Influencing Mechanism of Job Demand and Positive Affections on R&D Staff's Innovative Behavior

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Abstract　Through the empirical study on 823 R&D staff among 72 domestic organizations in China, the relationship of job demand and innovative behavior is found an inverted U-shaped curve. Employees' positive affections show a significant positive function on their innovative behaviors and it plays a moderating role between job demands and innovative behaviors. When people are in the high level of positive affections, the inverted U-shaped relationship of their job demand and innovative behavior is more obvious, which means that the function of job demand on innovative behavior is stronger than when people in the low level of positive affections. Upon these findings, some suggestions are drawn for management on R&D staff's innovative behaviors.

Key words　Job demand; Positive affections; Innovative behavior; R&D staff

1 Introduction

It is R&D staffs who are in charge of technical innovation in enterprises. With the increasingly accelerating advancement of technology and severe competitiveness of market on a daily basis, enterprises will correspondingly increase the job demands on R&D staff. However, will the improvements of their job demands enhance their innovation vitality, and thus contributing to the technical innovation of the enterprise? The existing literatures about the relationship between job demands and innovative behaviors have shown that it is far more a simple linear relation. Apart from job demands, employees' work affect and attitudes also impact on behavior performance. In the field of positive psychology, the scholars represented by Fredrickson [1] especially emphasize on the positive affections' direct promotion on innovative behaviors. This study explores the joint working mechanism of staff' job demands assigned by the management of enterprises and their positive work affect on their innovative behaviors, and on this basis some relevant proposals are presented for motivating and managing R&D staff' innovative behaviors.

2 Theoretical Framework and Research Hypotheses

2.1 Job demand and innovative behavior

Job demands can be captured as psychological stressors, such as requirements of working fast and hard, having much work to do within little time, or a heavy workload [2]. The arousal and activation theory in psychological field have been wielded by researchers to analyze the relationship between job demands and innovative behaviors. Bunce and West considered that higher job demands were bound to provide an elevated state of arousal in a worker, and this elevated state of arousal in turn motivated a worker to take corresponding measures to adapt oneself to the working environment. Generally speaking, there are two ways of adaptation. One is to adjust the workers themselves, including upgrading one's skills and abilities in order to match the high job demands; the other is to adjust the work itself, containing modifying working objectives, working methods, allocation and coordination of tasks, interpersonal communication and the like. The two ways of adaptation will also be accompanied by innovative behaviors [3]. The activation theory presented by Gardner (1986) can explain the job demand's effect on behavior performance. According to Gardner, each individual is assumed to have a characteristic level of activation which could cause the central nervous system function most efficiently, and thus resulting in the highest behavioral performance. As the experienced activation level deviates negatively or positively from the characteristic activation level, central nervous system efficiency is diminished, causing decreases in performance [4]. Gardner and Cummings deemed that job demands were closely bound up with the activation level and therefore the job demand and the job performance exhibited an inverted U-shaped relationship. In addition to this, Gardner and Cummings also held that the inverted U-shaped relationship was more likely to be significant for complex jobs such as the managers' job than for simple or easy jobs such as the ordinary workers' job on production line, because complex jobs often demand high ability to cope with plenty of information. However, over high and low activation levels impair the ability to process information [5]. In this study, the study object is the group

of research and development staff. The R&D job is typically intellectual-intensive labor with high complexity. Based on the above analysis, the 1st hypothesis is proposed:

H1: The relationship between the job demand and innovative behavior shows an inverted U-shaped curve, and the R&D staff's innovation level is the highest under the moderate intensity of job demand.

2.2 Positive affections and innovative behavior

Fredrickson's broaden-and-build theory of positive emotions expounds the influence of individual's positive emotion towards innovative behaviors. She deemed that people's positive emotion could motivate them to discard time-tested or automatic (everyday) behavioral scripts and to pursue novel, creative, and often unscripted paths of thoughts and actions [6]. Within organizations, employees' innovative behaviors are shown in two aspects. One is generating new views and ideas; the other is implementing successfully the new views [7]. In this study, we consider that under the positive affections state not only people's mind come alive to generate more new ideas, but also they take initiative to work and make more effort for implementing the new ideas. Hence the following hypothesis is presented:

H2: The positive affections have positive impact on R&D staff's innovative behavior.

