analysis of the indirect effects of the sub-dimensions of team empowerment are discussed in Appendix D.

introducing behavioral expectation into the IS domain, Venkatesh et al. (2008) emphasized the need for future research to identify antecedents of the construct. By theorizing and analyzing the effects of team empowerment, we showed how the individual-level cognitions—ICE and ECE—can be shaped by the team environment in which an individual is embedded. Such a result is also particularly relevant for the stream of research on continuance in the IS field. Indeed, we contribute to the call by Limayem et al. (2007) who point to the need for studies that provide a better understanding on how to promote and sustain continued behaviors that may facilitate the exploitation of system features in the long run. The contribution of our study in addressing this call is twofold. First, we showed that a motivational state at the team level can trigger continuance intentions and expectations in individuals, thus demonstrating that contextual characteristics foster long-lasting cognitions that go beyond a one-time event. Second, our study shows that such continuance cognitions are a driving force behind the exploration-oriented behaviors that have been recognized to be critical for the long-term viability of the system and for the realization of the expected benefits (Li et al. 2013).

Third, our identification of two pathways through which team empowerment affects individual technology exploration is noteworthy in that it reflects two different cognitive orientations when relating to collaboration technology at the post-adoption stage. Through the ICE pathway, team empowerment leverages the internally oriented formulation of plans geared toward engaging with the technology (Venkatesh et al. 2008; Venkatesh et al. 2006). ECE represents a pathway that incorporates consideration of the external environment including knowledge of the work routines and daily ebbs and flows of work activity that can affect one's probability of engaging with the technology to find potential work-enhancing uses. These two cognitions fully mediate the cross-level effects of team empowerment on individual collaboration technology exploration, thus uncovering a cross-level chain from team environment → individual exploration cognition → individual collaboration technology exploration. As the results of our contrast of indirect effects showed, team empowerment appears to operate more strongly through the internally oriented ICE than it does through the externally oriented ECE. This suggests that although team empowerment is an element of the team environment (external to the individual), its motivational underpinnings tap into ICE. By embracing multilevel and continuance perspectives, this finding is particularly worthwhile because it complements the results of recent research showing that innovative post-adoptive usage is more likely to be triggered by internal motivational drivers (Li et al. 2013).

Limitations and Directions for Future Research

As with any research, our study has several limitations that must be acknowledged. First, our research used survey methods to measure the various variables in the model. Naturally, this raises concerns about common method variance. However, we followed several steps in our study design to attempt to alleviate these concerns. Some of the variables in the model were measured using multiple respondents within each team (e.g., team empowerment). We also separated the measurement of some of the variables in time. Multiple response formats were also used in the survey (Sharma et al. 2009). Second, although we controlled for a variety of factors at the individual and team levels of analysis, there is always the possibility that other factors, for which we did not account, could influence individual exploration of collaboration technology. We feel that the factors we controlled for at both levels of analysis are reasonable given the sample size and the fact that we collected two waves of data in this field setting.

The findings in this research provide a useful foundation for future research. In this research, we found that team empowerment, although an element of the team environment, tapped more into ICE than into ECE. Moreover, the indirect effect of team empowerment was stronger through ICE. One important direction for future research would be to build on the different orientations of ICE versus ECE. Specifically, future research should begin to examine the nature of the collaborative work that teams perform. Future research would also benefit from examining the downstream outcomes of individual exploration of collaboration technology. In this research, we focused on the top-down effects of team environment on individual exploration of collaboration technology. However, benefits accrue to the team only if discoveries from such exploration proliferate throughout the team as a unit. The process through which such proliferation occurs is a complex one that warrants future study. In contrast to top-down effects such as those examined in this research, bottom-up effects such as those that would be involved in linking individual exploration of collaboration technology to team-level benefits (e.g., more efficient processes) are emergent and unfold over a longer time period (Klein and Kozlowski 2000).

