Team Learning and Creativity: the Roles of Exploitation and Team Cohesiveness

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Exploitation, as a means of achieving team creativity, has been thought to be limited compared with exploration. In an empirical study, we investigated the potential value of team exploitation as a strong independent initiator of team creativity, considering team cohesiveness as a moderator of that relationship. Our results support our hypothesis that when team cohesiveness is high, team exploitation exhibits a U-shaped relationship with creativity, whereas when team cohesiveness is low, the relationship is inverted-U-shaped.

INTRODUCTION

It is widely accepted that creativity is key to organizations' competitiveness and survival (Nonaka, 1991). At the same time, firms are increasingly reliant on teams to carry out work. Creativity within the team context, then, has been a further, specific focus of research (Shalley, Zhou, & Oldham, 2004).

For a team, learning plays a large role in achieving creativity (Edmondson, 2001; Ghoshal & Bartlett, 1994). March (1991) suggested two broad types of learning activities between which firms divide attention and resources: exploration and exploitation. Exploration consists of "activities that search for unfamiliar, distant, and remote knowledge"; exploitation, by contrast, includes "activities that search for existing, familiar, mature, current knowledge" (Ahuja & Lampert, 2001; Benner & Tushman, 2003). Since March (1991) linked innovation and knowledge management to exploration and exploitation, the effects of these two activities as well as the challenges inherent in their respective pursuits have been widely studied (Atuahene-Gima, 2005).

Even so, the existing literature has given but little consideration to exploration and exploitation as independent constructs (Li, Vanhaverbeke & Schoenmakers, 2008). Given the limitations of organizations' attention and resources, pursuing both directions has, at least to date, seemed impractical.

The characteristics of team tasks in given situations need to be considered as well. Hackman and Morris (1975) argued that group tasks determine the substantive contents of group activities. For instance, if the characteristics of a team task require exploitation rather than exploration, members on a team are more likely to work exploitatively. Teams charged with tasks that require exploitative activities need to find effective processes by which creativity can be enhanced in given situations. Because exploitation improves a firm's ability to isolate cause-effect relationships within a particular knowledge domain, prior success tends to reinforce the belief that leveraging experience and expertise will lead to future success as well. In this light, firms are likely to continue working in areas that are familiar and proximate to existing solutions, rather than pursue novel, emerging, pioneering knowledge (Ahuja & Lampert, 2001; Argyris & Schon, 1978; Levinthal & March, 1993; McGrath, 2001). Accordingly, individual team units are likely to exploit their experience and knowledge in a given context.

Furthermore, exploitation is superior to exploration in the aspect of efficiency, because "the certainty, speed, proximity, and clarity of feedback ties exploitation to its consequences more quickly and more precisely than is the case with exploration" (March, 1991, p. 73). Over-reliance on exploratory learning typically causes units to operate less efficiently, thereby preventing them from gaining full returns on their capabilities (Levinthal & March, 1993). As Nonaka noted (1991), diffusing and developing an extant-knowledge stock is a critical mode of team learning. Iterative cooperation and mutual refinement can spur knowledge transfer among team members and, in turn, enhance team creativity. In this sense, team-level exploitation can be a crucial factor for team creativity because, as implied above, each team member can make his or her unique contribution to the knowledge stock, and frequent interaction among team members can stimulate mutual transaction and refinement of such individual knowledge. Nonetheless, the issue of exploitation as a booster of team creativity has been relatively neglected in the literature.

Better understanding of the dynamics of team-level creativity process requires consideration of the relevant contextual factors that either enhance or stifle creativity (Amabile, 1996; Woodman, Sawyer, & Griffin, 1993). In the present study, we considered team cohesiveness as contextual factor moderating the relation between exploitation and creativity. Team cohesiveness is the degree of attraction the group holds for individualist members and the corresponding desire of those members to remain in the group (Beal, Cohen, Burke, & McLendon, 2003). Certainly, in an exploitative team activity, high team cohesiveness can enhance the effectiveness of team exploitation and, thus, creativity. Specifically, team cohesiveness helps teams manage conflicts among members, enhance idea generation through knowledge exchange, and foster a supportive climate for creative behavior.

Our research aimed (1) to examine the exploration and exploitation literature in the team context, (2) to extend the team creativity literature by reinvestigating exploitation as an effective antecedent of team creativity, and (3) to determine the contextual factors that can complement the effect of exploitation on creativity.

