Effect of Research and Development Improvisation on Innovation Performance : The Moderating Role of Shared Mental Models

Huamin Mo* Ekrisi Niyomsilp**

Received: March 7, 2020 Revised: April 14, 2020 Accepted: April 17, 2020

Abstract

This article examines the relationship between R&D staff improvisation, shared mental models and innovation performance. The findings confirm that the R&D staff improvisation behavior, and its three dimensions, spontaneity behavior,creativity behavior and utilizing available resource behavior are positively related to the firm innovation performance. Furthermore, the findings suggest that the relationship between the R&D staff improvisation behavior and innovation performance is moderated by the team shared mental models. The results would benefit to motivate R&D staff improvisation for innovative and offer guidance to managers for improving the innovation performance of enterprises.

Keywords: Improvisation; Shared Mental Model; Innovation Performance; R&D Staff

Introduction

In this VUCA era of variability, uncertainty, complexity, and ambiguity, unexpected things often happen. The enterprise had to adopt the coping style that was flexible, impromptu and quick to effectively deal with some exceptions, or to grasp the fleeting opportunities The organization improvisation was a response to rapidly changing environment with flexibility and response sensitivity way (Crossan & Sorrenti ,1997). And R&D staff improvisation means that organizations can quickly

* School of Management, Shinawatra University

** Faculty of Management, Shinawatra University

develop new products (Brown & Eisenhardt,1997), while adapting to a rapidly changing market and technology environment. However, until now, empirical studies on the relationship between improvisation and innovation performance have been limited and the relationship has not been finalized, some studies think there is positive relationship between improvisation and innovation performance (Vera & Crossan, 2005; WU.D et al.,2010), but there are also studies that suggest a slight or even negative correlation between the two. (Moorman & Miner,1998; Magni M. et al, 2010).

Furthermore, studies have found there was a complex moderating effect on the relationship between the improvisation and the outcome variable. Improvisation was influenced by team attributes (e.g., cohesion), team dynamics, and the environment of team or organization (Vera & Crossan, 2005). Such as the relationship between improvisation and new product development was regulated by environmental volatility and organizational memory(Miner & Moorman, 2010), the information and knowledge of team (Akgün et al,2010), etc. In line with this, the research objectives was presented.

Research Objective

This paper focuses on R&D staff working in high-technology firms in China.

1. To examine the impact of R&D staff improvisation on firm innovation performance.

2. To investigate the moderating role of shared mental models between R&D staff improvisation and firm innovation performance.

Literature Review and Research Hypothesis

Staff improvisation

Improvisation was introduced into Organizational Behavior as an unconventional way to deal with the increasing complexity and uncertainty of the

business environment. The improvisation was regard as a "behavioral concept" and a time-bound phenomenon, usually associated with ambiguity, uncertainty and unexpected situations, and which focused on timeliness and creative intent (Moorman & Miner,1998) and drew on available resources (Cunha, 2009). The improvisation was defined that the process of creative and spontaneous action to achieve goals in new ways (Vera et al.,2005) ,and was about relying on intuition and existing resources to solve problems creatively under time pressure (Leybourne et al.,2006).With the deepening of the research, the characteristics of improvisation such as "intention creation", "spontaneity (intuitive response)" and "utilizing existing resources" have been explored by scholars.

R&D work is improvised, it is only when the R&D staff spontaneously show the process of innovation or apply the knowledge of innovation that the R&D work really emerges. The R&D staff more or less show spontaneity and innovation (Dehlin E, 2013). R&D staff improvisation is defined as the ability of researchers to creatively recombine and redistribute existing resources in the situation of an emergency or emergency using unconventional behaviors.

Shared mental models

The Mental model refers to a psychological mechanism by which people can describe the purpose and form of the system, explain the function and current state of the system, and predict the future state of the system(Rouse & Morris,1986). The shared mental models (SMM) are developed from mental models, and which was psychological representation of the key elements shared by team members.The SMM contained team-task models, such as equipment, technology, and tasks ,etc, and team member-related models, (Li Baizhou et al., 2015), such as the structure of knowledge, and the attitudes or beliefs.

The SMM could be divided into assignment-based SMM and cooperation SMM (Wang Liying,2010). The former referred to team members had overlapping,

similar, or consistent knowledge about the team's tasks, technologies and equipment, and operating specifications. The latter referred the recognition about knowledge and roles of teammates, as well as team interaction modes and channels, are mainly reflected in process collaboration, role distribution, and member trust.

The staff improvisation and innovation performance

The staff improvisation has an important impact on innovation performance, however the relationship between the two wasn't clarified. Akgün and Lynn(2002) found a significant correlation between improvisation and the rapid launch of new products. Organizational Improvisation shorten product development time , and improved new product development performance and product characteristics (Dhumal, 2008).