Practical Implications

Our research has several implications for managers. First, our findings suggest that managerial interventions aimed at promoting exploration of collaboration technology need to be directed at *teams* rather than individuals. As tight-knit social collectives, teams are an important entity that shapes and reinforces desirable team member behaviors over time. Thus, teams represent an ideal target through which managers can influence how individual employees engage with implemented collaboration technologies. Second, given the diversity of work practices and norms that organizational teams develop, no one size fits all when it comes to the manner in which teams incorporate the collaboration technology features into their work routines. Managers are encouraged to focus on cultivating a team atmosphere that empowers team members to take responsibility for managing this process. Given the positive motivational atmosphere associated with empowered teams, team members are likely to be positively reinforcing of each other's efforts to engage with the technology. Indeed, Amabile and Khaire (2008) highlight the development of such an atmosphere as being critical to leaders' efforts to encourage employees to be proactive in their creative efforts in the workplace. When team members collectively experience such positive task motivation, they are less likely to resist using the technology, and rather will embrace it due to the sense of "ownership" (via potency, meaningfulness, autonomy, and impact) they associate with the technology and their work.

Acknowledgments

We would like to express our sincerest gratitude to the senior editors, Sue Brown and Mike Morris, for guiding us through the review process. Our deepest thanks also go to the associate editor, who worked tirelessly to provide constructive feedback throughout the review process. We are grateful to the anonymous reviewers, whose insights helped to improve the quality of the manuscript. The authors also benefitted from the feedback of attendees at a workshop at Georgia State University. Finally, we thank Jan DeGross for her efforts in editing and typesetting the manuscript.

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MIS Quarterly
RESEARCH ARTICLE

MOTIVATING EMPLOYEES TO EXPLORE COLLABORATION TECHNOLOGY IN TEAM CONTEXTS

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Appendix A

Measurement Scales[1]

Main Study Variables

CT Exploration (Nambisan et al. 1999) [Cronbach α: .75; mean: 3.34; standard deviation: 1.00]
1. I explore [*system name*] to enhance my work effectiveness.
2. I explore [*system name*] for potential application in my work.

Team Empowerment (Kirkman et al. 2004) [Cronbach α: .93; mean: 3.44; standard deviation: 0.36]
(*Potency*)
1. Our team has confidence in itself.
1. My team believes that we can produce high quality work.
2. My team believes that we can be very productive.

(*Meaningfulness*)
1. Our team cares about what it does.
2. Our team feels that its tasks are worthwhile.
3. My team feels that its work is meaningful.

(*Autonomy*)
1. Our team can select different ways to do the team's work.
2. Our team determines as a team how things are done in the team.
3. Our team makes its own choices without being told by management.

(*Impact*)
1. Our team has a positive impact on this company's customers.
2. Our team performs tasks that matter to this company.
3. Our team makes a difference in this organization.

[1]Unless otherwise indicated, all multi-item scales were measured on a five-point Likert scale with 1 = "Strongly disagree" to 5 = "Strongly agree."

Continued Intention to Explore (adapted from Nambisan et al. 1999) [Cronbach α: .96; mean: 3.24; standard deviation: .87]
1. I intend to continue exploring how [*system name*] can be used in my work tasks.
2. I intend to continue exploring other ways that [*system name*] may enhance my work effectiveness.
3. I intend to continue spending time and effort in exploring [*system name*] for potential applications to my work.

Continued Expectation to Explore (adapted from Venkatesh et al. 2008) [Cronbach α: .84; mean: 3.24; standard deviation: .83]
1. I expect to continue exploring how [*system name*] can be used in my work tasks.
2. I am likely to continue spending time and effort in exploring [*system name*] for potential applications to my work.
3. I am going to continue exploring how [*system name*] can be used in my work tasks.

Control Variables

Perceived Usefulness (Davis et al. 1989) [Cronbach α: .88; mean: 2.87; standard deviation: .80]
1. [*system name*] will be useful for synchronizing tasks with my teammates.
2. [*system name*] will be effective for sharing information with my teammates.
3. [*system name*] will be effective for managing multiple communications.
4. [*system name*] will be effective for making me accessible while I am traveling outside the office.
5. [*system name*] will be effective for storing and tracking collaboration data.

Facilitating Conditions (Venkatesh et al. 2003) [Cronbach α: .70; mean: 3.18; standard deviation: .82]
1. Team members support each other's efforts to integrate [*system name*] into our work.
2. Our managers suggests ways to integrate [*system name*] into our work.

