Investigation on the Measurement of Burnout among Scientific Research and Its Impact Factors: Taking Linbrary and Information Science as an Example

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Abstract: Scientific researchers in China have a high incidence of job burnout and the research on job burnout of researcher has become a hot issue in the academic community. This paper focuses on the field of Library and Information, introducing panel data analysis model to identify the influencing factors of burnout syndrome of scientific researchers, with the level of burnout symptoms calculated by individual academic performances. Results have shown that age, gender, and professional title of scientific researchers significantly affect their burnout level. Scientific institutions and academic community need to optimize management system and improve evaluation system, so as to lower the level of burnout of scientific researchers.

1. Introduction

Job burnout is a syndrome conceptualized as resulting from chronic workplace stress that has not been successfully managed[1]. Few of current studies are about researchers, and most of them use psychological scale measurements. However explicit and interpretable, scale survey might introduce serious social desirability bias[2]; and the comparability between different questionnaires is limited. This paper uses academic performance of researchers to quantify the level of burnout, which is relatively more objective and independent and effectively eliminates social desirability bias. Structure of this paper is as follows: firstly we analyse the phenomenon and factors of burnout among researchers; then we use the literature output of researchers in panel time to calculate level of job burnout; finally, we put forward suggestions on prevention of burnout.

2. Concept and Theoretical Model of Job Burnout

Occupational burnout is a syndrome caused by long-term work stress; it contains three manifestation symptoms: (1) emotional exhaustion; (2) depersonalization; (3) reduced personal accomplishment. The job demand-resource model (JDR model) proposed by Demerouti argues that psychosocial status of individuals is determined by the combination of job demand and resources through internal and external interaction (Fig. 1). Job demand (D) acts as a negative factor in the

model, while excess demand may lead to exhaustion; Job resources (R) helps as a positive factor in the model, which raise work participation. JDR model believes that sufficient resources help buffer negative effects from demand and decrease burnout level, while individuals with high job demands and limited job resources are more likely to experience occupational burnout.(As shown in Figure 1)
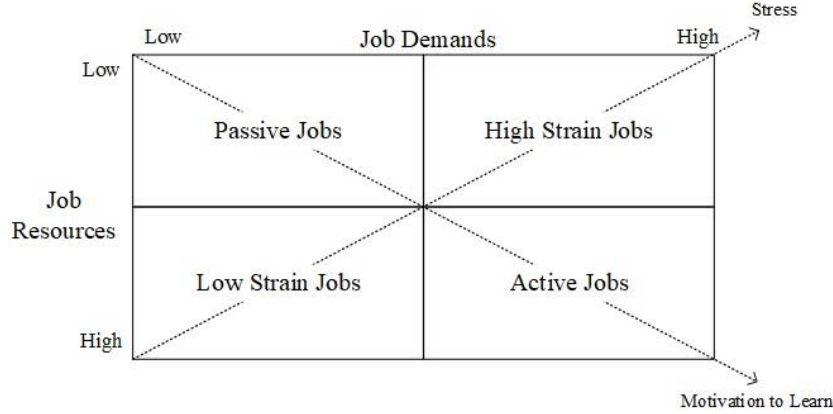

Figure 1: JDR Model.

JDR model pays attention to positive stress effect of job characteristics, better adapted to the strong endogenous motivation and high decision-making autonomy of scientific researchers[3].

3. Methods

3.1. Data and Sample Selection

In this paper, 180 researchers of Library and Information field were randomly sampled from the World Library and Information Education Database (a total of 1947 data records); entries of the researchers who were in a state of scientific silence (no retrievable literature output) throughout the time span were removed. Our analysis is based on a total of 146 researchers, along with the panel data about their literature output from 2007 to 2021.

3.2. Dependent variable

According to the dynamic definition of occupational burnout, the measurement of burnout levels is supposed to be analysed over a period of time[13]. This paper divides the whole time span (15 years) into a set of panel data with T=3, and the Burnout Index (BOI) is taken as a dependent variable of the monotone decreasing function with respect to AAI (Academic Activeness Index, see equation (1)) within each five-year window.

$$BOI = f(AAI)$$

$$(1)$$

AAI_t represents the activity index in the t-th window, using the average number of works (Ave) and the literature output development rate (Dev), where a_1 to a_5 represents the number of literature output per year during the five-year window. Ave_t represents the average literature output number over that period of time, calculated using the average of a_i; Dev_t represents the growth rate of the number of thesis works over that period (see equation (2-3)).

$$AAI_t = Ave_t \times Dev_t$$

$$(2)$$

$$Dev = exp\left(\frac{(a_3 + a_4 + a_5) - (a_1 + a_2 + a_3)}{a_1 + a_2 + a_3 + 1}\right)$$

(3)

Introduce logarithmic function to convert the right-biased function to normal distribution ($ln\frac{1}{AAI}$), the formula for the burnout index is as follows (equation (4)):

$$BOI = ln\frac{1}{AAI} = ln\frac{1}{Ave \times Dev}$$

(4)

3.3. Independent variable

JDR model is selected as the theoretical framework for constitution of influencing factor system, with both individual occupational characteristics and the dimensions of JDR theoretical models fully considered. This section will operationalize the above conceptual dimensions to provide a theoretical foundation for the subsequent regression result interpretation.