2.3 Positive affections as a moderator of the relationship between job demand and innovative behavior

According the analysis mentioned above, the two driving forces of the job demand and positive affections can function on the innovative behavior respectively. Job demands provided by organizational management is an external driving force to stimulate innovative behaviors, while employee's own positive affections is a vital internal driving force. According to Weiss and Cronpanzano's views [8], employees' work behaviors were driven directly by their affects and emotions. In reality, managers often discover that when employees lack positive affections such as enthusiasm and interest in their work, raising their job demands is not often necessarily to have a satisfactory performance improvement; while with a high positive affections, individuals are more likely to produce innovative behaviors once raising job demands. On this occasion, improving job demands, employees' behaviors or behavior tendency will vary significantly. Therefore, we consider that the internal driving force of positive affections towards innovative behaviors can influence the intensity of the external driving force of job demands. And then there is the following hypothesis:

H3: The positive affections moderate the inverted U-shaped relationship of job demand and innovative behavior in such a way that the job demand has greater impact on innovative behavior in the higher level of positive affections than the lower level.

3 Methodology

3.1 Sample and data collection

In this study we investigated the R&D staff from 72 enterprises in 17 provinces (or cities), including Hubei, Guangdong, Zhejiang, Shandong, Beijing, Shanghai, Chongqing, and the like. 1000 questionnaires in total were sent out and 823 valid questionnaires were received. In the valid samples, 72.1% were male, and 27.9% were female; the age distribution revealed that 24.7% were less than 25 years old, and 45.9% in the 26-30 year old group, 15.5% in the 36-40 year old age group, and 8.5% above 40 years old. Although the samples' distribution of gender and age is not very even, it is in accord with the reality that R&D employees are usually young males. The distribution of education experience is that 10.9% is under B.S. degree, and 59.9% B.S. degree, and 28.5% were Master degree, and 0.7% were PH.D. Of the samples, 58% are from large enterprises, 17.6% from medium size, and 24.4% from small size. Concerning the organizations' properties, state-owned enterprises account for 46.4%, private enterprises 22.7%, and foreign (or joint) ventures 30.9%. As for the industrial composition, 39.5% are from technological manufacture, 23% from technological service, 21.8% from traditional manufacture, and 15.7% from science and research institution.

3.2 Measuring instrument

In this study, the three variables need to be measured referring to job demand, positive affections, and innovative behavior.

In order to measure the variable of the job demand, we revised the scale edited by Ganster and Fusilier[9] in accordance with R&D job's characteristics, and forming a 9-item's scale about job demand. Likert's 5-point rating score is used in this scale ("1= very inconsistent", "2=less inconsistent", "3=hard to say", "4=consistent", "5= very consistent"). The scale's alpha value in this study is 0.796, and its reliability is acceptable.

As for the measurement of positive affections, we adopted the positive affections sub-scale of the

PANAS designed by Waston and his workmates [10]. This scale consists of 10 descriptive adjectives which are determined, enthusiastic, proud, active, inspired, attentive, alert, interested, excited and strong. Since PANAS is not specially designed for workplace, the special emphasis on workplace has been made in the instruction. To avoid respondents show neutral response without any careful consideration about their affects, the 4-point's response pattern was adopted in the scale ("1=no response", "2=weak", "3=little strong", "4=very strong"). In this study, the sub-scale demonstrates a satisfactory reliability (alpha=0.884).

In this study, Janssen's 9-item one-dimensional scale was adopted for the measurement of innovative behaviors[11]. This scale follows the 3 phases of innovative behaviors divided by Kanter[12] i.e. generation, promotion and application, and has 3 items for each phase accordingly. This scale also adopts the same 5-point's response pattern with the scale of job demands. This scale's alpha value is 0.801.

