RESEARCH ARTICLE

THE MODERATOR EFFECT OF RESEARCHERS' INDUSTRIAL EXPERIENCE HETEROGENEITY ON THE RELATIONSHIP BETWEEN IMPROVISATION BEHAVIOR AND INNOVATIVE PERFORMANCE IN HENAN PROVINCE, CHINA

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ABSTRACT

With a highly uncertain market environment, an empirical study of researchers in Henan Province found that improvisation has a positive effect on innovation performance, and that industry experience heterogeneity has a significant moderating effect between improvisational behavior and innovative performance. Based on this founding, we suppose that the heterogeneity of industry experience could be used to improve innovation performance, form scientific research teams and create an environment conducive to the improvisation of researchers.

INTRODUCTION

Scientific and technological innovation is a basic force for promoting industrial upgrading and improving the core competitiveness of enterprises. It plays a decisive role in the status of enterprises in market competition and is becoming more and more important in the current era. After Weick (1998) first introduced improvisational behavior into management, scholars have tried to study relationships between improvisational behavior and working performance from different perspectives. However, there is still a research gap about researchers' industrial experience heterogeneity on the relationship between improvisation behavior and innovative performance. In different situations, research angles, and study perspectives, the effect of improvisational behavior on innovative performance is different. Hmieleski and Ensley (2004) believe that the improvisational behavior of researchers could have a negative and even irrelevant correlation on innovation performance. Qiu Ying's (2011) research pointed out that the effect of improvisational behavior

on innovative performance could be different, because of different behavioral dimensions, moderator variables, research objects and social situations selected by researchers. However, other scholars deemed that improvisational behavior could improve the innovative performance in the macro view. Ji Xiaoli (2013) and Ruan Guoxiang (2015) test the correlations between improvisational behavior and innovation performance by introducing many different moderator variables such as sharing mind, power distance, management strategy, etc., and give a result that there is a positive effect of improvisational behavior on innovative performance. Consequently, the purpose of this research is to study the relationship between improvisational behavior and innovative performance of researchers who are working in Heian province, China. It could help researchers to achieve more effective improvisation teams and to improve their innovative performance. The objectives of this study are to determine the effectiveness of improvisational behavior of researchers on their innovative performance and to determine the effectiveness of industry experience heterogeneity of researchers on the relationship between improvisational behavior and innovative performance.

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Conceptual Framework

Research Hypothesis

H_1: There is a significant correlation between improvisational behavior of researchers and their innovative performance.

H_{1a}: There is a significant correlation between the spontaneity of researchers and their innovative performance.

H_{1b}: There is a significant correlation between the creativity of researchers and their innovative performance.

H_{1c}: There is a significant correlation between utilizing existing resources by researchers and their innovative performance.

H_2: The industry experience heterogeneity of researchers could significantly influence the relationship between their improvisational behavior and their innovative performance.

Literature Review

The Relationship between Improvisational Behavior and Innovative Performance: Improvisational behavior of researchers as the spontaneous and creative problem-solving behaviors and abilities adopted by scientific researchers to use the existing resources for dealing with sudden emergencies,it mainly refers to the use of three dimensions include utilizing existing resources, immediate response and intention to create. Vera and Rodrigue-Lopez (2007) point out that improvisational behavior also implies taking a risk at the same because it is essentially spontaneous, creative, and unpredictable. Therefore, under the situationof environmental uncertainty and limited resources, the purpose of researching improvisational behavior in the field of management is aimed at innovative researches on the management to resolve unexpected problems and ultimately achieve positive performance.