Personal Innovativeness with IT (Agarwal and Prasad 1998) [Cronbach α: .85; mean: 3.05; standard deviation: .55]
1. If I heard about a new information technology, I would be the first to experiment with it.
2. Among my peers, I am usually the first to try out new information technologies.
3. In general, I am hesitant to try out new information technologies. [reverse-scored item]
4. I like to experiment with new information technologies.

Intention to Explore (Nambisan et al. 1999) [Cronbach α: .94; mean: 3.94; standard deviation: .68]
1. I intend to explore how [*system name*] can be used in my work tasks.
2. I intend to explore other ways that [*system name*] may enhance my work effectiveness.
3. I intend to spend time and effort in exploring [*system name*] for potential applications to my work.

Training (Yi and Davis 2003) [Cronbach α: .86; mean: 2.88; standard deviation: .85]
1. I have undergone training on how to use [*system name*].
2. I attended training sessions about using [*system name*].
3. I was taught how to use [*system name*].
4. I received instructional material on [*system name*].

Task Interdependence (Campion et al. 1993) [Cronbach α: .82; mean: 3.11; standard deviation: .35]
1. Each team member cannot accomplish tasks without information or materials from other members of the team.
2. Members of my team depend on each other for information or materials needed to perform their tasks.
3. Within my team, jobs performed by team members are all related to one another.

Team Dispersion (O'Leary and Cummings 2007)
1. Number of different cities in which team members are located. [obtained from team rosters]

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Appendix B

Results of Factor Analysis with Direct Oblimin Rotation

Item	1	2	3	4	5	6	7	8	9	10
CT exploration1	**.77**	.30	.33	.13	.10	.05	.13	.06	.01	.04
CT exploration2	**.79**	.26	.40	.12	.12	.04	.12	.09	.10	.05
Expectation to continue exploring1	.27	**.78**	.35	.23	.11	.02	.17	.14	.14	.18
Expectation to continue exploring2	.29	**.89**	.32	.06	.03	.08	.32	.08	.21	.29
Expectation to continue exploring3	.26	**.71**	.37	.23	.08	.08	.31	.15	.30	.01
Intention to continue exploring1	.19	.21	**.92**	.16	.11	.06	.13	.07	.18	.05
Intention to continue exploring2	.17	.17	**.96**	.15	.04	.12	.15	.06	.14	.19
Intention to continue exploring3	.32	.30	**.93**	.06	.06	.02	.12	.08	.14	.07
Potency1	.04	.04	.08	**.73**	.15	.08	.16	.19	.18	.27
Potency2	.13	.01	.05	**.75**	.05	.01	.03	.06	.17	.06
Potency3	.11	.01	.22	**.74**	.06	.06	.05	.11	.29	.26
Meaningfulness1	.18	.03	.01	**.75**	.08	.01	.01	.08	.16	.14
Meaningfulness2	.05	.03	.10	**.74**	.11	.02	.05	.01	.26	.10
Meaningfulness3	.02	.04	.03	**.70**	.17	.01	.01	.18	.08	.14
Autonomy1	.13	.03	.03	**.80**	.16	.14	.07	.10	.04	.09
Autonomy2	.15	.20	.04	**.72**	.11	.02	.19	.11	.01	.13
Autonomy3	.02	.04	.03	**.84**	.10	.07	.11	.19	.04	.08
Impact1	.06	.11	.01	**.72**	.02	.09	.11	.25	.05	.08
Impact2	.13	.04	.03	**.74**	.07	.01	.13	.01	.29	.04
Impact3	.05	.03	.01	**.72**	.07	.02	.11	.04	.06	.20
Intention to explore 1	.01	.00	.03	.11	**.91**	.05	.11	.12	.12	.04
Intention to explore 2	.00	.03	.01	.14	**.94**	.08	.04	.09	.05	.01
Intention to explore 3	.05	.04	.09	.15	**.90**	.02	.15	.03	.01	.01
Perceived usefulness 1	.03	.06	.11	.10	.03	**.79**	.02	.07	.08	.27
Perceived usefulness 2	.01	.07	.01	.10	.12	**.84**	.01	.15	.16	.43
Perceived usefulness 3	.08	.09	.13	.13	.11	**.81**	.05	.09	.03	.14
Perceived usefulness 4	.15	.17	.04	.07	.11	**.70**	.15	.24	.03	.25
Perceived usefulness 5	.12	.12	.13	.11	.25	**.68**	.02	.10	.05	.08
Personal innovativeness in IT 1	.02	.17	.04	.01	.08	.12	**.84**	.00	.05	.05
Personal innovativeness in IT 2	.10	.24	.10	.12	.15	.09	**.76**	.05	.03	.03
Personal innovativeness in IT 3	.14	.12	.09	.16	.11	.02	**.65**	.09	.03	.13
Personal innovativeness in IT 4	.08	.27	.01	.15	.02	.04	**.78**	.02	.02	.17
Training 1	.05	.04	.33	.09	.03	.05	.03	**.81**	.10	.18
Training 2	.12	.13	.08	.10	.03	.02	.05	**.83**	.08	.02
Training 3	.02	.17	.05	.07	.04	.01	.04	**.79**	.04	.07
Training 4	.16	.06	.13	.18	.04	.02	.10	**.70**	.03	.01
Task interdependence 1	.10	.17	.00	.04	.04	.02	.06	.05	**.75**	.15
Task interdependence 2	.07	.12	.07	.04	.04	.01	.05	.04	**.86**	.11
Task interdependence 3	.11	.16	.14	.12	.06	.12	.04	.22	**.72**	.07
Facilitating conditions1	.10	.10	.13	.21	.18	.24	.07	.03	.09	**.74**
Facilitating conditions2	.15	.20	.25	.28	.09	.13	.03	.06	.13	**.73**

