Journal of Mathematics and Informatics
Vol. 19, 2020, 13-21
ISSN: 2349-0632 (P), 2349-0640 (online)
Published 6 July 2020
www.researchmathsci.org
DOI: http://dx.doi.org/10.22457/jmi.v19a03177

Journal of
Mathematics and Informatics

A Research on the Problem of Engineer Addiction Based on Optimal Scale Regression

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Received 5 June 2020; accepted 4 July 2020

Abstract. With the development of the progress of human civilization, the working hours of laborers tend to extend continuously. Work addiction has become a common phenomenon, which has a greater impact on the family life and occupation of laborers. In this paper, through questionnaire survey, using the optimal scale regression method, on the basis of the Spencer 6-dimensional work addiction scale, through cluster analysis, principal component analysis, regression analysis verification, respectively, the construction of work addiction to work family conflict and career satisfaction 1. The influence model of turnover intention. Finally, the analysis of the result of the work addiction model influencing the engineer's intention to leave has achieved certain results.

Keywords: Optimal Scale Regression, Cluster Analysis, Principal Component Analysis

AMS Mathematics Subject Classification (2010): 03H10

1. Introduction

With the development of the Internet and technology, the boundary between work and life has become more and more blurred, resulting in the phenomenon of work addiction. Due to long-term life under psychological full load or overload, their psychological flexibility has been very small, and years of work have made The body is often in a state of stress because of its high standards, distrust of its peers, and competition, which may hinder the completion of the team's tasks and may lead to the resignation of work addicted people [1]. The phenomenon of work addiction has attracted the attention of the media. As the phenomenon spreads around the world, it will gradually become a hot topic in academia.

2. Data preprocessing

For the collected questionnaires, data statistical analysis and preprocessing were performed to select the effective questionnaire [2].After the missing items were eliminated and the outliers were processed, a total of 312 valid questionnaires were obtained.

3. The model

3.1. The influence of work addiction on the conflict between work and family

3.1.1. Establishment of conflict table between work and family

Using cluster analysis to classify the 18 questions, first calculate the correlation coefficient matrix between the 18 questions: [3]

$$(p_{ij})_{18\times 18} = \frac{\operatorname{cov}(Q_i, Q_j)}{\sqrt{D(Q_i)}\sqrt{D(Q_j)}} \tag{1}$$

Select the corresponding index of the largest element among the off-diagonal elements to form a new category:

$$G_{ij} = \{Q_i, \quad Q_j\} \tag{2}$$

After that, calculate the correlation coefficient matrix of the new class and other types, classify all indicators into a class, draw a pedigree chart, and finally determine the number of classifications and explain each class [4]. Therefore, the dendrograms about the conflict between working and family is as follows:

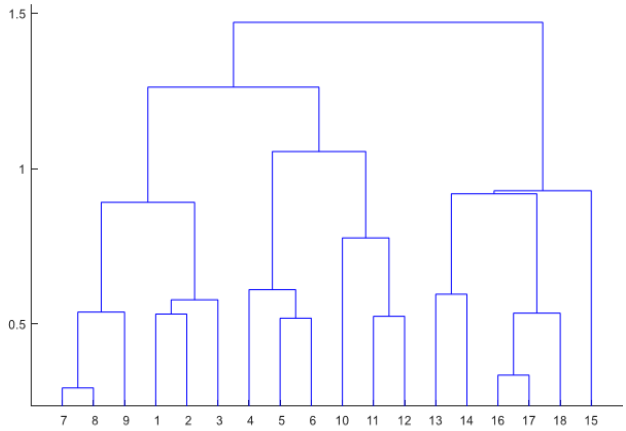

Figure 1: Cluster diagram of indicators of work-family conflict

Combined with relevant information inquiries, work-family conflicts mainly include: family interference with work, work interference with family, and interference between family and work [5].

According to the above clustering, the above problem indicators can be divided into the following three categories:

Dimensions	Questions
Work interferes with family	Q1: Your work keeps you away from family activities. Q2: The time you have to spend at work prevents you from sharing the housework equally. Q3: You have to spend a lot of time on the work undertaken,so missed family activities. Q4: You often feel tired after returning home from get off work so you can't participate in any family affairs. Q5: You are often depressed when you come home from work, so you can't do anything for your family. Q6: Due to all the work pressure,sometimes you are still too nervous to do what you like when you go home.
Family interferes with work	Q1: The time you spend on family often gets in the way of your job responsibilities. Q2: The time you spend on family often results in a lack of time for career development. Q3: You have to spend a lot of time at home, so you miss work occasionally. Q4: Due to the pressure in the family,you often worry about your family at work. Q5: It's hard to concentrate on your work because you often worry about household responsibilities. Q6: The stress and anxiety of family life often weakens your ability at work.
Work and family behavior interfere with each other	Q1: The way you solve problems at work doesn't solveproblems at home effectively. Q2: What you do effectively at work may be counterproductive in your family. Q3: Your effective behavior at work will not help you to be a good parent or spouse in your family. Q4: The effective behavior in the family is not very suitable for work. Q5: Your effective behavior at home may be counterproductive at work. Q6: Your effective problem-solving behavior in the family seems to be less useful once it is used in work.