The moderator effect of industry experience heterogeneity on improvisational behavior and innovative performance: Magni et al. (2009) in the empirical study of the impact of team cohesion and behavioral integration on improvisational behavior, mentioned that in future research prospects, researchers can consider team heterogeneity. Pelled (1996) has proved that between improvisational behavior and innovative performance there are some moderator factors, which could influence the performance of improvisational behavior, such as heterogeneity of different teams and different knowledge backgrounds. Moreover, Hoegland Proserpio (2004) also believe that improvisational behavior could influence innovative performance by different moderator variables. Team heterogeneity could positively contribute to the relationship between improvisational behavior and innovative performance. Heterogeneity is associated with a high level of spontaneity, because of team members no need to deliberately consider actions, they can create patterns in new contexts by using their heterogeneity, they almost spontaneously to know what they should do (Crossan et al., 1999). Bao Gongmin, Qian Yuanyuan (2009) found out that heterogeneity can not only increase the effectiveness of the spontaneity of researchers, but also benefit to create a highly efficient internal process of the team. In conclusion, based on the literature review, the improvisational behavior of researchers has been divided into three dimensions in this research. From the perspective of resources, with the increase of team heterogeneity, the positive effect of team available resources on team innovative performance could be enhanced. the moderating effect of the team's heterogeneity could positively influence the relationship between available resources and team innovative performance. The greater heterogeneity that a team can have, the moreteam members can acquire more information, cognitive, social interaction, psychological and other resources. According to Weick (1998), in case of an emergency, the more resources that can be utilized and integrated, there are more alternatives can be chosen by a team. Therefore, the direct result of the expansion of team heterogeneity is to have more available resources, which increases the possibility of improvisational behavior. Enough resources can reduce the constraints of the organization to implement improvisational behavior.

METHODOLOGY

Research Design: This is a quantitative research that aims at studying the relationship between improvisational behavior and innovative performance of researchers who are working in Heian province, China. The researcher used a survey questionnaire to collect data from 506 scientific research team members from different cities of Henan province, China. The researchers employed One-Way ANOVA and multiple regressions to test the correlations of variables and to test the research hypotheses.

Population and Sample: The population size of this research is scientific research team members who worked in computer information technology, software development, data service, and other research and development enterprises in Zhengzhou, Luoyang, Nanyang and other cities where located in Henan province, China. According to the statistical yearbook of Henan Province (2018), the total number of R&D personnel in Henan province was 266,427. The sampling method can be calculated by using Taro Yamane (Yamane, 1973) formula with a 95 percent confidence level, the formula is as follows:

$$n = \frac{N}{(1+Ne^2)}$$

Where

n = corrected sample size
N = population size
e = Margin of error (MoE), e = 0.05 based on the research condition. Supposing to calculate a sample size of a finite, when the original sample collected is more than 5% of the population size, the corrected sample size is determined by using the Yamane's formula. Based on this study, the population size is 266,427, the error level is 0.05. the calculation for the required sample size will be as follows:

$$n = \frac{266427}{1 + 266427 \times 0.05^2} = 399.9 \approx 400$$

By applying Taro Yamane formula (1973) to derive the sample size for the survey on the population is finite, the sample size from the computation was 400 samples. However, for more convenience and to protect from the incomplete questionnaires, the researcher used 600 samples in this research for easy computation.

Table 3.1. Improvisational Behavior and Innovative Performance Correlation Analysis

	Improvisational behavior	Innovative performance
Improvisational behavior	1	
Innovative performance	.658[**]	1

**.The significance level of the mean difference was 0.05.

Table 3.2 Dimensions of Improvisational Behavior Correlation Analysis

	Spontaneity	Creativity	Resources	Innovative performance
Spontaneity	1			
Creativity	.766[**]	1		
Resources	.721[**]	.746[**]	1	
Innovative performance	.562[**]	.632[**]	.607[**]	1

**. The significance level of the mean difference was 0.05.

Table 3.3. *Improvisational Behavior and Innovative Performance Regression Coefficient* [α]

Model		Unstandardized coefficient		Standardized coefficient		
		B estimate	SD	Beta distribution	T	Sig
1	constant	.994	.216		4.590	.000
	IB	.762	.042	.658	17.998	.000

Table 3.4. *Improvisational Behavior and Innovative Performance Regression Model Summary* [b]

Model	R	R²	Adjusted R²	Std. Error of the Estimate	Durbin Watson
1	.658[a]	.433	.431	0.91099	1.525

Table 3.5. Dimensions of Improvisational Behavior and Innovative Performance Regression Coefficient [α]