Appendix C

Meso-Mediation Tests

In order to test this cross-level mediation, we followed the guidelines for cross-level mediation testing outlined by Mathieu and Taylor (2007). Cross-level mediation tests (also referred to as meso-mediation tests) build on similar principles to traditional mediation tests outlined by Baron and Kenny (1986) and others (e.g., Krull and MacKinnon 1999, 2001), but differs in that it includes cross-level effects as well (Bauer et al. 2006). Also, depending on the type of cross-level mediation model being hypothesized, considerations of between- and within-group variability need to be addressed (Bauer et al. 2006). In the context of our research model, we posit a 2-1-1 cross-level mediation model, where the relationship between a level-2 (team-level) predictor and a level-1 (individual-level) outcome is mediated by a level-1 (individual-level) mediator (Bauer et al. 2006). Mathieu and Taylor refer to this as cross-level mediation—lower mediation ($X \rightarrow m \rightarrow y$). Cross-level mediation testing follows six steps: (1) account for any level-1 control variables; (2) examine any level-1 outcomes and mediators for between-group variability; (3) establish within-group (level-1) relationships before cross-level mediation testing; (4) establish the relationship between the predictor (X) and the mediator (m); (5) examine the effect of the predictor (X) on the outcome (y) without the mediator (m) in the model; (6) examine the effect of the predictor (X) on the outcome (y) with the mediator (m) in the model. Steps 1 and 2 were followed in that we included level-1 control variables in all models and we established that ICE, ECE, and CT exploration each had sufficient between-team variability. Step 3 was followed in that we found support for H2a and H2b relating ICE (level-1) and ECE (level-1) to CT exploration (level-1). Step 4 was followed in that we found support for H1a and H1b relating team empowerment (level-2) to ICE (level-1) and ECE (level-1). In step 5, we found a positive but nonsignificant cross-level relationship between team empowerment and CT exploration ($\gamma = .10$, $p > .10$). However, a direct relationship is not necessary for indirect effects. In step 6, we observe that this relationship is still nonsignificant ($\gamma = .14$, $p > .10$) in the presence of the mediators, suggesting full mediation. These results provide support for H3a and H3b.