Table 1: Three-dimensional structure and items of work-family conflict

3.1.2. Hypothesis

For the work addiction six-dimensional scale, the work-family conflict three-dimensional scale [6], assuming that the score weight of each question is the same, the score of each

dimension is the average score of the included problem [7]. Then make the correlation matrix is as follows:

$$C_1 = \begin{bmatrix} 1 & 0.67 & 0.54 & 0.30 & 0.38 & 0.24 & 0.22 & 0.15 & 0.11 \\ 0.67 & 1 & 0.65 & 0.34 & 0.44 & 0.29 & 0.23 & 0.17 & 0.10 \\ 0.54 & 0.65 & 1 & 0.36 & 0.40 & 0.20 & 0.15 & 0.10 & 0.08 \\ 0.30 & 0.34 & 0.36 & 1 & 0.59 & 0.44 & 0.53 & 0.32 & 0.27 \\ 0.38 & 0.44 & 0.40 & 0.59 & 1 & 0.40 & 0.40 & 0.15 & 0.20 \\ 0.24 & 0.29 & 0.20 & 0.44 & 0.40 & 1 & 0.54 & 0.46 & 0.29 \\ 0.22 & 0.23 & 0.15 & 0.53 & 0.40 & 0.54 & 1 & 0.64 & 0.51 \\ 0.15 & 0.17 & 0.10 & 0.32 & 0.15 & 0.46 & 0.64 & 1 & 0.54 \\ 0.11 & 0.10 & 0.08 & 0.27 & 0.20 & 0.29 & 0.51 & 0.54 & 1 \end{bmatrix}$$

It can be seen from the above correlation coefficient matrix that work pressure has a strong correlation [6] with work-family conflict, and the correlation coefficients with the three-dimensionality of the work-family conflict are (0.53, 0.32, 0.27); unauthorized is strongly correlated to the work-family conflict, The correlation coefficients are (0.54, 0.46, 0.29). According to this, the following classification only considers the impact of the work stress dimension and the unauthorized dimension on working family conflicts.

(1) Hypothesis of the impact of work pressure on work-family conflict [8].

According to the definition of work pressure in the Spencer6 dimension, it means that the work load is too heavy and that you are always worried about your work, which has a negative impact on people. It is mainly manifested in the lack of attention to family affairs, the time spent on the family is too little, and the family interference Larger, therefore, the following assumptions about working pressure are proposed:

H_{1a}: Work stress is positively correlated to the degree to which work interferes with the family.

H_{1b}: Work stress is inversely correlated to the degree of family interference with work.

H_{1c}: Work stress is positively correlated to the degree of mutual interference in work and family behavior.

(2) The assumption of the impact of unauthorization on work-family conflict

Unauthorization is defined as dealing with things at work, always by hand, relying too much on your own ability to ignore the role of the team, more independent, less dependent on the family, away from family activities, so the following hypothesis of unauthorized:

H_{2a}: Unauthorization is positively correlated to the degree to which work interferes with the family.

H_{2b}: Unauthorization is negatively correlated to the degree of family interference with work.

H_{2c}: Unauthorization is positively correlated to the degree of mutual interference in work and family behaviors.

3.1.3. Regression analysis test

After the above correlation analysis, it has been shown that there is a correlation between the dimensions of the two variables and how close the correlation is [9]. The regression analysis is used to further verify the direction of the influence between the variables and further explain whether there is a certain causal relationship between the factors.

Taking work indulgence as an independent variable x and work-family conflict as a dependent variable y, establish a univariate regression model:

$$y = \beta_0 + \beta_{1x} + \varepsilon \tag{3}$$

It assumes:

$$\begin{cases} E(\varepsilon) = 0 \\ Var(\varepsilon) = \sigma^2 \end{cases} \tag{4}$$

F-test for significance of regression equation:

$$F = \frac{SSR/1}{SSE/(n-2)} \tag{5}$$

The larger the value of F, the better. Indicating the coefficient of regression significance $Sig.$ Value: When $Sig.$ <0.05, the regression equation has a certain statistical significance. Goodness of fit R[2]: It is the coefficient of determination in regression analysis [6]. The closer the value is to 1, the better the regression effect.

