Empirical research on the influencing factors of the occupational stress for construction workers

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Abstract. Employee’s occupational stress and safety performance are highly related, which has been generally recognized by the researchers. We did this research to understand the status of the stress for construction workers, and explore the influence factors of pressure source with characteristics of construction industry. Based on the results of previous studies, we designed questionnaire to collect the influence factors on occupational stressors. The study selected workers from certain construction units at the grass-roots level as sample source. According to the results of the questionnaire, we redesigned the interview outline, and did the semi-structured interviews on workers randomly selected. Finally, we developed a scale which combined the characteristics of construction projects in China. Using SPSS software for factor analysis, reliability analysis, and descriptive statistical analysis, the results show that there are six factors affecting the workers’ occupational stress, including The Work Itself, Family-Work, Career Development, Organization Style, Interpersonal Relationship and Role Management Style. The work itself is the main sources of occupational stress. The results can be used by the construction company to provide guidance for workers to control and manage occupational stress.

1. The Introduction
Occupational stress has been one of the main problems that bother people’s work and life, and attracted many scholars’ research. Predecessors’ research shows that work stress not only harms the job itself, but also causes great damage to individual in psychology and physiology. [1] China’s construction industry has evolved rapidly in recent years, since 2008 the full opening of the market in China. During these years, domestic construction companies are not only facing challenges from advanced construction enterprise, but also experiencing structural, technical and personnel aspects of the deep transformations, which cause more and more workers suffering and experiencing chronic stress. However, a vast number of employees lack of understanding of occupational stress and scientific control methods to pressure, which will create a vicious cycle. [2] And job stress can affect not only individual and organizational level, and even affect the society. [3] Therefore, the effective identification of the occupational stress structure for construction staff is of great significance for the development of construction industry. Over the past few decades, a large number of researchers proposed different concepts and models on occupational stress, as well as some theories, stress scales and questionnaires which are different but overlapping each other. Such as Vagg and Spielberger compiled a work stress questionnaire lists 20 things which lead to occupational stress. [4] Evers, Frese and Cooper developed a second edition occupational stress index to measure the stress source, the result shows that mental health, physical health and job satisfaction affect the job stress. [5] Pan YingXin, Wang Lei, Ren XiangYun and Zeng Yan compiled the Chinese employees work stress questionnaire, found that lack of control, time pressure and insufficient information are three main...
factors affecting stress.[6] Phillip in the book Stress and Health wrote the main occupational stress source of employees can be divided into the working conditions, role stress, relationship factors, career development, organizational structure and the influence between family and work, etc., he also developed an occupational stress scale including interpersonal relationship, physical conditions and job interest[7]. But, whether this kind of scale’s structure is in line with the situation in our country, especially the specific conditions of the occupational stress for construction workers, that still needs further research.

At present, there has no research on the stress of construction project staff, but there have been some researches on the stress of other industry practitioners, which we can use for reference. Xu Fuming found that among primary and secondary school teachers the most pressure events, in turn, are the test, the work itself, occupational prestige and employment pressure [8]. Cooper and Marshal’s study found that the occupational stress of white-collar workers are career development, interpersonal relationship, the balance between family and work, role conflict, role ambiguity, organizational structure and atmosphere[9]. The research, Janet and Cary did, shows that the pressure of the civil service mainly comes from the work itself, such as relatively low wages, poor working conditions, or lack of controlling on job and the organization [10]. Chen ZhiXia and Liao JianQiao found that the main factors of occupational stress for knowledge workers are the work task, career development, organizational management, interpersonal relationship and ability, time urgency and the work environment [11]. The mainly purpose of this study is to compile a suitable work stress questionnaire for the workers in construction projects. It is concluded that structure factor of workers’ occupational stress, and put forward suggestions according to different factors.

2. Research design

2.1. Questionnaire design

The questionnaire designed on the basis of previous relative researches, such as railway locomotive driver [12], knowledge employees from apparel industry [13] and civil aviation practitioners [14], and other workers’ occupational stress. We mainly refer to the occupational stress measurement index system which was designed by Cooper and Williams, namely the OSI occupational stress scale. We also refer to the occupational stress scale designed by Bai YuLing. The semi-structured interview outline was designed on the basis of the questionnaire. And then combined with the characteristics of construction project in China, we compiled the occupational stress scale. The factors of this scale include the work itself, management roles, relationships, career development, organization style, conflicts between families and work, six aspects, a total of 20 items, for the form of 1-5 Likert scale. From "strongly disagree" to "strongly agree" meter respectively from 1 to 5.