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Appendix D

Results of Supplementary Analysis of Indirect Effects

As noted in the main paper, prior research has treated team empowerment as a unidimensional construct in some studies and a multidimensional construct in others (Seibert et al. 2011). In order to examine potential differences in the effects of the underlying dimensions of team empowerment in this CT exploration context, we conducted the tests of indirect effects using the decomposed dimensions. The results are shown in Table 3 of the main paper. As the results show, the indirect effects of all subdimensions of team empowerment are all significant,providing support for treating it as a unidimensional construct. Similarly, contrasts of indirect effects of each subdimension of team empowerment through ICE versus ECE are all statistically significantly different from 0. These results directly mirror those of the uni-dimensional construct and lend additional support for arguments in favor of this uni-dimensional approach (Seibert et al. 2011).

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Appendix E

Inter-Item Correlations

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. CT exploration1															
2. CT exploration2	.70***														
3. ICE1	.35***	.39***													
4. ICE2	.31***	.37***	.87***												
5. ICE3	.46***	.50***	.80***	.87***											
6. ECE1	.29***	.40***	.44***	.50***	.46***										
7. ECE2	.27***	.22**	.42***	.34***	.47***	.68***									
8. ECE3	.39***	.37***	.49***	.52***	.56***	.71***	.94***								
9. Organizational tenure	-.02	-.12†	.10	-.09	-.06	.00	-.08	-.04							
10. Age	-.09	-.18**	-.12†	-.13†	-.10	-.08	-.14*	-.10	.60***						
11. Gender	.00	.00	.00	.11	.02	.07	.06	.03	.09	-.04					
12. Perceived usefulness1	.03	.10	.01	.00	.03	.07	.02	.03	-.04	-.03	.00				
13. Perceived usefulness2	.07	.10	.10	.03	.06	.02	.02	.02	-.19**	-.17*	-.02	.66***			
14. Perceived usefulness3	.14*	.14*	.12†	.19**	.16*	.09	.16*	.24***	-.11	-.10	.01	.49***	.44***		
15. Perceived usefulness4	.09	.08	.05	.09	.08	.01	.06	.11	-.05	-.02	-.02	.46***	.36***	.51***	
16. Perceived usefulness5	.07	.16*	.18*	.19**	.07	.19**	.01	.07	-.12†	-.10	.00	.31***	.41***	.44***	.41***
17. Facilitating conditions1	.22**	.12†	.27***	.33***	.21**	.29***	.26***	.33***	-.06	.07	-.04	.13†	.10	.17*	.14*
18. Facilitating conditions2	.09	.03	.24**	.08	.24***	.31***	.27***	.25***	-.02	-.04	.01	.12†	.11	.04	.13†
19. PIIT1	.17*	.21**	.16*	.20**	.21**	.25***	.26***	.37***	-.10	-.17*	.10	.04	.01	.17*	.03
20. PIIT2	.25***	.22**	.22**	.26***	.23**	.32***	.34***	.31***	-.09	-.21**	.15*	.03	.02	.05	.02
21. PIIT3	.21**	.20**	.15*	.15*	.08	.14*	.14*	.21**	-.13†	-.24***	.09	.03	.11	.02	.02
22. PIIT4	.20**	.21**	.21**	.23**	.28***	.13†	.29***	.34***	-.22**	-.22**	.09	.01	.06	.06	.07
23. Intention to explore1	.11	.14*	.00	.12†	.00	.04	.21***	.08	-.15*	-.28***	.12†	.13†	.23**	.22**	.17*
24. Intention to explore2	.11	.20**	.01	.12†	.01	.08	.14*	.05	-.14*	-.33***	.10	.12†	.22**	.19**	.21**
25. Intention to explore3	.14*	.20**	.06	.14*	.04	.09	.21**	.14*	-.13†	-.29***	.08	.11	.20**	.22**	.21**
26. Training1	.23**	.08	.01	.04	.08	.13†	.20**	.12†	.10	.04	-.02	.01	.03	.06	.03
27. Training2	.19**	.08	.06	.01	.20**	.11	.18*	.20**	.07	.02	-.03	.01	.06	.03	.08
28. Training3	.27***	.11	.07	.00	.14*	.14*	.15*	.20**	.04	.10	-.10	.01	.04	.08	.04
29. Training4	.19**	.06	.01	.02	.12†	.21**	.19**	.22**	.02	.01	-.02	.11	.01	.07	.02
30. Potency1	.02	.02	.17*	.15*	.07	.21**	.19**	.15*	-.04	.00	.14*	.11	.09	.09	.04
31. Potency2	.10	.16*	.19**	.18**	.15*	.26***	.10	.18**	-.02	-.12†	.18**	.09	.08	.20**	.03
32. Potency3	.04	.11	.14*	.12†	.19**	.25***	.10	.25***	.01	-.09	.09	.04	.04	.02	.17*
33. Meaningfulness1	.12	.20**	.27***	.17*	.22**	.25***	.09	.16*	.03	-.04	.10	.03	.05	.08	.08
34. Meaningfulness2	.02	.08	.16*	.21**	.11	.25***	.07	.20**	-.11	-.10	.14*	.07	.00	.09	.02
35. Meaningfulness3	.04	.03	.13†	.18*	.11	.23**	.12†	.25***	-.03	-.03	.15*	.06	.06	.00	.13†
36. Autonomy1	.03	.05	.25***	.09	.23**	.22**	.17*	.10	.03	-.05	.06	.04	.10	.10	.08
37. Autonomy2	.16*	.16*	.15*	.18**	.17*	.31***	.18**	.23**	.11	-.04	.03	.14*	.02	.16*	.08
38. Autonomy3	.02	.05	.09	.00	.08	.13†	.13†	.11	-.01	-.06	-.04	.07	.04	.11	.03
39. Impact1	.11	.09	.16*	.18**	.17*	.27***	.13†	.22**	-.08	-.02	.12†	.05	.01	.06	.09