The staff and R&D team improvisation would be beneficial to team innovation performance (Li Haidong, 2011), and brought positive results for product innovation management, and positively affect product innovation performance by moderating variable effect (Gao Pengbin, 2015). Ruan Guoxiang (2015) found that employees promoted their knowledge creation ability through improvisation to improve innovation performance in their research. Therefore, this study took the R&D staff of high-tech enterprises as the survey object, and empirical study the relationship between R&D staff improvisation and innovation performance. The following hypotheses were proposed:

H_1: The R&D staff improvisation is positively related to their firm innovation performance.

$SubH_{1a}$: The R&D staff spontaneity behavior is positively related to their firm innovation performance.

$SubH_{1b}$: The R&D staff creativity behavior is positively related to their firm innovation performance.

$SubH_{1c}$: The R&D staff utilizing available resource behavior is positively related to their firm innovation performance.

The role of the shared mental models

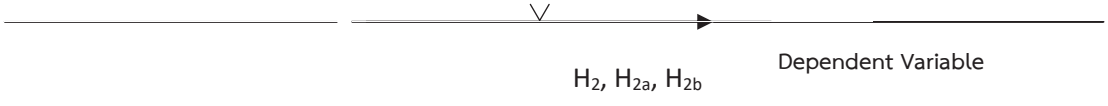
The shared mental models was considered that improved communication and coordination between members by making the individual form correct explanations and expectations for a team and its mission (Xinwen B & Erping,W 2004), and which was benefit to the improvement of the utilization level of team knowledge (Mathieu, etc., 2000). Among the two teams with different development degrees of SMM, with higher SMM similarity have stronger positive performance (Zhou & Wang, 2010). So,the team SMM could enable members to have a common and consistent understanding of dynamic and complex, fuzzy and changeable scenarios, which were conduced to members to explain emergencies, reduced the loss of team processes, and improved team work efficiency. The following assumptions are presented.

H_2 : The relationship between the R&D staff improvisation behavior and their firm innovation performance is moderated by the shared mental models of a R&D team.

H_{2a} : The relationship between the R&D staff improvisation behavior and their firm innovation performance is moderated by the assignment-basted shared mental models of a R&D team.

H_{2b} : The relationship between the R&D staff improvisation behavior and their firm innovation performance is moderated by the cooperation-based shared mental models of a R&D team.

Figure 1 summarizes the research model tested in this study.



H_1, H_{1a}, H_{1b}, H_{1c}

Figure 1 The model tested in the study

Research Methods

1. The Population and Sampling

The population of this study is composed of R&D staff working in High-tech enterprise in China. Since the population is large amount, this study employ W.G.Cochran's 1977 correction formula to compute for the sample size. 313 is the minimum returned sample size required.

2. Data Collection

The participation was solicited from R&D team of high-tech enterprise in China. The respondent was strictly voluntary in the survey. The data were collected with a structured questionnaire, containing 7-point Likert type scales, adopting the online survey and field survey. Of a total of 380 individuals involved, 348 usable surveys were completed (a 91.6 % response rate), and no team in the sample had a response rate lower than 80%.

3. Sample

The demographic profile of the subordinates was follows: 67.7% of the respondents were male, 32.3% were women. 27.9% were 20-25 years old, 37.2% were 26–30 years old, 21.7% were 31–35, and 10.6 % were 36-40 years old, and 2.7% were more than 40 years old. 13.3% of the respondents had a Junior college, 59.7% had an undergraduate school, and 23.5% had a master degree, and 3.6% had a doctor degree.

4. Measures Variable

The item of R&D staff improvisation was designed referring to the scales that developed by Crossan & Vera (2005), Leybourne & Smith(2006), and Ding Lin et al, 2014), with 9 items(alpha=0.866; CR=0.852; AVE=0.64). Innovation performance

was measured using a five-item scale developed by Bell (2005), Ritter and Gemunden (2004), with 5 items (alpha=0.903; CR=0.904; AVE=0.653). Shared mental models were measured using the scale developed by Wang, Liying (2010),with 10 items (alpha=0.858; CR=0.918; AVE=0.692). Control variables mainly include the following: Gender, Old, Education level.

5. Common Method Bias

The Harman one-factor test was performed on the data(Podsakoff et al, 2003). All the items were conducted a principal component analysis. The largest factor accounted for 36.964% of the variance,which suggested the common method bias is acceptable.

Research Results

Testing the relationship between R&D staff improvisation and innovation performance

The results of the regression analysis are present in Table 1. The R&D staff improvisation (IM), spontaneity behavior (SP), creativity behavior (CR), and utilizing available resource behavior (UT) could explain 40.2%, 28%, 28.2% and 28.3% of the variance in innovation performance. The R&D staff improvisation(H_1) (β=0.615, p<0.001), the spontaneity dimension (H_{1a}) (β=0.502, p<0.001), creativity dimension (H_{1b}) (β =0.503, p<0.001) and utilizing available resource (H_{1c}) (β =0.427, p<0.001) all had a significant, positive impact on innovation performance. So hypothesis H_1, H_{1a}, H_{1b}, and H_{1c} was supported.