4 Hypotheses Testing and Results Analysis
4.1 Curve estimation on the relationship of job demand and innovative behavior
In order to explore the relationship of the job demand and innovative behavior to verify the H1, taking the variable of innovative behavior (IB) as the dependent variable, and job demand (JD) as the independent variable, We constructed a linear model and a quadratic model reflecting the relationship showed as the following "(1)" and "(2)".

$$\text{Linear Model：} IB=b_0 + b_1 \times JD \tag{1}$$
$$\text{Quadratic Model：} IB=b_0 + b_1 \times JD + b_2 \times JD^2 \tag{2}$$

If job demands and innovative behaviors present an inverted U-shaped relation, then the mathematical equation of quadratic model is viable. The coefficient of JD^2, $b_2 < 0$, and the goodness-of-fit surpasses the linear model.

With the application of the function of Curve Estimation in SPSS software, the statistics of both linear model and quadratic model were estimated and the resulting values were exhibited in Table 1. The corresponding F statistics' probabilities are less than the significant level of 0.05 in the both models (0.0095 in linear model and 0.0000 in quadratic model), which indicated that the both models are also acceptable. However, through comparing each statistics in the both model, we can observe that the determination coefficient, R^2 of the quadratic model (0.0385) is greater than that of the linear model (0.0082), which reveals the stronger explanatory power of quadratic model. In addition, taking the significance of the coefficients into consideration, the quadratic model is highly favorable, which attests to the higher goodness-of-fit of the quadratic model than the linear one. The JD^2's coefficient, b_2 is -0.4568, which illustrated the quadratic model is an inverted U-shaped curve, so the H1 was tested.

Table 1   The Result Values of Curve Estimation on the Relationship of JD& IB   （Sample Size=823）

Model	R^2	F	Sig F	b_0	b_1	b_2
Linear	0.0082	6.7541	0.0095	2.4770***	0.1557**	
Quadratic	0.0385	16.4170	0.0000	-2.1529*	3.0852***	-0.4568***

Note: *** p<0.001, ** p<0.01, * p<0.05, 2-tailed test

4.2 Testing the positive affections' moderating function
In order to test H2 and H3, the three variables of innovative behavior (IB), job demand (JD), and positive affections (PA) were respectively regarded as the dependent variable, independent variable and moderating variable, and they were entered into the regression equation in stepwise method. Seen from the results of regression analysis showed in Table 2, the third step of regression analysis was to test the significances of the main effects, and the standardized regression coefficients of JD, JD^2, PA are 1.096, -1.074, 0.379 respectively, and the main effects of job demand and positive affections towards innovative behavior are significant ($p<0.001$), so the H2 was tested. In the fifth step of regression analysis, the "$PA \times JD^2$" was added to regression equation, and "ΔR^2" is significant. Meanwhile, the standardized regression coefficients of "$PA \times JD$" and "$PA \times JD^2$" are also significant ($p<0.001$), which illustrated that the positive affections plays a moderating role between job demands and innovative behaviors.

Table 2   The Standardized Coefficients and Relevant Statistics of Hierarchical Regression

|	Step 1	Step 2	Step 3	Step 4	Step 5
Control Variable:					
Gender	-0.196***	-0.190***	-0.165***	-0.164***	-0.168***
Age	-0.083	-0.070	-0.025	-0.025	-0.009
Education Experience	0.021	0.023	0.022	0.022	0.017
Tenure for Work	0.010	0.008	0.031	0.032	0.019
Tenure for R&D	0.238**	0.218**	0.212**	0.211**	0.219**
Organization's Size	-0.036	-0.030	0.008	0.009	0.010
Organization's Property	0.027	0.027	0.009	0.009	0.000
Industry Affiliation	-0.036	-0.031	-0.003	-0.003	-0.009
JD		1.627***	1.096***	1.093***	1.451***
JD^2		-1.577***	-1.074***	-1.071***	-1.428***
PA			0.379***	0.379***	0.394***
PA×JD				-0.005	1.008***
PA×JD^2					-1.016***
R^2	0.080	0.109	0.243	0.243	0.256
F	8.687***	9.767***	23.402***	21.428***	21.106***
ΔR^2		0.029***	0.135***	0.000	0.012***

