Understanding Organizational Creativity: Relationships among Cross-level Variables and Creativity in Research and Development Organizations

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Abstract: We examined the association of creativity with creative personality, domain expertise, non-controlling supervision, and organizational learning culture, as well as cross-level interactions in R&D organizations. Using HLM, domain expertise and non-controlling supervision were found to be positively associated with creativity. Practical implications and recommendations for further research are provided.

Employee creativity has received substantial attention in the literature for the role that it plays, particularly in research and development (R&D) organizations that consider employee creativity as the lifeblood for their survival (McLean, 2011). However, the majority of scholars have investigated this phenomenon primarily at the individual level: "The major focus in creativity research has been on the individual creator and his or her personality, traits, abilities, experiences, and thought processes" (Williams & Yang, 1999, p. 378).

It has been only recently that more scholars have turned their focus to the influence of organizational context on employee creativity: "The social environment can influence both the level and frequency of creative behavior" (Amabile, Conti, Coon, Lazenby, & Herron, 1996, p. 1155). Employee creativity should not be understood as an individual behavior that is a part of a person's characteristics or abilities but as a complex phenomenon that is influenced by organizational contexts, such as supervisor's leadership style or organizational climate (McLean, 2011). As the current study incorporates multiple variables at different levels of organizations that might influence employee creativity, it contributes to expanding the knowledge base about creativity.

Purpose, Research Questions, and Hypotheses

The purpose of this study was to examine the associations among four variables (i.e., domain expertise, creative personality, non-controlling supervision style, and organizational learning culture) to understand how creativity is related to each variable, as well as the cross-level interactions. Research questions were:

1. What are the associations between supervisor rating of employee creativity in R&D organizations and individual-level variables (i.e., personality and expertise) and team-level variables (i.e., supervision style and organizational learning culture)?
2. Do team-level variables moderate the associations between supervisor rating of employee creativity and individual-level variables?

The following hypotheses were tested:

Hypothesis 1: Creative personality is positively associated with employee creativity.

Hypothesis 2: Domain expertise is positively associated with employee creativity.

Hypothesis 3a: Non-controlling supervision is positively associated with employee creativity.

Hypothesis 3b: The strength of the relationship between creative personality and creativity

across supervisors is positively moderated by non-controlling supervision style.

Hypothesis 3c: The strength of the relationship between domain expertise and creativity across supervisors is positively moderated by non-controlling supervision style.

Hypothesis 4a: Organizational learning culture is positively associated with employee creativity.

Hypothesis 4b: The strength of the relationship between creative personality and creativity across supervisors depends on organizational learning culture.

Hypothesis 4c: The strength of the relationship between domain expertise and creativity across supervisors is positively moderated by organizational learning culture.

Hypothesis 5: Creativity-related personal characteristics and contextual variables interact in such a way that employee creativity is highest when employees have a highly creative personality, possess high domain expertise, are supervised in a non-controlling manner, and perceive a strong organizational learning culture.

Literature Review

Amabile (1983) asserted that there are three necessary and sufficient components to produce creativity: (a) domain-relevant skills (or domain expertise), (b) creativity-relevant skills, and (c) task motivation. Domain-relevant skills indicate "factual knowledge, technical skills, and special talents in the domain in question" (Amabile, 1983, p. 67). Expertise refers to a person's tacit and explicit knowledge of a certain domain, and experts are able to identify problems and go beyond what is already known (McLean, 2011). Tiwana and McLean (2005) found that individuals' expertise integration plays a central role in achieving team creativity.

"Creativity-related skills include cognitive style, application of heuristics for the exploration of new cognitive pathways, and working style" (Amabile, 1983, p. 67). An individual's creativity is claimed to be a dispositional phenomenon, and the profile of a creative personality includes being unconventional, independent, open to new experiences, and risk-taking (Simonton, 2000).

Lastly, task motivation includes "the individual's baseline attitude toward the task…and the individual's perceptions of his reasons for undertaking the task" (Amabile, 1983, p. 76) and is known to be the most effective component in enhancing creativity (Gumusluoglu & Ilsev, 2009). Organizational climate affects employees' motivation to generate new ideas, and organizational climate is largely affected by leadership style. Zhang and Bartol (2010) provided empirical evidence that empowering leadership has positive associations with both intrinsic motivation and employee creativity. Furthermore, Gumusluoglu and Ilsev (2009) found a positive association between transformational leadership and employee creativity. Values, norms, and beliefs that are driven by the organizational culture either support or inhibit employee creativity (Martins & Terblanche, 2003).