THEORY AND HYPOTHESES

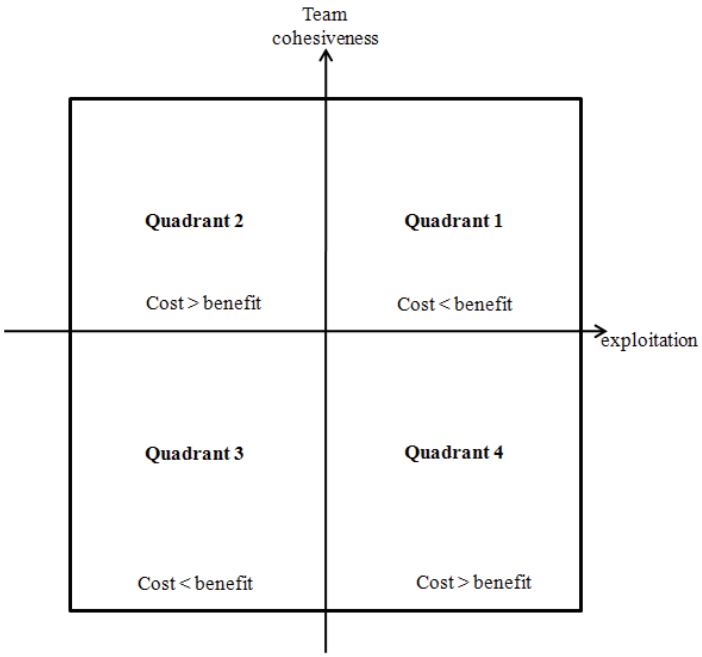
Cost and Benefit Approach

Creativity can be considered a cognitive production activity. Like other production activities, creativity, in its development and expression, has costs and benefits. As noted above, exploitation contributes to team creativity in two ways. First, it aggregates the knowledge stock, and facilitates its flow, by drawing upon the unique ideas of each individual member (Nonaka, 1991). Second, it develops each member's own knowledge. This latter process, however, entails a relatively high level of exploitation. It is quite obvious that mastering existing technology and knowledge (e.g., in the case of artists or master craftsmen) is tedious and time-consuming. Team-knowledge diffusion, therefore, contributes to the benefit in the early stage of exploitation, while each member's self-development of possessed knowledge adds to the benefit as the level of exploitation increases.

Meanwhile, exploitation can be the opportunity cost of other activities such as exploration. All things being equal, enhancing exploitation sacrifices exploration, which is another (and sometimes more important) factor affecting creativity. This trade-off relation regards exploitation as an aspect of cost.

Hence, the level of exploitation for team creativity is determined by whether this cost be exceeded by the benefit (see Figure 1).

FIGURE 1
QUADRANTS OF TEAM EXPLOITATION AND TEAM COHESIVENESS



We posit team cohesiveness as a contextual input and moderator between team exploitation and team creativity. Indeed, team cohesiveness, which, as already mentioned, is the degree of attraction the group holds for the individual members and the resulting desire of those members to remain in the group, is associated positively with team-level outcomes (Cartwright, 1968).

High Team Cohesiveness

When the level of team cohesiveness is high, the frequency and quality of interaction among teammates also will be high (Cartwright, 1968). Under high cohesiveness, the incremental effect of exploitation on the spread of knowledge will be small, because there is already a great potentiality for knowledge sharing among team members (Rulke & Rau, 2000). Therefore, we expect that as exploitation increases, creativity decreases. However, as noted above, when exploitation is applied beyond a certain extent, qualitative changes in individuals' knowledge, effected by self-development, can occur. Furthermore, the free flow and exchange of unique information among individuals should ultimately result in an expanded knowledge base that can generate a greater number of alternatives (Csikszentmihalyi & Sawyer, 1995). This, in turn, can stimulate team creativity. Hence, it is expected that the benefit of team cohesiveness will grow and overtake the cost. Two possible scenarios attendant on high team cohesiveness can be inferred: (1) increasing exploitation will negatively affect team creativity to a certain extent, but, (2) beyond that point, the effect will be positive.

Low Team Cohesiveness

When team cohesiveness is low, knowledge sharing among members cannot easily be achieved. In this situation, raising the level of official interaction by means of exploitative tasks, and facilitating communication through routinization, can be beneficial to creativity. As for exploration, integration of the various forms of externally obtained knowledge is the critical prerequisite for team creativity (Bolinger, Bonner & Okhuysen, 2009). Integration, however, is unlikely to occur under low cohesiveness. In this

case, as the level of exploitation goes beyond a certain extent, the effect on creativity becomes negative. That is, under low cohesiveness, the resultant formalization of individual members' respective roles sacrifices the flexibility necessary for creativity. And under low cohesiveness, the exploitative process, as it fosters interdependence among team members, can result in conflict, which, in most cases negatively affects team creativity. Two possible scenarios linked to low cohesiveness can now be inferred as well: (1) increasing exploitation will be positively affect team creativity to a certain extent, but, (2) beyond that point, the effect will be negative.

