PROJECT TECHNOLOGICAL CAPACITY AND PROJECT OUTCOMES: THE MODERATING ROLE OF TEAM CREATIVITY

HONG LONG CHEN

Department of Business and Management, The National University of Tainan
E-mail: along314@mail.nutn.edu.tw

Abstract - Extensive research in the creativity and innovation literature develops creativity models and approaches to promote high-quality creativity and innovation and thereby, improving organizational performance. However, relatively few explore how team creativity affects project performance. In this study, our analysis via the bootstrap-based method and PROCESS shows that the relationship between project technological capacity and project performance is significantly stronger when team creativity is higher. The finding indicates that team creativity magnifies the potential project performance through team creativity. The finding also reveals that team creativity negatively moderates the relationship between project technological capacity and project performance. This suggests that the positive relationship between project technological capacity and project performance becomes stronger when team creativity weakens. A possible explanation of this negative moderation is that project technological capacity and team creativity do not have a linear relationship; rather it is curvilinear. Future research should clarify this negative moderating influence of team creativity.

Keywords - Project Management, Project Performance, Creativity, Project Technological Capacity.

I. INTRODUCTION

Research has documented how important creativity is to organizational performance [1]-[5]. For example, Yuan and Woodman [6] examine 216 managers and employees in four large companies using structural equation modeling (SEM) and conclude that expected image risks, expected image gains and expected positive performance outcomes significantly affect employee creative behavior that affects business performance. Stenholm [5] assesses 232 small and medium companies using a longitudinal experiment based on hierarchical linear regression analysis; they conclude that employee creative behavior significantly influences company growth. Additionally, Romero and Martínez-Román [7] analyze 747 self-employed workers using logistic regression analysis. They find that education is a critical factor whose effect on creative behavior comes from its impact on the self-employed motivation and management style, which in turn influences organization performance. However, despite the panoply of studies acknowledging the importance of creativity to organizational performance, relatively few explore how team creativity influences project outcomes. There appears to be a lack of research investigating the relationship among project team creativity, project technological capacity and project performance. The objective of this study is, therefore, to investigate how team creativity impacts project outcomes using the bootstrap-sampling method and PROCESS [8], [9]

II. RESEARCH HYPOTHESES

To explore how team creativity affects the relationships between project technological capacity and project outcomes, we propose a moderated model shown in Figure 1. The central ideal of this model is that project team creativity amplifies the level of project performance through project technological capacity. In other words, we argue that project technological capacity has a stronger positive impact on project performance when team creativity is stronger.

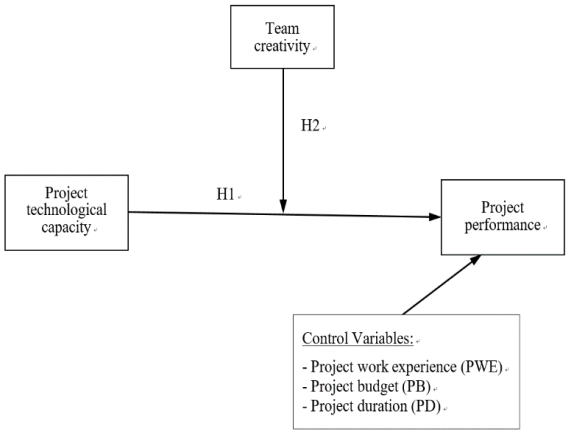


Fig. 1 Moderating effects of team creativity on project technological capacity toward project performance

While the importance of creativity for organizational competiveness and efficiency is widely recognized, creative behavior has become an important corporate asset in business environments characterized by ever-increasing competition (e.g., [1]; [3]). For example, Romero and Martínez-Román [7] state the important effects of employee creative behavior in the early stages of small business conception and development on their following economic outcomes. They show that employee education and training are key determinants of creativity.

Madrid et al. [10] state that creative behavior often enables businesses to function more efficiently. They provide a multilevel and interactional creativity model that elucidates employee creative behavior. Likewise,

Ng and Lucianetti [3] use a sample of 267 employees from 60 companies to develop a moderated mediation model to explain what motivates employees to improve organizational performance via creative behavior.

In other words, individual creativity involves idea dissemination and execution that motivate and inspire team members to work creatively over time [11]. On teams, creative behavior brings and employs new knowledge and technologies that are likely to enhance technological capacity over time, advancing firm performance [6]. Therefore, we hypothesize:

Hypothesis 1: Project technological capacity positively influences project performance.

Similarly, we expect that project technological capacity affects project performance to some degree that is contingent on team creativity. Specifically, the connection between project technological capacity and project performance becomes stronger when team creativity improves. We hence hypothesize:

Hypothesis 2: Team creativity moderates the connection between project technological capacity and project performance.