The effects of the SMM was tested by hierarchical regression analysis. As shown in Table 3, the interaction effect models explain 69.6%, 68.8% and 44.8%. In Model 6, the moderating effect of the shared mental models was significant and positive (β=0.150, p<0.001). Hypothesis H_2 was be supported. In model 7, the moderating effect of assignment-based shared mental models was significant and

positive (β=0.146, p<0.05). Hypothesis H_{2a} was be supported. In model 8, the moderating effect of cooperation-based shared mental models was significant and positive (β=0.108, p<0.05). Hypothesis H_{2b} was be supported.

Table 1 The Result of Regression Analysis

	Innovation Performance				
	M 1	M 2	M 3	M 4	M 5
	β	β	β	β	β
Gender	-0.088***	-0.059	-0.058	-0.074	0.083
Age	0.166	0.084	0.119	0.128	0.200
Education	-0.011	-0.015	-0.003	-0.007	-0.015
IM		0.615***			
SB			0.502***		
CI				0.503***	
UR					0.427***
R^2	0.031	0.402	0.280	0.282	0.283
F	3.617***	57.572***	33.284***	33.680***	33.800***

Notes: *,P<0.05; **,P<0.01; ***,P<0.001;

Testing the moderating effect of shared mental models

Discussion and Conclusions

The study finds that R&D staff improvisation behavior could significantly promoted their firm innovation performance. Specifically, the R&D staff spontaneously utilizing the available resources to innovate, that could improve their ability to face the competitive environment and emergencies, and thus improve the firm innovation performance. So managers should encourage and train the the improvisation ability.

The shared mental models were of great value in revealing how R&D teams accomplish innovation tasks through implicit collaboration (Wang,L,Y & Chen, J,2010), and beneficial to internal team processes (Liu Xiaojun, 2009). In the process

of new product development, R&D staff need to adjust their plans to research in time. In R&D team with high-level assignment-based shared mental model, the team members has a high degree of consistent understanding of team tasks, technologies and equipment, and operating specifications, therefore, who could immediately response to change that have occurred with their ability to respond to dynamic environments or emergencies enhancing and sensitivity to things increasing. (Wang L. & Chen J., 2010;Xinwen,B. & erping,W,2004).

In addition, R&D personnel with a highly cooperation-based shared mental models have a high level of knowledge of the knowledge structure of other members, and trust each other (Wang L., 2009), which also helps R&D staff to respond quickly and utilizing available resources to support others improvisational ideas, thereby improving the performance of improvisation. So the results of this study provide strong support for sharing mental models to promote team performance.

Recommendations for Management

The results this study will provide some management enlightenment for enterprises or managers to improve the improvisation ability of R&D staff and team, so as to improve the firm innovation performance. Firstly, staff Improvisation was regard as an acquired ability, an spontaneous and creative action, that could be cultivated or improved through various methods. For instance, the organization of situation simulation training, drama improvisation, outdoor outreach and other projects, to develop improvisation awareness and ability.

Secondly, managers should set moderate and loose mission goals, so as to leave more freedom for R&D team. The similar task knowledge, including the specific goals and procedures, action and strategy, etc., and which was beneficial for rapidly executing and creatively using available resources (Wang L.& Chen J., 2010),.

Thirdly, managers should encourage R&D staff to share information, express views frankly, and integrate various information resources in team. The improvisation innovation activities are characterized by high time pressure, strong collaboration, uncertainty and high risk (Vera D et al., 2005), which determines that timely communication and exchange of information among members is the key to improving the innovation efficiency of the R&D team.

Limitations and Future Researches

Although some valuable conclusions have been obtained in this study, there are still some problems. The data of variables were collected by employee self-evaluation, and adopted cross-section date was adopted, which may affect the relationship between variables at a certain point in time, Therefore, subsequent study could carry out longitudinal studies or case studies based on time span to further explore the causal relationship between variables. Future studies may explore the effects of other regulatory variables or mediating variables on their relationships, such as information communication, experimental culture and organizational memory.

Reference

Akgün, A. E., Keskin, H., Byrne, J. C., & Gunsel, A. (2011). **Antecedents and results of emotional capability in software development project teams.** Journal of Product Innovation Management, 28(6), 957-973.

Bell, G. G. (2005). **Clusters, networks, and firm innovativeness.** Strategic management journal, 26(3), 287-295.

Dehlin, E. (2013). **Fleshing out everyday innovation: phronesis and improvisation in knowledge work.** In Handbook of organizational and managerial innovation. Edward Elgar Publishing.