> *Hypothesis. Team cohesiveness will moderate between team exploitation and team creativity such that, when team cohesiveness is high, team exploitation will exhibit a U-shaped relationship with creativity, whereas when team cohesiveness is low, the relationship will be inverted-U-shaped.*

METHODS

Participants

Using an e-mail-based on-line survey, data were collected from 332 employees working on 48 teams in a South Korean engineering company. The survey was conducted for three weeks, from the end of February until the middle of March, 2011. The average response rate was 87.64%. Two teams were excluded because, in both cases, only one member responded to the questionnaire. The remaining sample consisted of 330 employees on 46 teams. The number of respondents per team ranged from two to 29, for a mean of 7.17 (SD=5.69). The teams did not differ significantly with respect to average age or tenure. Most respondents were male (96%), and the average age was 34.65 years (SD= 7.10). In terms of functional roles, the current sample included R&D (23%), sales (14%), planning (11%), production technology (38%), and support (14%) personnel.

Measures

All of the measures were translated into Korean by two organizational behavior professors, including the first author. To verify the validity of the translated measures, the factor structure of each variable were checked by confirmatory factor analysis. The results revealed that all of the translated measures had the same factor structure as the original ones. Each item was followed by a seven-point Likert-type scale. Each scale exhibited $r_{wg}(j)$ values (James et al., 1993) for within-group-agreement computation, the results of which suggested that the individual-level data was sufficient and reliable enough to justify the group-level aggregation of variables in the present study.

Team Creativity

A four-item scale team-creativity measurement scale, adapted from Scott and Bruce (1994) and Zhou and George (2001), was constructed: (1) "suggests new ways to achieve goals or objectives"; (2) "comes up with new and practical ideas to improve performance"; (3) "often has new and innovative ideas"; (4) "often has a fresh approach to problems" ($\alpha = .97$, $r_{wg}(4) = .71$).

Team Exploitation and Team Exploration

Team exploitation was measured using four items (e.g., "The tasks of your team consist of activities that you can properly conduct using your present knowledge"; $\alpha = .78$, $r_{wg}(4) = .77$) adapted from Mom, Bosch, and Volberda (2009). Team exploration was measured using four items (e.g., "The task of your team consists of activities requiring you to learn new skills or knowledge"; $\alpha = .87$, $r_{wg}(4) = .71$) also adapted from Mom, Bosch, and Volberda (2009).

Team Cohesiveness

Team cohesiveness was measured on a five-item scale adopted from Lee and Farh (2004). Sample items included: "How well do members of your group stick together?", "How well do members of your

group stick together (i.e. remain close to each other)?", "Would you socialize with the members of your group outside the class?"(α = .92, $r_{wg}(5)$ = .69)

Control Variables

To examine the independent effect of exploitation on team creativity, our analyses controlled for team exploration. For the same reason, when we conducted a further analysis on exploration, exploitation was introduced to the model as a control variable. Since all of the variables in this study were measured from self-reports, we needed to control for a variable indicating a team's general confidence in order to minimize the possibility of common methods bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Group efficacy was measured on a seven-item scale adapted from Riggs and Knight (1994). We changed "this department" to "my team" for referent accuracy. A sample item is "My team is not able [is able] to perform as well as it should." (α = .86, $r_{wg}(7)$ = .79)

RESULTS

Since, as above-noted, we measured all of the variables using self-reports, we first conducted a confirmatory factor analysis to test for common method bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). We allowed all of the items to load on their respective constructs and a common method factor. The variance explained by the common method factor was 6.16%, which is smaller than the 25% average reported in two previous studies (Perry, Witt, Penny, & Atwater, 2010; Williams, Cote, & Buckley, 1989). Thus, we determined to proceed with hypothesis testing.

As shown in Table 1, team creativity was positively correlated with all of the study variables: team exploration (r =.713, p < .01), team exploitation (r =.365, p < .05), and team cohesiveness (r =.774, p < .01). Team cohesiveness was positively correlated with team exploration (r =.696, p < .01) but not with team exploitation. Team exploration and team exploitation, it was found, were not significantly related.