III. RESEARCH METHODOLOGY

A. Participants

In order to explore the hypotheses, we employ a survey research design. The survey instrument is based on a systematic review of literature in the project-management field. The final version of the survey questionnaire comprises two sections. The first section, composed of open-ended questions, gathers detailed background information such as annual revenue; project type; project cost. The second section gathers data for the project-management variables and measures that data. Section two consists of multiple-choice questions in which respondents indicate on a 5-point scale the extent to which certain project-management performance variables likely affect project outcomes.

A sample of randomly selected 700 company members from the CNAGC was invited to participate, and 108 companies participated in this research, a 15.43 percent response rate; each of 108 companies assigned a project manager who had just completed the process of the initiation and planning of a capital project, where the project had to be scheduled to be finished within the next two years. The 108 capital projects were classified into four types: 20 are industrial facility projects, 17 are environmental facility projects, 16 are transportation facility projects, and 55 are building projects. Years of experience as a project manager of the 108 participants are between 1 and 30 years: 20 participants less than 3 years; 29 participants between 3 and 5 years; 32 participants between 5 and 10; 13 participants between 10 and 15 years; six between 15 and 20 years; five between 20 and 25 years; and three participants between 25 and 30 years.

B. Measures and Analysis

Project performance is measured according to six-item scales in [12] [13] and [14]. The Cronbach's α for project performance is 0.92. Project technological capacity is measured according to a nine-item scale in [12], and [15]. The Cronbach's α for project technological capacity it is 0.96. Team creativity is measured according to [16] three-item scales (Cronbach's $\alpha = 0.86$).

This study controls the potential impact of project budget (PB), project duration (PD), and the project work experience (PWE) of a project manager as these variables may affect project performance. The methodology to examine the hypotheses is straightforward. Specifically, this study employs the hypothesis testing procedure in [17], as well as the bootstrap-sampling method and PROCESS to examine the hypothesized model [8], [9].

IV. RESEARCH RESULTS

Hypothesis testing follows the procedure in [17]. We first regress the dependent variable (i.e., project performance) on the independent variable (i.e., project technological capacity) with control variables (i.e., (PB, PD, and PWE) in the equations. Significance for an independent variable in such a regression equation suggests support for the hypothesis (i.e., hypothesis 1). Second, we introduce team creativity as a moderator of the relationships between project technological capacity and project performance. Significance for the interaction term involving team creativity using the bootstrap-sampling method and PROCESS [8], [9] suggests support for the cross-level prediction (i.e., hypothesis 2).

Table 1 reports the bootstrap-based hierarchical linear regression results with 1,000 bootstrap samples for hypothesis 1 analysis. Table 2 exhibits the results of moderation (i.e., team creativity) analysis using the bootstrap-sampling method and PROCESS [8], [9] with 1,000 bootstrap samples.

As table 1 shows, the regression coefficient for project technological capacity is 0.688 that is significant at the $P < 0.001$ level. The bootstrapping test produces the bias-corrected 95% CI of 0.622 to 0.754, which excludes zero. This further confirms the significance of project technological capacity to project performance. The result supports Hypothesis 1 that project technological performance positively influences project performance (Hypothesis 1).

As shown in table 2, the regression coefficient for the interaction term Team creativity x Project technological capacity -0.073 at the $P < 0.05$ level. The bootstrapping test generates the bias-corrected 95%

CIs of -0.134 and -0.011 that excludes zero, confirming the significance of the interaction term. The result suggest that team creativity moderates the relationship between project technological capacity and project performance (hypothesis 2).

Variables and Sources	Products of Coefficients		Bias-Corrected 95% Confidence Interval	
	Estimate	SE	Lower	Upper
Intercept	1.449	0.149***	1.158	1.742
Control variable				
PWE	0.003	0.006	-0.008	0.015
PB	-0.001	<0.001	<0.001	<0.001
PD	0.000	<0.001	-0.001	<0.001
Independent variable				
Project technical capacity	0.688	0.035***	0.622	0.754
Adjusted R-squared	0.605			

Table 1: Bootstrap-based hierarchical regression results for hypothesis 1

Note: 10,000 bootstrap samples. ***P < 0.001, **P < 0.05, and *P < 0.10.

Variables and sources	Products of coefficients		Bias-corrected 95% CI	
	Estimate	SE	Lower	Upper
Intercept	0.614	0.244**	0.133	1.096
Control variables				
PWE	0.002	0.005	-0.001	0.012
PB	-0.001	0.001	-0.001	0.002
PD	-0.001	0.001	-0.001	0.002
Independent variables				
Team creativity	0.622	0.101***	0.423	0.821
Project technical capacity	0.589	0.101***	0.389	0.788
Moderating effects (hypothesis 4b)				
Team creativity x Project technical capacity	-0.073	0.031*	-0.134	-0.011
R-square	0.710			
Improved R-square due to interaction (%)	0.008			
F-value	85.399***			

Table 2: Results of the bootstrap-based method for testing the moderating effect of team creativity on project technical capacity and project performance

Note: 1,000 bootstrap samples. SE = standard error, t = student t-statistic, CI = confidence interval, ***P < 0.001, **P < 0.01, and *P < 0.05.