The analysis results are shown in the following table:

Classifications	R^2	B	F	Sig.
work stress and work interference with family	0.2851	1.0979	126.8382	0.00
work stress and family interference with work	0.1038	0.6578	36.8432	0.65
work stress and interference between work and family	0.0729	0.5072	25.0091	0.832
unauthorization and work interference with family	0.2881	1.1374	128.6983	0.00
unauthorization and family interference with work	0.2126	0.9702	85.8791	0.012
unauthorization and interference between work and family	0.0836	0.5597	29.0020	0.00

Table 2: Significance tests for regression equations

3.1.4. Result analysis

According to the above table, the verification conclusion can be drawn:

Assumptios	Test results
H_{1a}	support
H_{1b}	nonsupport
H_{1c}	nonsupport
H_{2a}	support
H_{2b}	support
H_{2c}	support

Table 3: Test results

3.2. The effect of work addiction on career satisfaction

3.2.1. Hypothesis

Perform a correlation analysis between the indicators of career satisfaction and get the correlation coefficient matrix:

$$C_2 = \begin{bmatrix} 1 & 0.72 & 0.60 & 0.57 & 0.59 \\ 0.72 & 1 & 0.73 & 0.77 & 0.59 \\ 0.60 & 0.72 & 1 & 0.76 & 0.59 \\ 0.57 & 0.77 & 0.76 & 1 & 0.59 \\ 0.59 & 0.59 & 0.59 & 0.59 & 1 \end{bmatrix}$$

It is found that there is a large correlation between the indicators. Consider the principle component analysis [10] of the indicators to extract the principal component factors:

Step 1. Find the feature root of the correlation matrix λ_i and the corresponding feature vector ei.

Step 2. Calculate the principal component contribution rate [11] and cumulative contribution rate, the contribution rate of the principal component zi is:

$$z_i = \frac{\lambda_i}{\sum_{k=1}^{\alpha} \lambda_k} (i = 1, \ldots, p) \tag{6}$$

p is the number of indicators. The cumulative contribution rate is:

$$total_{zi} = \frac{\sum_{k=1}^{i} \lambda_k}{\sum_{k=1}^{\alpha} \lambda_k} (i = 1, \ldots, p) \tag{7}$$

Step 3. Calculate the load of principal component:

$$a_{ij} = p(z_i, x_j) = \sqrt{\lambda_i} e_{ij} (i, j = 1, ..., p) \quad (8)$$

Step 4. Normalize the load of principal component.

Step 5. Get the expression of the principal component.

For the above steps, use MATLAB for Principal Component Analysis, take the cumulative contribution rate higher than 0.7, and propose a principal component factor F_1, the principal component expression is as follows:

$$F_1 = 0.43 \times Q25 + 0.47 \times Q26 + 0.46 \times Q27 + 0.46 \times Q28 + 0.41 \times Q29 \quad (9)$$

Then consider the impact of the six-dimensional index of work addiction on the principal component factor [12].

According to the Spencer 6-Dimensional Work Indulgence Scale, the definition of work-driven is that the heart is willing to work, can't do without work, thinks that it is an obligation to work, and loves his work more, so the following assumptions [13] are made:

I_1: Work-driven is positively correlated to career satisfaction

I_2: Work enjoyment is positively correlated to career satisfaction

I_3: Work input is positively correlated to career satisfaction

I_4: Work stress is inversely correlated to career satisfaction

I_5: Perfectionism is negatively correlated to career satisfaction

I_6: Unauthorization is negatively correlated to career satisfaction

The regression test of the above six impact models on career satisfaction:

3.2.2. Regression analysis test

Classifications	R^2	B	F	Sig.
work-driven and career satisfaction	0.0578	0.6754	19.2647	0.0000
work enjoyment and career satisfaction	0.0943	0.7566	32.6752	0.0000
work input and career satisfaction	0.0554	0.5937	18.4024	0.0000
work stress and career satisfaction	0.0053	0.1597	1.6604	0.1985
perfectionism and career satisfaction	0.0002	0.0356	0.0687	0.7944
unauthorization and career satisfaction	0.0297	0.3826	8.9995	0.0029

Table 4: Significance test of regression equation of career satisfaction

3.2.3. Result analysis

Analyze the influence model of job addiction on career satisfaction. From the above results, the test results of the proposed research hypothesis are as follows:

Assumptios	Test results
I_1	support
I_2	support
I_3	support
I_4	nonsupport
I_5	nonsupport
I_6	support

Table 5: Test results

4. Conclusion

First of all, work-addiction research is a significant section to promote the development of this field. In this paper, we construct the models of the effects of engineer work addiction on work-family conflict and career satisfaction. The optimal scale regression analysis overcomes the condition that variables are continuous in traditional regression analysis [14]. Secondly, this paper discusses the relationship between variables by reducing the dimension of variables, which reduces the complexity of the problem, and also can reflect the reality more scientifically.

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