Model		Unstandardized coefficient		Standardized coefficient		
		B estimate	SD	Beta distribution	T	Sig
1	Constant	1.986	.207		9.575	.000
	Spontaneity	.563	.040	.562	13.993	.000
2	Constant	1.386	.209		6.646	.000
	Creativity	.693	.041	.632	16.804	.000
3	Constant	1.514	.215		7.059	.000
	Resources	.650	.041	.607	15.729	.000

Table 3.6. Dimensions of Improvisational Behavior and Innovative Performance Regression Model Summary [b]

| Model	R	R²	Adjusted R²	Std. Error of the Estimate	Durbin-Watson
1	.562[a]	.315	.314	1.00060	1.506
2	.632[a]	.399	.398	.93737	1.558
3	.607[a]	.368	.366	.96142	1.593

Table 3.7. Coefficient [α] of Moderator effect test for Different Industry Experience Groups of Researchers

Experience			Unstandardized coefficient		SC	t	Sig.
			B estimate	SD	Beta Distribution		
1-3 years	1	(Constant)	.637	.309		2.061	.041
		IB	.789	.061	.715	12.891	.000
3-5years	1	(Constant)	1.610	.416		3.866	.000
		IB	.643	.081	.650	7.894	.000
5-7years	1	(Constant)	1.262	.587		2.151	.036
		IB	.737	.115	.665	6.414	.000
7-10years	1	(Constant)	-.209	.949		-.221	.826
		IB	1.033	.190	.618	5.446	.000
More than10years	1	(Constant)	2.319	.589		3.940	.000
		IB	.560	.110	.510	5.071	.000

a. Independent variable: Centralization of innovative performance.

the moderator effect of researchers' industrial experience heterogeneity on the relationship between improvisation behavior and innovative performance. A pilot test of the structured survey questionnaire was conducted on potential respondents to ensure ease and to test the questions from the

Data Collection: The semi-structured survey questionnaire was used for data gathering from scientific researchers in Henan province, China, and using purposive sampling. In order to avoid possible misunderstandings caused by different personal cognition about the designed questions, we
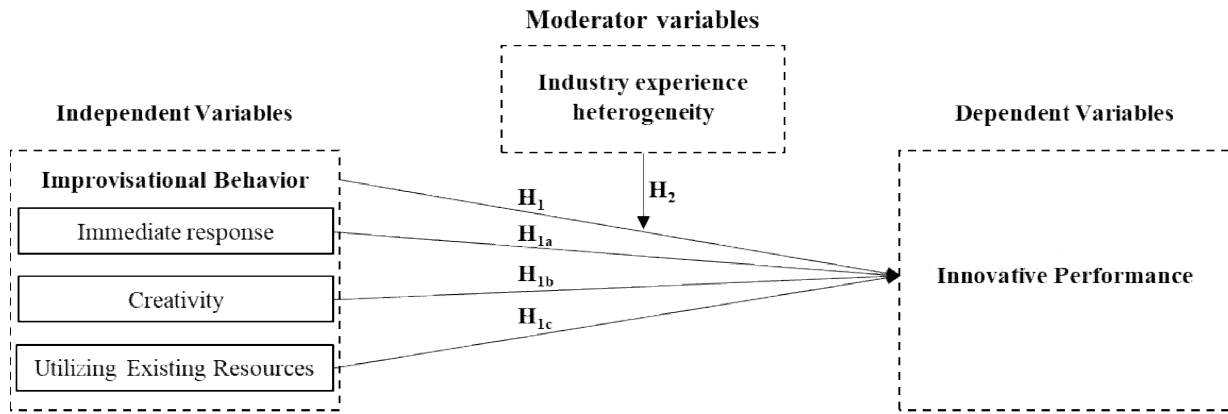
Source: The author developed from Wang Jun (2016).