TABLE 1
DESCRIPTIVE STATISTICS AND INTER-CORRELATIONS OF VARIABLES IN STUDY

	M	*SD*	1	2	3	4
1. Team Creativity	4.51	1.08	--			
2. Team Cohesiveness	4.82	1.12	.77**	--		
3. Team Exploration	4.01	1.08	.71**	.70**	--	
4. Team Exploitation	4.30	0.96	.37*	.25	.21	--

Note. Sample size is 330. All variables were measured on a 7-point scale.
* $p < .05$, ** $p < .01$.

Following Aiken and West (1991), we mean-centered the variables (transforming the data into deviation score form with means equal to zero). By so doing, we were able to minimize the distortion due to high correlations between the interaction term and its component variables. We introduced the control and main-effect variables into a regression equation (steps 1 and 2, respectively); to control for potential linear trends, linear two-way interaction was introduced (step 3); and finally, to test our hypothesis that team exploitation would have a curvilinear relation to team creativity, we introduced quadratic team exploitation as well (step 4). Table 2 lists the results of a hierarchical regression analysis performed to test our hypothesis.

We predicted, further, that team cohesiveness would moderate the curvilinear relation between team exploitation and team creativity. To test this hypothesis, we introduced the relevant interaction term (team exploitation^2 × team cohesiveness: step 5). The results showed that the coefficient associated with this term was statistically significant (β = .67, p < .05), thereby supporting the hypothesis. An interaction plot (see Figure 2) revealed, as expected, that for a team with high cohesiveness, the relation between team

exploitation and team creativity followed a U-shaped function whereas, under the low-cohesiveness condition, the function was inverted-U-shaped.

TABLE 2
RESULTS OF HIERARCHICAL REGRESSION ANALYSIS (EXPLOITATION)

Predictor	β		ΔR^2	ΔF	
Step 1			.63	36.21	**
Group Efficacy	.39	**			
Team Exploration	.53	**			
Step 2			.07	5.09	*
Team Exploitation	.09				
Team Cohesiveness	.42	**			
Step 3			.01	1.94	
Team Exploitation × Team Cohesiveness	.14				
Step 4			.02	2.20	
Team Exploitation^2	-.15				
Step 5			.05	9.27	*
Team Exploitation^2 × Team Cohesiveness	.67	*			

Note. N=46 after listwise deletion. Standardized regression coefficients are reported for the step indicated. R^2 and *F* for the full model are .78 and 19.63, respectively. * $p < .05$, ** $p < .01$ (two-tailed).

FIGURE 2
CURVILINEAR INTERACTION OF TEAM EXPLOITATION, TEAM COHESIVENESS AND TEAM CREATIVITY

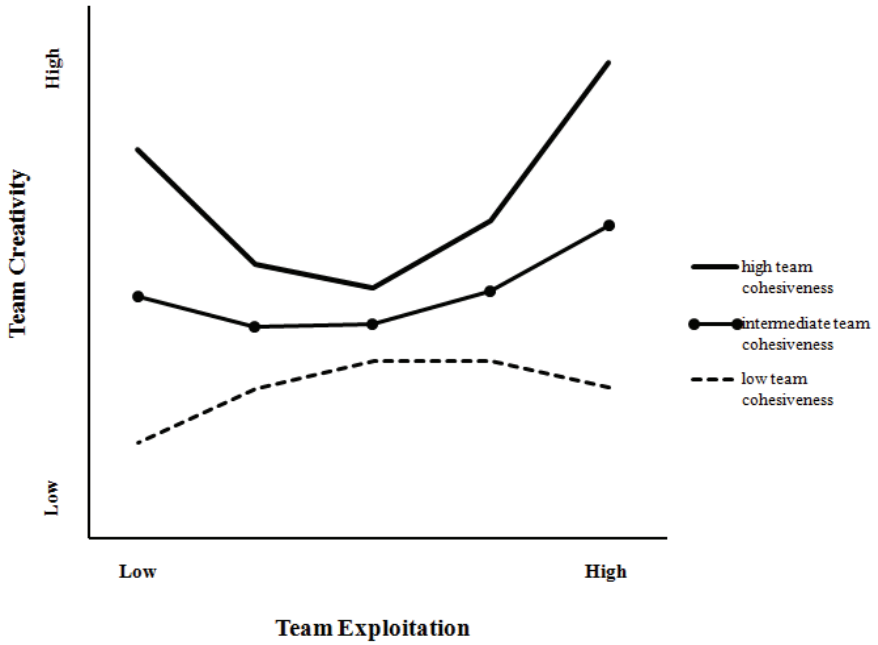


TABLE 3
RESULTS OF HIERARCHICAL REGRESSION ANALYSIS (EXPLORATION)

Predictor	β		ΔR^2	ΔF	
Step 1			.42	15.24	**
Group Efficacy	.64	**			
Team Exploitation	.01				
Step 2			.29	19.70	**
Team Exploration	.31	*			
Team Cohesiveness	.42	*			
Step 3			.08	13.82	**
Team Exploration × Team Cohesiveness	-.28	*			
Step 4			.01	2.03	
Team Exploration^2	.20				
Step 5			.01	1.14	
Team Exploration^2 × Team Cohesiveness	-.15				

Note. N=46 after listwise deletion. Standardized regression coefficients are reported for the step indicated. R^2 and *F* for the full model are .80 and 21.09, respectively. $^{*}p < .05$, $^{**}p < .01$ (two-tailed).