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
40. Impact2	.11	.13†	.30***	.30***	.21**	.18**	.21**	.27***	-.14*	-.17*	.17*	.02	.01	.10	.03
41. Impact3	.08	.09	.14*	.19**	.18**	.18**	.17*	.23**	-.05	-.11	.15*	.08	.08	.03	.05
42. Team size	.03	.01	-.04	-.07	.02	.00	.03	.09	.00	.10	-.02	-.08	-.03	-.03	-.16*
43. Task interdependence1	.11	.06	.21***	.14*	.23**	.22**	.28***	.13†	-.06	-.09	.10	.03	.08	.02	.06
44. Task interdependence2	.14*	.00	.16*	.17*	.22**	.19**	.20**	.13†	-.02	.01	-.02	.07	.03	.03	.07
45. Task interdependence3	.29***	.13†	.20**	.17*	.27***	.22**	.17*	.17*	.02	-.04	-.03	.04	.04	.04	.09
46. Team dispersion	.07	.02	.07	.02	.05	.02	.07	.06	.08	.17*	.05	-.02	.01	-.08	-.12†

Variables	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
16. Perceived usefulness5															
17. Facilitating conditions1	.14*														
18. Facilitating conditions2	-.05	.47***													
19. PIIT1	.10	.06	.03												
20. PIIT2	.05	.07	.01	.61***											
21. PIIT3	.11	.05	.06	.54***	.57***										
22. PIIT4	.01	.08	.03	.57***	.51***	.46***									
23. Intention to explore1	.28***	.05	.08	.19**	.23**	.17*	.11								
24. Intention to explore2	.37***	.14*	.13†	.16*	.18**	.18**	.10	.86***							
25. Intention to explore3	.26***	.13†	.17*	.22**	.22**	.13†	.12†	.77***	.85***						
26. Training1	.07	.09	.25***	.00	.00	.31***	.07	.03	.05	.01					
27. Training2	.12	.09	.21**	.03	.03	.20**	.06	.08	.12†	.02	.66***				
28. Training3	.09	.25***	.26***	.04	.05	.23**	.03	.07	.07	.01	.50***	.57***			
29. Training4	.01	.11	.18**	.01	.11	.27***	.05	.01	.01	.08	.41***	.45***	.47***		
30. Potency1	.11	.32***	.32***	.06	.08	.17*	.08	.01	.08	.07	.03	.03	.01	.07	
31. Potency2	.16*	.28***	.29***	.05	.06	.10	.05	.06	.08	.03	.03	.11	.02	.01	.51***
32. Potency3	.08	.22**	.33***	.09	.06	.16*	.12†	.06	.03	.03	.13†	.11	.02	.03	.49***
33. Meaningfulness1	.14*	.27***	.27***	.03	.07	.05	.04	.00	.03	.01	.03	.06	.02	.12†	.50***
34. Meaningfulness2	.13†	.22**	.32***	.09	.04	.06	.15*	.01	.01	.04	.07	.10	.09	.04	.46***
35. Meaningfulness3	.05	.25***	.29***	.14*	.12†	.07	.10	.08	.01	.01	.05	.07	.03	.02	.42***
36. Autonomy1	.02	.21**	.28***	.10	.10	.09	.10	.09	.15*	.14*	.10	.09	.05	.05	.35***