Note: *** $p<0.001$, ** $p<0.01$, * $p<0.05$, 2-tailed test. *IB* is as independent variable. Sample Size=823

In order to further study the functioning manner of the moderating role, the whole sample data were divided into the high score group and low score group according the mean value (2.6920) and standard deviation (0.4899) of *PA* values. Those sample data in the area of more than "2.6920+0.4899" was regarded as high *PA* score group, and less than "2.6820-0.4899" as low *PA* score group. In the different groups, the regression relationship of "*JD*" and "*IB*" is the following:

$$\text{High } PA \text{ Score Group: } IB = -6.377 + 6.313 \times JD - 0.996 \times JD^2 \qquad (3)$$
$$\text{Low } PA \text{ Score Group: } IB = 0.813 + 1.048 \times JD - 0.128 \times JD^2 \qquad (4)$$

Applying the MATLAB mathematical software, the function curves of "(3)" and "(4)" were drawn (as shown in Figure 1). From Figure 1, it is observed that the level of innovative behaviors vary more greatly with the job demands in the high *PA* score group; on the contrary, in the low PA score group, the inverted U-shaped curve of job demands and innovative behaviors appears comparatively smooth. In other words, innovative behaviors vary little with job demands. We can also find that high PA level with moderate intensity of job demands can bring about the highest level of innovative behaviors from Figure 1.
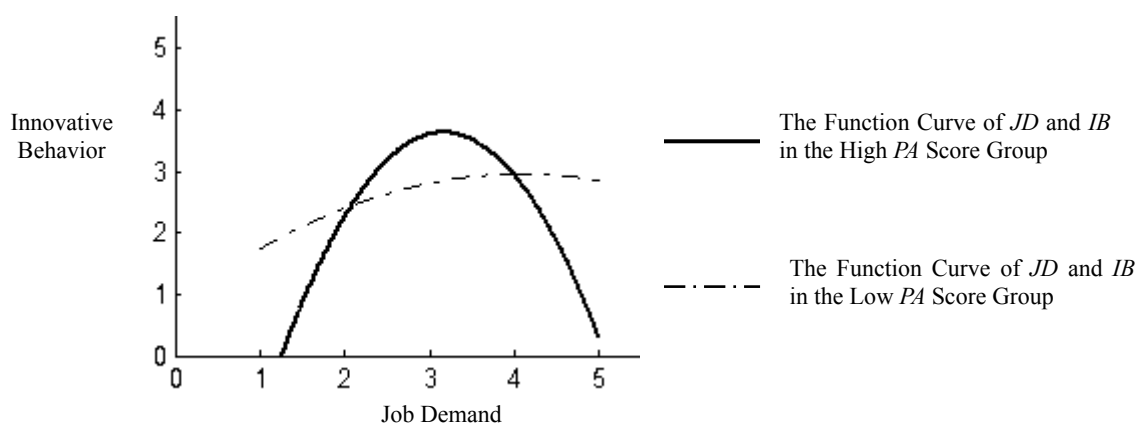
Figure 1   The Positive Affections' Moderating Function on the Relationship of Job Demand and Innovative Behavior

4 Conclusions

This study inquired into the interaction mechanism of the job demand and positive affections influence on R&D staff's innovative behavior. Through proposing and testing relevant hypotheses, some conclusions were drawn as the following: ①There exists an inverted U-shaped relation between job

demands and innovative behaviors and our empirical research is in line with Gardner and Cumming's explanation on the impact of job demands on behavior performance with the employment of their activation theory. ②The positive affections has a significantly positive impact on innovative behaviors. In the field of positive psychology, the scholars stress people's positive mentality and affect can promote their behavior performance, especially promoting the innovative behavior performance. This viewpoint was completely verified by our empirical study. ③Employees' external influence of job demand toward innovative behavior was moderated by their internal positive affections. In the high level of positive affections, the job demand have greater impact on innovative behavior, and the inverted U-shaped curve is steeper; on the contrary, in the low level of positive affections, job demands impact comparatively little on innovative behaviors.