Further Analysis

The correlation between team exploration and team creativity, and the moderating effect of team cohesiveness on it, were analyzed following the same steps as for team exploitation.

As shown in Table 3, team exploration had a statistically significant main effect on team creativity ($\beta = .31$, $p < .05$). Interestingly, the results also revealed a negative linear two-way interaction, between team exploration and team cohesiveness, with team creativity ($\beta = -.28$, $p < .05$). Team exploration, unlike team exploitation, did not have a statistically significant curvilinear relation with team creativity ($\beta = .20$, $p > .05$).

DISCUSSION

In contrast to the existing studies on exploration and exploration, the present study has investigated the independent group-level effects of those on creativity. Specifically, we identified exploitation as a limited but potentially strong antecedent of team creativity. For managerial considerations, team cohesiveness was adapted to our study. Through our comprehensive analysis, we found that team cohesiveness moderated the curvilinear relation between team exploitation and team creativity. Specifically, under the high-cohesiveness condition, the exploitative team exhibited a U-shaped relation with creativity, whereas under the low-cohesiveness condition, the relation was inverted-U-shaped.

In the light of costs and benefits, we could build on our case findings and the existing literature to theorize how firms might manage teams to maximize efficacious creativity in the performance of tasks (see Figure 1). In this framework, team cohesiveness plays a key role in determining the extent to which teams should exploit their existing knowledge and resources.

Additionally, we found that team exploration has only a linear relation with team creativity and that this relation changed its direction when a team had high cohesiveness. This result constitutes further evidence that exploration and exploitation have different and separate effects on creativity. According to

the unique nature of exploration relative to exploitation, team cohesiveness was not a strong moderator or interacting variable in that case.

IMPLICATIONS

The present findings offer valuable insights on how team learning theory, focusing more on exploitation as a factor independent from exploration, might be integrated into the team creativity research. Taking into consideration the significance of team creativity as a critical group behaviour that stems from both explorative and exploitative activities, this team-level approach, by expanding consideration to a costs and benefits analysis, provides for a better understanding of exploitative tasks. Our results carry some interesting practical implications as well. First, if management is interested in boosting creativity by means of their existing organizational knowledge and resources, supervisors might firstly identify the aspect of team cohesiveness that generates a positive effect on creativity. A highly cohesive team can access its own knowledge and resources (exploitation) more effectively. This benefit can exceed the opportunity cost of long-term creativity that has been considered as being achieved only by exploration. The present study also suggests that managers adjust the level of exploitation to a given team's cohesiveness. As one team's cohesiveness is not interchangeable with that of another team, managers should maximize a team's creativity by determining the precise point at which exploitation positively affects it.

STUDY LIMITATIONS AND FUTURE RESEARCH

Notwithstanding the present study's contributions, some methodological limitations need to be discussed. First, given that the data were collected from a Korean engineering company, some of the findings (e.g., the positive effects of team cohesiveness on team creativity) might reflect the strong collectivistic culture characteristic of typical Korean organizations.

Second, although a confirmatory factor analysis revealed that common method bias accounted for only 6.0% of the total variance (which indeed is relatively low: see Perry, Witt, Penny, & Atwater, 2010 and Williams et al., 1989), the data were still cross-sectional. Cross-sectional data not only incur risks of common method bias, but also renders causal directions ambiguous. Longitudinal designs are still generally lacking from much of the research on learning and teamwork (Mathieu et al., 2008). Utilization of such designs would contribute to a more accurate understanding of how, for instance, exploratory and exploitative team behaviours are linked to team creativity.

Third, even though the existing literature (e.g., Raisch et al., 2009) conceives of team exploration and exploitation explicitly as critical group processes, the present study measured both based on team tasks. This approach inevitably invites the serious criticism that the meanings of exploration and exploitation at the group level do not reflect individual task characteristics or the tendency of serving task in a team. Also useful would be an exploration of the potential multilevel and cross-level mechanisms by which both individual and group-level tendencies explore or exploit each other over time.

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