37. Autonomy2	.07	.22**	.31***	.11	.07	.03	.02	.02	.03	.07	.17*	.05	.04	.10	.31***
38. Autonomy3	.08	.14*	.15*	.01	.05	.13†	.02	.04	.10	.08	.06	.06	.21**	.08	.31***
39. Impact1	.07	.30***	.30***	.02	.07	.00	.05	.07	.05	.04	.08	.01	.01	.10	.51***
40. Impact2	.10	.28***	.25***	.01	.04	.10	.14*	.06	.03	.05	.08	.12†	.02	.05	.46***
41. Impact3	.07	.17*	.21**	.06	.07	.04	.08	.06	.08	.07	.01	.05	.08	.00	.40***
42. Team size	.11	.10	.09	-.10	-.14*	-.04	-.06	.02	.06	.09	.09	.07	.03	.07	.40***
43. Task interdependence1	.03	.09	.18*	.03	.09	.09	.11	.07	.05	.00	.09	.06	.03	.15*	.14*
44. Task interdependence2	.01	.23**	.22**	.08	.05	.10	.04	.11	.11	.08	.10	.13†	.08	.12†	.23**
45. Task interdependence3	.11	.18*	.22**	.01	.03	.04	.05	.08	.05	.07	.17*	.11	.17*	.09	.09
46. Team dispersion	.12†	.01	.00	.04	.10	.01	.06	.01	.04	.01	.02	.06	.09	.05	.18*

Variables	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
31. Potency2															
32. Potency3	.48***														
33. Meaningfulness1	.55***	.51***													
34. Meaningfulness2	.46***	.47***	.51***												
35. Meaningfulness3	.33***	.45***	.45***	.50***											
36. Autonomy1	.29***	.26***	.30***	.29***	.22**										
37. Autonomy2	.34***	.26***	.37***	.33***	.32***	.34***									
38. Autonomy3	.34***	.19**	.24***	.26***	.20**	.26***	.19**								
39. Impact1	.47***	.45***	.38***	.39***	.48***	.28***	.33***	.22**							
40. Impact2	.43***	.40***	.52***	.46***	.44***	.27***	.25***	.15*	.46***						
41. Impact3	.39***	.38***	.43***	.45***	.47***	.21**	.28***	.17*	.39***	.56***					
42. Team size	.06	.01	.07	.00	.10	.06	.06	.03	.04	.01	.07				
43. Task interdependence1	.05	.12†	.18*	.09	.06	.07	.03	.01	.19**	.14*	.12†	.04			
44. Task interdependence2	.04	.03	.11	.10	.09	.22**	.12†	.04	.21**	.19**	.19**	.12†	.49***		
45. Task interdependence3	.15*	.09	.12†	.08	.10	.20**	.10	.03	.22**	.18**	.15*	.05	.38***	.47***	
46. Team dispersion	-.17*	-.13†	-.14*	-.11	-.15*	-.10	-.06	-.08	-.15*	-.13†	-.15*	.56***	-.04	-.03	-.02

Notes: n = 212; gender is dummy coded (0 = women, 1 = men); CT = collaboration technology; ICE = intention to continue exploring, ECE = expectation to continue exploring; PIIT = personal innovativeness in IT.

$^{\dagger}p < .10$, $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.