V. DISCUSSION AND CONCLUSION

Previous studies of creativity focus on how employee creativity influences organization performance (e.g., [2] - [5]). Relatively few investigate how team creativity affects project performance. There appears to be a lack of studies exploring the relationship among project team creativity, project technological capacity and project performance. This study thus develops and examines the theory that team creativity facilitates high-quality project technological capacity, which in turn enhances project performance. The research results demonstrate that team creativity moderates the relationship between project technological capacity and project performance.

In particular, the moderating role of team creativity in Table 2 reveal interesting nuances in the relationships. The interaction term Team creativity x Project technological capacity is negative, suggesting that team creativity negatively moderates the relationship between project technological capacity and project performance. In other words, the positive relationship between project technological capacity and project performance turns stronger when team creativity weakens. One possible explanation is that project technological capacity and team creativity do not have a linear relationship; rather it is curvilinear (such as an inverted u-shaped relationship) [1].

In conclusion, extensive research in the creativity literature develops creativity models and approaches to promote high-quality creativity and innovation and thereby, improving organization performance. However, little research explores how team creativity affects project performance. Our analysis via the bootstrap-based method and PROCESS [8], [9] shows that the relationship between project technological capacity and project performance is significantly stronger when team creativity is higher. The finding indicates that team creativity magnifies the potential project performance through team creativity.

REFERENCES

[1] H.L. Chen, "Impact of Communication on Capital Project Performance: A Mediated Moderation Model," Sustainability, vol. 13, no. 20, p.11301, Jan.2021.

[2] A.Newman, H.M. Herman, G. Schwarz, and I. Nielsen, "The effects of employees' creative self-efficacy on innovative behavior: The role of entrepreneurial leadership," Journal of Business Research, vol. 89, pp.1-9, Aug. 2018.

[3] T.W. Ng, and L. Lucianetti, "Within-individual increases in innovative behavior and creative, persuasion, and change self-efficacy over time: A social-cognitive theory perspective," Journal of Applied Psychology, vol. 101, no. 1, pp. 14–34, Jan. 2016.

[4] W.Omri, "Innovative behavior and venture performance of SMEs," European Journal of Innovation Management, vol. 18, no. 2, pp. 195-217, May 2015.

[5] P.Stenholm, "Innovative behavior as a moderator of growth intentions," Journal of Small Business Management, vol. 49, no. 2, pp.233-251, April 2011.

[6] F.Yuan, and R.W. Woodman, "Innovative behavior in the workplace: The role of performance and image outcome expectations," Academy of Management Journal, vol. 53, no. 2, pp. 323–342, Apr. 2010.

[7] I.Romero, and J.A. Martínez-Román, "Self-employment and innovation. Exploring the determinants of innovative behavior in small businesses," Research Policy, vol. 41, no. 1, pp. 178-189, Feb. 2012

[8] A.F. Hayes, "PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling," Retrieved from http://www.afhayes.com/public/process2012.pdf, 2012.

[9] K.J.Preacher, and A.F. Hayes, "Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models," Behavior Research Methods, vol. 40, no. 3, pp. 879–891, Aug. 2008.

[10] H.P. Madrid, M.G. Patterson, K.S. Birdi, P.I. Leiva, and E.E. Kausel, "The role of weekly high-activated positive mood, context, and personality in innovative work behavior: A multilevel and interactional model," Journal of Organizational Behavior, vol. 35, no. 2, pp. 234–256, Feb. 2014.

[11] Y.Gong, J.C. Huang, and J.L. Farh, "Employee learning orientation, transformational leadership, and employee creativity: The mediating role of employee creative self-efficacy," Academy of Management Journal, vol. 52, no. 4, pp. 765–778, Aug. 2009.

[12] H.L.Chen, "Innovation stimulants, innovation capacity, and the performance of capital projects," Journal of Business Economics and Management, vol. 15, no. 2, pp. 212–231, March 2014.

[13] H.L.Chen, "Performance measurement and the prediction of capital project failure," International Journal of Project Management, vol. 33, no. 6, pp. 1393–1404, Aug. 2015.

[14] H.LChen, and Y.L. Lin, "Goal orientations, leader-leader exchange, trust, and the outcomes of project performance," International Journal of Project Management, vol. 36, no. 5, pp. 716–729, July 2018.

[15] D.I.Prajogo, and P.K. Ahmed, "Relationships between innovation stimulus, innovation capacity, and innovation performance," R&D Management, vol. 36, no. 5, pp. 499–515, Nov. 2006.

[16] O.Janssen, "Fairness perceptions as a moderator in the curvilinear relationships between job demands, and job performance and job satisfaction," Academy of Management Journal, vol. 40, no. 5, pp. 1039–1050, Oct. 2001.

[17] S.Tangirala, S.G. Green, and R. Ramanujam, "In the shadow of the boss's boss: Effects of supervisors' upward exchange relationships on employees," Journal of Applied Psychology, vol. 92, no. 2, pp. 309-320, Mar. 2007.

★★★