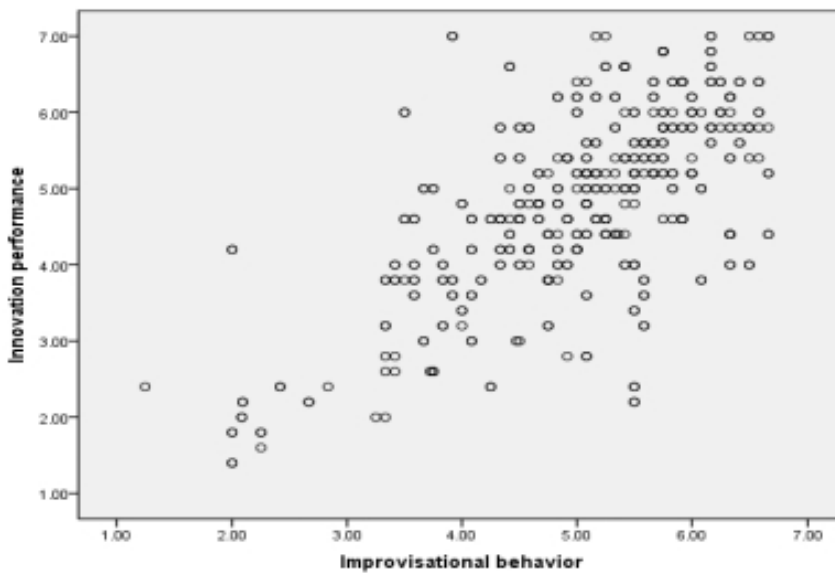**Figure 1.1. Logical relations among the research hypotheses**
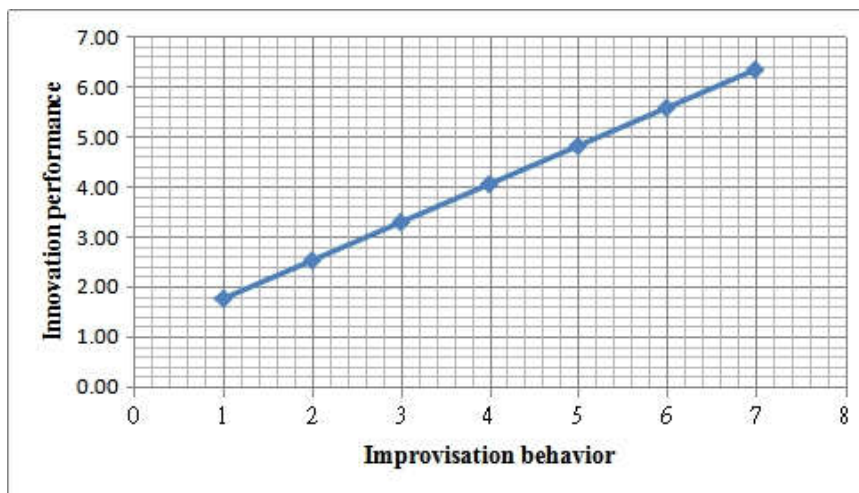

Figure 3.2. Scatter Diagram

Figure 3.3 Linear Model

distributed questionnaires in designated groups which nearly formed by scientific researchers, such as research and development department of universities and companies, different kinds of scientific research centers, and meetings of researchers. Moreover, the author will face to face explain the survey questionnaire to designated participants until they clearly understood, and then authorize these people to distribute the survey questionnaire to scientific researchers, and in this process, one participant can only fill out one questionnaire. If there are any questions the respondents confuse about, he or she can connect the author directly. Furthermore, if there are a large number of identical answers in the same batch of questionnaires, this batch of questionnaires was regarded as invalid data.

Data Analysis: Due to the research design for the study was designed as quantitative research, descriptive and inferential statistics were employed to analyze the data from the survey questionnaires. The descriptive statistics in the survey questionnaire includes frequency, percentage, mean, and standard deviation, which describes the personal data and attitude on improvisation behavior and innovative performance. In addition, Cronbach's Alpha, and regression are employed to test variables and the hypothesis. The obtained data from the survey questionnaires will be input into a software computer program for computation and analyzing the data.

Research Findings and Analysis

Since this study only focuses on scientific researchers in Henan province, China, after two questionnaire distributions and collections, there were 600 questionnaires have been distributed, and 506 were received, which excludes 17 non-scientific researcher's questionnaires. Therefore, the total valid data comes from 427 questionnaires, the receiving rate was 71.1%.