The claim has been made and empirically tested that individual and contextual factors described above are related to employee creativity. However, how might these factors at different levels interact to influence creativity? What factors, when combined, produce the greatest employee creativity? Scholars have recently begun to investigate antecedents across levels that influence creativity. Despite current efforts, much more work is needed to specify better models incorporating the right combination of variables, to validate models across populations, and to replicate these studies to increase confidence in them (McLean, 2011).

Methods

The target population was employees in the R&D function (e.g., scientists, engineers, and

technicians but excluding administrative staff and management) in organizations engaged in new product development in the United States. The first author's personal network was used to select organizations willing to participate; thus, convenience sampling was used. As a result, four R&D organizations participated, and an online survey was utilized to inquire into their perceptions of their personalities, their direct supervisor's supervision style, and the organizational learning culture. In addition, their direct supervisors were asked to complete a separate survey that reflects their perceptions of each employee's level of expertise and creativity. Lastly, secondary data for each organization, including invention disclosures written, patent applications filed, and patents received, were collected as a measure of creativity. The number of survey questions across both the employees' and supervisors' versions was 65. According to the Cronbach's alpha test, all instrument variables were reliable, except for the creative personality scale, .65, which is less than the .70, the threshold of acceptable reliability (DeVellis, 2003). Therefore, results from this scale should be interpreted with some caution. Domain expertise was validated by using inter-rater correlations. The validity of the other instruments was based on research conducted by the instrument developers.

The overall response rate was approximately 70% (596 of 848). At the supervisor level, the response rate was 64% (104 of 154). At the employee level, the response rate was 71% (492 of 694); 93.3% of the respondents possessed a post-secondary degree, and 54% had graduate degrees. The average working experience of the respondents was 13.1 years (s.d. 9.4) with 11.2 years (s.d. 8.6) at his/her organization.

Honoring the nature of the two-level data structure, hierarchical linear modeling (HLM) and general linear modeling (GLM) with the generalized estimating equation (GEE) were used for data analysis.

Results

HLM results showed that there is a positive association between supervisor rating of employee creativity and non-controlling supervision style, and that there is a positive association between supervisor rating of employee creativity and domain expertise ($p < .01$). However, the relationships between creative personality and organizational learning culture and creativity were not significant. None of the interactions among the predictors had a significant relationship with creativity. The level 2 variables explained 95% of the variance in random effect on expertise across supervisors. The results using invention disclosures as the measure of creativity showed that only domain expertise predicted at a significant level ($p < .01$) the likelihood that an individual in an R&D organization would have at least one invention disclosure. Neither creative personality, non-controlling supervision style, nor organizational learning culture predicted the likelihood that an individual had at least one invention disclosure at a significant level ($p < .05$). Tables 1 and 2 summarize the outcomes of the tests of each of the hypotheses in this study. All hypotheses were rejected except for hypotheses 2 and 3a.

Table 1

Results of HLM Full Model for Supervisor Rating of Employee Creativity

Effect	Estimate	SE	*t*	*p*
Within Supervisor				
Intercept	11.09	0.14	77.95	<.0001***
Expertise	1.04	0.14	7.69	<.0001***
Creative Personality	.02	0.03	0.62	0.534
Between Supervisor – Intercepts				
Non-controlling Supervision	.13	0.04	3.47	0.001***
Organizational Learning Culture	.01	0.01	1.09	0.277
Expertise Slope Non-controlling Supervision	-0.01	0.06	-1.96	0.051
Creative Personality Slope Non-controlling Supervision Organizational Learning Culture	0.02	0.01	1.56	0.120

*** $p < .001$, ** $p < .01$, * $p < .05$

Table 2

General Linear Model Using Invention Disclosures as Measure of Creativity

Effect	Estimate	*SE*	*p*
Intercept	.99	.18	4.07e-08 ***
Expertise	.65	.20	.001 **
Creative Personality	.00	.05	.968
Non-controlling	-.08	.06	.138
Organizational	-.02	.01	.071
Org1	.31	.48	.520
Org2	-1.84	.39	2.09e-06 ***
Org3	.96	.43	.0251 *

*** $p < .001$, ** $p < .01$, * $p < .05$

Discussion

Based on the results of this study, four key findings can be made. First, domain expertise of employees in R&D organizations positivity affects supervisor rating of creativity. There has been an on-going debate in the literature of whether expertise promotes or stifles creativity. Some scholars have argued that creating novel ideas or solutions requires a high level of expertise, as it reflects the existence of deep knowledge and skills in a given domain (Kulkarni & Simobate, 1988). Others have claimed that a firm grasp of knowledge can block the generation of new thinking and ideas (Frensch & Sternberg, 1989; Hausman, 1984). This study provides empirical evidence that supports a positive relationship between expertise and supervisor rating of creativity. One caution related to this finding is necessary: Creativity in this study was determined by supervisor ratings, which is an indirect and potentially limited measure of creativity. Supervisor ratings in appraisals have been seriously questioned (Suddath, 2013).