3.3.1. Job Demand

Dual-role expectation puts equal emphasis on family and work for women in modern society. Female individuals are more likely to fall into the dilemma of work-family conflict (WFC), which may reduce job satisfaction, weaken organizational commitment, and increase individual's turnover intention[4], so this paper employ gender factors to interpret the dimension of role conflict.

Workload and time pressure are important stressors of the job requirement dimension, we measure which by observing whether or not the individual is a student mentor. Supervisors tend to have more mentoring work, which can lead to fatigue, energy exhaustion, and dehumanization in individuals[5].

3.3.2. Job Resources

Decision-making participation helps employees relieve emotional pressure; capacity and skill level improve sense of competence and are less prone to learned helplessness. This paper uses job title (junior, intermediate, associate senior, senior title) and highest education degree (doctor's, master's, bachelor's) to measure this dimension[6].

Personality traits significantly affects individual's ability to withstand stress. We use age to interpret this dimension, where younger researchers tend to have more professional efficacy; As age increasing, limited promotion opportunity may reduce individual's initiative. Studies have proved that age has influence on "dehumanization" and "emotional exhaustion" dimension of burnout[7].

Organizations have structural constraints on researchers' career opportunities, while development space affects job engagement. Career opportunities vary among individuals working in double first-class universities, double first-class disciplines and research institutes[6]. We use the category of organizations researchers affiliated with to explain this dimension of job resources.

Economic support and social prestige are mainly discussed as social support in this paper. Studies have proved that regional investment in sci-tech is significantly correlated with regional economic development[8]; while raises in scientific research fund pump up motivation among researchers[9], so the city-tier of location of the institution is introduced to explain this dimension. We also use "whether or not a distinguished professor" to interpret the social prestige dimension.

3.4. Model Construction

We employed panel data analysis model, introducing the inertia effect of scientific research behaviour, and the model is constructed as follows[10]:

$$B_{it} = \rho B_{i,t-1} + \beta X_{it} + \gamma f_i + u_i + e_{it}; i = 1,2,\dots N; t = 1,2,\dots T$$

(5)

where B_{it} is the dependent variable; X_{it} is the time-varying variable in independent variables; f_i is the non-time-varying variable in the independent variable; the β and γ are coefficient vectors corresponding to the time-varying and non-time-varying variables respectively; u_i is for the unobservable individual heterogeneity (considered related to explanatory variables); and e_{it} represents random perturbation term changing over time. N is the number of section members, and T is the total number of periods for each section member.

4. Results

Panel data model with two-stage regression was used to complete fixed-effect model analysis containing non-time-varying variables. This model brings in first-order lag of the independent variable, consisting of time-varying independent variable (age), and non-time-varying variables (gender, supervisor work, job title, highest degree, age, organization category, city-tier, distinguished title). Regression results are shown in Table 1.

Table 1: Panel regression results.

Variables	Coef.	Std. Err.	z	p> |z|	[95% Conf	Interval]	Sig
Burnout-level							
Gender	-.546	.196	-2.79	.005	-.930	-.162	***
Supervisor	-.085	.130	-0.65	.513	-.341	.170	
Title	-.251	.087	-2.87	.004	-.422	-.080	***
Degree(highest)	.045	.132	0.34	.732	-.213	.304	
Age	.087	.026	3.40	.001	.037	.138	***
City-tier	.116	.112	0.10	.917	-.209	.232	
Distinguished	-.638	.394	-1.62	.105	-1.410	.134	
Institution	.088	.123	0.71	.476	-.153	.328	
*** p<.01, ** p<.05, * p<.1							

From the panel data regression results, it can be seen that the three variables of age, gender and title significantly affect the burnout level of researchers. According to the result, (1) burnout index and age were positively correlated; (2) the average burnout index of women is higher than that of men; (3) the title elements were related to the level of burnout, burnout level of junior title tops the list of all the researchers. Among the senior and associate senior titles, the average burnout level of professors in the professorship was lower, followed by associate professor.

5. Conclusion

This paper introduced average number and development rate of individual literature output to design indicators for the burnout level of researchers. We found that age, gender and title factors significantly affect researchers' burnout level, manifested as following: older researchers are more likely to burn out than younger researchers; Female are more likely to burn out than male ones;

Researchers with lower title are more likely to burn out than researchers with higher title. Following suggestions are made for research institutions and academic industry: institutions should strengthen intrinsic motivation of individuals and implement EAP program; also avoiding fast orders and allowing intellectual capital of researchers[11]. Academic community should improve evaluation system, which can raise work enthusiasm and lower burnout level[12].

There are also certain shortcomings in this study: the amount of data in this paper is small; With regard to explanatory variables, factors such as academic background and college background could be taken into account. Moreover, citation can be introduced to improve burnout indicator.

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