Correlation Analysis: Table 3.1 shows that the improvisational behavior and innovative performance correlation coefficient value 0.658, greater than 0.5, indicating that there was a strong correlation between improvisational behavior and innovation performance. Then, the correlation analysis between three dimensions of improvisational behavior and innovative performance are shown in Table 3.2, Spontaneity correlation coefficient value 0.562, Creativity correlation coefficient value 0.632 and Utilizing existing resources correlation coefficient value 0.607, the correlation coefficient between improvisational behavior and innovative performance value 0.658, each value is greater than 0.5,indicating that there was a strong correlation between improvisational behavior and innovation performance.

Improvisational Behavior and Innovative Performance Research Hypothesis Test (Regression Analysis): After determining the correlation between independent variables and dependent variables, the scatter diagram is used to judge the linear relationship between independent variables and dependent variables, as shown in Figure 3.2, it can be intuitively found that improvisational behavior is linearly correlated with innovative performance. The regression analysis results as shown in Table 3.3. The standardized regression coefficient has a Beta distribution value is 0.658, P-value is less than 0.05, and the constant is 0.994, both are significant, indicating that improvisational behavior positively correlated with innovative performance, improvisational behavior positively affects innovative performance. The Beta estimate value of innovative performance is 0.762, indicating that the slope of the two linear equations is 0.762, indicating the change of innovative performance with each unit of improvisational behavior change. In summary, we can confirm that there is a positive correlation between improvisational behavior and innovative performance, so the linear model of the two is established as follows: Y=0.762X+0.994. According to the *Improvisational Behavior and Innovative Performance Regression Model Summary* [b] as shown in Table 3.4, the R^2 value is 0.433, it indicates that improvisational behavior can explain the change is 43.3% of the innovative performance, even if the Adjusted R^2 value is 0.431 is slightly smaller,

improvisational behavior can also explain the change is 43.1% of the innovative performance. Some scholars believe that in social science research, there are many variables that affect the dependent variable, and it is quite meaningful if the interpretation of a single variable can reach more than 30%. In the same way, it can be explored in depth whether all dimensions of improvisational behavior are equally significant in predicting innovative performance.

Dimensions of Improvisational Behavior and Innovative performance Regression Coefficient: [a] as shown in Table 3.5, the significance coefficient of each dimension p-value is less than 0.05, and the standardization coefficient of three dimensions of improvisational behavior (utilizing existing resources, immediate response and intention to create) are 0.563, 0.693, 0.650, respectively, indicating that all dimensions of improvisational behavior have significant positive correlation with innovative performance.

Dimensions of Improvisational Behavior and Innovative Performance Regression Model Summary [b] as shown in Table 3.6, the Adjusted R^2 from three dimensions of improvisational behavior (utilizing existing resources, immediate response and intention to create) are 0.314, 0.398, 0.366, respectively, indicating that the three dimensions of improvisational behavior explains innovative performance 31.4%, 39.8%, 36.6%, respectively. In summary, H_1 was accepted that there is a significant positive correlation between improvisational behavior of researchers and their innovative performance. At the same time, all sub-hypotheses also were accepted, which are H_{1a}: there is a significant positive correlation between the spontaneity of researchers and their innovative performance. H_{1b}: There is a significant positive correlation between the creativity of researchers and their innovative performance. H_{1c}: There is a significant positive correlation between utilizing existing resources by researchers and their innovative performance.

Industry Experience Heterogeneity Moderator Effect Test: The relationship between variable Y and variable X is affected by the third variable M, which is called the moderator variable. When the independent variable is a continuous variable and the moderator variable is a category variable, a group regression analysis is needed. The so-called group regression analysis is based on the value of the adjustment variable M. The centralization of the dependent variable and the independent variable is followed by the regression analysis equation of Y to X, the regression equation model is Y = a + bX + e if the regression coefficient of each group is significantly different, the moderator effect is significant.

Coefficient α of Moderator effect test for Different Industry Experience Groups of Researchers: Shown in Table 3.7, 1-3 years (excluding 3 years), 3 to 5 years (contain 5 years), 5-7 years (excluding 7 years), 7-10 years (excluding 10 years) and more than 10 years groups, the standardized regression coefficients of the Beta value of five industry experience groups, respectively of 0.715, 0.650, 0.665, 0.618, 0.510, P-value is 0, reached significant level (P < 0.05), it shows that improvisational behavior has a significant predictive effect on innovation performance.