The group of R&D staff is our study object, and innovation is one of the major features of R&D work. Because of facing weeding through the old to bring forth the new at all time, the R&D staff stand high pressure in enterprises, which is even more apparent in those high technology industries with rapid technological advancement and fierce market competition. Enterprises are under great pressure to improve their technological innovation for their own sustainable development, and therefore the R&D employees are faced with increasingly high job demands, and assigned more and more heavy workload. Upon our findings in this study, some suggestions as the following are proposed for management on R&D staff's innovative behaviors: ①When improving the job demands, the managers should take employees' endurance into consideration and gain control of the characteristic level of activation towards best behavior. They should bear in mind that the job demand beyond the employee's endurance will restrain the work behavior performance. ②Raising the job demand should go along with brewing employee's positive affections on condition that the job demands are within the acceptable scope, which will make managers get satisfactory innovative performance.

References

[1] Frederickson, B.L. The Role of Positive Emotions in Positive Psychology[J]. American Psychologist, 2001, 56(3): 218-226
[2] Karasek, R.A. Job Demands, Job Control and Mental Strain: Implications for Job Redesign[J]. Administrative Science Quarterly, 1979, 24(2): 285-308
[3] Bunce, D., West, M. Changing Work Environments: Innovating Coping Responses to Occupation Stress[J]. Work and Stress, 1994, 8(4): 319-331
[4] Gardner, D.G. Activation Theory and Task Design: An Empirical Test of Several New Predictions[J]. Journal of Applied Psychology, 1986, 71(3): 411-418
[5] Gardner, D.G., Gummings, L.L. Activation Theory and Job Design: Review and Reconceptualization[A]. In Staw, B.M., Cummings, L.L. (Eds.). Research in Organizational Behavior[C], Greenwich, CT: JAI Press, 1988, 10: 81-122
[6] Frederickson, B.L. What Good are Positive Emotions?[J]. Review of General Psychology, 1998, 2(3): 300-319
[7] Zhou, J., George, M.J. When Job Dissatisfaction Leads to Creativity: Encouraging the Expression of Voice[J]. Academy of Management Journal, 2001, 44(4): 682-696
[8] Weiss, H.M., Cropanzano, R. Affective Events Theory: A Theoretical Discussion of the Structure, Causes and Consequences of Affective Experiences at Work[A]. In Straw, B.M, Cummings, L.L (Eds.). Research in Organizational Behavior[C], Greenwich, CT: JAI Press, 1996, 18: 1-74
[9] Ganster, D.G., Fusilier, M.R. Control in the Workplace[A]. In Gooper, G.L., Robertson, I. (Eds.). International Review of Industrial and Organizational Psychology[M], Chichester, England: Wiley, 1989: 235-280
[10] Waston D., Clark L. A., Tellegen A. Development and Validation of Brief Measures of Positive and Negative Affect: the PANAS Scale[J]. Journal of Personality and Social Psychology, 1988, 54(6): 1063-1070
[11] Janssen, O. Job Demands, Perceptions of Effort-reward Fairness and Innovative Work Behavior[J]. Journal of Occupational and Organizational Psychology, 2000, 73(3): 287-302
[12] Kanter, R.M. When a Thousand Flowers Bloom: Structural, Collective, and Social Conditions for Innovation in Organizations[A]. In Staw, B.M., Cummings, L.L. (Eds.). Research in Organizational Behavior[M], Greenwich, CT: JAI Press, 1988, 10: 169-211