Second, this study found that non-controlling supervision style positively predicts the level of employee creativity, whether measured by supervisor ratings or invention disclosure. Non-controlling leadership is likely to create a climate that promotes creativity, as it increases job autonomy, motivation, and employee empowerment. Controlling supervisors are generally autocratic, exclude employees from decision-making processes, and expect employees to behave as they are told; thus, it is more likely to hinder creativity among employees (Zellars, Tepper, & Duffy, 2002). Interestingly, the study results provided evidence that non-controlling supervision did not affect the relationship between domain expertise and creativity as measured by invention disclosure. In other words, non- controlling supervision style was the only variable positively associated with creativity, whether an employee was rated low or high by his or her supervisor or invention disclosure.

Third, creative personality and organizational learning culture showed no significant relationships to creativity, in any measures used, calling into question the importance of these variables when studying creativity, at least in the population examined for this study. The relationship between personality and creativity has been well captured in the literature. A person with a high level of creativity tends to be more open to exploring new experiences and being less conventional (Flynn, 2005). Considering the weight of evidence in the literature, the current study results seem to be counter-intuitive. A possible explanation might be an invalidity of the Creative Personality Scale (CPS) as a measure of creative personality for the current study sample. Developing and validating the CPS, Gough (1979) collected data from twelve different occupations and found that the instrument was not validated for male research scientists and female mathematicians. Thus, it is possible that the CPS was not valid for the present study's population.

The relationship between creativity and organizational learning has not been well established in the literature. However, the literature has suggested a positive link between these two constructs. "An organization learns when, through its processing of information, it increases the probability that its future actions will lead to its improved performance" (Huber, 1998, p. 3). To generate and combine new ideas, it is important that they be exposed in an environment that provides multiple learning resources (Robinson & Stern, 1997). Hirst, Van Knippenberg, and Zhou (2009) found that individuals working in a team that displayed a high level of team learning behavior tend to exhibit a greater level of creativity. Joo, Song, Lim, and Yoon (2011) also found a positive association between organization learning and creativity. However, surprisingly, the current study result is not consistent with the extant literature. The instrument DLOQ, a measure for organization learning for the present study, consists of seven factors that make up the complete scale. It may be that, although there is no significant relationship between the DLOQ scale as a whole and creativity, one or more of the sub-factors of the DLOQ may have a significant positive relationship. Future research should investigate whether any of the sub-dimensions of the DLOQ scale are significantly related to creativity.

Finally, this study highlights the difficulty of defining and measuring creativity. We know that supervisor ratings are not particularly valid measures of anything, and the variable of invention disclosures provided little variability. Thus, researchers in the area of creativity need to work at uncovering better measures of creativity.

Implications for the Field

This study sheds a light to employee expertise and non-controlling supervision style as these factors are discovered to be positively associated with employee creativity. Expertise and supervision style can be promoted by actions such as hiring, promotion, and training and development interventions. HR practitioners can arrange organizational initiatives to draw attention to and improve in these areas. They also should continue their efforts to pursue systemic solutions but can start with these factors that are more easily influenced. The current study presents new opportunities for researchers and practitioners to partner to understand creativity better and to improve the likelihood of producing greater creativity (McLean, 2011).

Recommendations for Future Research

First, more cross-level research that tests a various set of antecedent of employee creativity should be conducted. There is a scarcity of published empirical research that examined the interactions across the multiple levels in organizations. Other combinations of variables across levels should be studied with an aim towards further deciding and understanding which variables are most strongly related, how those variables interact, and which level(s) is/are most important for creativity (McLean, 2011).

Future research should also explore what outcome variable can be used in measuring employee creativity. The way in which creativity is defined in what domain or field, as something novel and useful (Sternberg & Lubart, 1999), creates challenges for measurement. Both *novel* and *useful* are often to be subjective and relative terms. "The researcher must decide how to define creativity to answer several subjective questions, such as, 'Novel to whom? Useful to whom? Novel at what point in time? Useful compared to what? "Besides R&D, what other functions require creativity?' among others" (McLean, 2011, p. 85).

The present study explored a new set of variables across multiple levels that has not been investigated previously. We hope that the field of creativity research will continue to make progress towards addressing some of the challenges highlighted in this study.

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