Model Summary b of Moderator effect test for Different Industry Experience Groups of Researchers shown in Table 3.8, 1-3 years (excluding 3 years), 3 to 5 years (excluding 5

years), 5-7 years (excluding 7 years), 7-10 years (excluding 10 years) and more than 10 years, the five industry experience groups of the regression equation had significant effects ($P < 0$), indicates that the regulation of this industry experience variables had a significant effect. It can be seen from the Table 4.31 that 1-3 years (excluding 3 years) group explains the variance of innovative performance reaching 50.8%, 3 to 5 years (excluding 5 years) group explains 42.3%, 5-7 years (excluding 7 years) group explains 44.2%, 7-10 years (excluding 10 years) group explains 38.2%, more than 10 years' group relatively low, explain 26%. In summary, H_2 was accepted that the industry experience heterogeneity of researchers could significantly and positively influence the relationship between their improvisational behavior and their innovative performance. It means that the richer the industry experience of researchers, there is more impact on the relationship between improvisational behavior and innovative performance.

RESULTS AND DISCUSSION

This study considers the moderator effect of researchers' industrial experience heterogeneity on the relationship between improvisation behavior and innovative performance in the Henan Province context. According to the statistical analysis, there are several results that could be concluded as below: The influence of improvisational behavior of researchers on their innovative performance. The result of the research is similar to Moorman and Miner (1998), in the dynamic environment and emerging situations, dealing with difficulties immediately, the ability to improvise, the ability to capture and discovering opportunities, can help to increase a team's innovative performance. it can be said that there is a positive correlation between spontaneity and innovative performance. Caldwell and O' Reilly (2003) proved that there is a positive relationship between creativity and innovative performance. Cunha (1999) and Weick (1998) pointed out that adequate resources can reduce the constraints on the organization or members' improvisational behavior, and improve organizational improvisation. There are some differences between the results of this research and others 'studies. In this study, based on the degree of explanation of innovative performance, it determined that efficient improvisational behavior can improve the level of innovative performance of researchers. It also answered the objective of this study, it determined the effectiveness of improvisational behavior of researchers on their innovative performance

The moderator effect of researchers' heterogeneity on the relationship between improvisation behavior and innovative performance. The result of this research is similar with Magni et al. (2009), they mentioned that in future research perspectives, team heterogeneity could be considered as an important moderator that will influence on the relationship between improvisational behavior and innovative performance. However, in this study, we are not only found the industrial experience heterogeneity of researchers has a significant moderator effect on the relationship between improvisational behavior and innovative performance, but also all the five industrial experience groups have a significant moderator effect, which indicates that certain industrial experience can benefit the innovative performance, and affects the improvisational behavior on innovative performance. It answered the objective of this study, it determined the

effectiveness of industry experience heterogeneity of researchers on the relationship between improvisational behavior and innovative performance.

Research Limitations: The moderator effect of industrial experience heterogeneity on improvisational behavior and innovative performance is still inconclusive. Based on the different research objects and scenarios, the results cannot be the same. There are similar limitations in this study. Moreover, based on the research perspective, this paper only studies the industrial experience heterogeneity variables of scientific research and does not consider other variables or regression analysis of the relationship between the improvisational behavior and innovative performance.

Management Practice: This study can provide human resources management strategy for research team formation and guide the R&D enterprise to use the industrial experience heterogeneity of researchers, in order to select appropriate researchers to form a team at the practical level. More than 10 years' industrial experience heterogeneity group is an important variable. Researchers with more than 10 years' industrial experience who are most likely to put forward views from multiple perspectives, which is conducive to innovative performance, and improve organizational innovative performance ultimately. In addition, scientific research units should pay attention to selecting researchers who are willing to play improvisational behavior and innovative performance, when forming a scientific research team. Moreover, they should also consider the working environment that can help researchers to have more effective and efficient improvisational behavior. The environment could include: the ability of improvisation training, sharing culture, fault tolerance mechanism, and learning organization

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