2.2. Data Collection

Through questionnaire, we collect the structure factors of workers’ occupational stress. The sample was selected in a primary construction unit. Before distributing the questionnaire to workers, the investigators explained the aim of this questionnaire and the meaning of each question to the workers. The survey handed out 150 questionnaires and recycle 132. The recovery rate was 88%, excluding eight invalid questionnaires. Finally, we received 124 valid questionnaires, the effective recovery rate were 83%. The basic information of sample is as shown in Table 1.

| variables | gender | age | Working age | education | matrimony |
|-----------|--------|-----|-------------|-----------|-----------|
| category  | male   | female  | ≤ 30 | 31-40 | 41-50 | 51-60 | ≤ 3 | 3-9 | 10-15 | 16-18 | Primary School or below | Junior High school | Senior High school | Up High school | married | unmarried |
| number    | 112 | 12 | 28 | 31 | 42 | 23 | 13 | 40 | 54 | 17 | 31 | 61 | 29 | 3 | 105 | 19 |
| Percentage (%) | 90% | 10% | 23% | 25% | 34% | 18% | 10% | 32% | 44% | 14% | 25% | 49% | 23% | 3% | 85% | 15% |
3. Data analyse

3.1. Factor analysis

This research use KMO and Bartlett test to figure out whether the questionnaire is suitable for factor analysis, the results are shown in Table 2.

| Table 2. KMO and Bartlett test. |
|----------------------------------|
| Kaiser-Meyer-Olkin | .856 |
| Bartlett sphericity test | chi-squared approximation |
| Df | Sig. |
| 916.275 | .000 |

Test results show that the KMO value between 0.8 and 0.9, Bartlett test showed significant value for.000, which mean that the occupational stress questionnaire is suitable for factor analysis. Occupational stress questionnaire factor analysis uses the statistical analysis software SPSS19.0, and 20 items of work stress questionnaire use principal component analysis method and maximum variance orthogonal rotation method to extract factor, the result of the analysis is shown in Table 3.

| Table 3. Rotation matrix of occupational stress questionnaire for construction workers. |
|----------------------------------|
| Factor | Factor1 | Factor2 | Factor3 | Factor4 | Factor5 | Factor6 | Factor7 | Factor8 |
|----------------------------------|
| item | C3 | C4 | C1 | C2 | C19 | C18 | C20 | C14 | C13 | C16 | C15 | C17 | C9 | C10 | C11 | C7 | C6 | C8 | C5 | C12 |
| 1 | 0.867 | 0.817 | 0.799 | 0.784 | 0.199 | 0.087 | -0.259 | -0.142 | 0.159 | 0.15 | -0.278 | -0.059 | -0.244 | 0.179 | -0.012 | -0.065 | -0.217 | 0.109 | 0.226 | 0.291 |
| 2 | -0.024 | -0.084 | -0.017 | -0.108 | 0.791 | 0.742 | 0.684 | 0.245 | 0.277 | 0.158 | -0.614 | 0.107 | -0.115 | 0.035 | 0.204 | 0.08 | 0.532 | -0.469 | -0.047 | -0.03 |
| 3 | 0.101 | 0.103 | 0.083 | 0.154 | 0.17 | -0.158 | 0.335 | 0.96 | 0.922 | 0.183 | 0.17 | -0.025 | -0.179 | 0.264 | 0.043 | -0.056 | -0.129 | 0.083 | -0.153 | -0.166 |
| 4 | 0.065 | 0.065 | -0.108 | 0.137 | -0.04 | 0.224 | 0.061 | 0.324 | 0.2 | 0.844 | 0.779 | 0.625 | 0.126 | -0.108 | 0.476 | 0.134 | 0.012 | 0.157 | 0.107 | -0.109 |
| 5 | 0.073 | 0.173 | 0.306 | -0.153 | -0.098 | 0.062 | 0.035 | -0.448 | -0.153 | -0.29 | 0.235 | 0.048 | 0.747 | 0.703 | 0.576 | 0.016 | 0.069 | -0.118 | 0.916 | 0.75 |
| 6 | -0.123 | 0.271 | 0.311 | 0.213 | 0.181 | 0.033 | 0.131 | -0.057 | 0.201 | 0.153 | 0.088 | 0.076 | -0.148 | 0.279 | 0.172 | 0.729 | 0.696 | 0.657 | 0.015 | 0.124 |
| 7 | 0.101 | -0.198 | 0.061 | 0.098 | 0.221 | -0.312 | -0.241 | -0.14 | 0.019 | 0.119 | -0.024 | 0.055 | 0.031 | 0.011 | -0.124 | 0.324 | -0.067 | 0.112 | 0.784 | -0.024 |
| 8 | -0.077 | -0.114 | 0.071 | 0.112 | 0.126 | -0.394 | -0.19 | 0.041 | 0.012 | 0.2 | 0.242 | 0.191 | -0.331 | -0.231 | 0.221 | 0.25 | -0.121 | 0.013 | 0.235 | 0.713 |

According to the matrix of occupational stress questionnaire for construction workers, there are totally 8 factors we listed. However, two of them (Factor 7 and Factor 8) only contain a single item respectively, which means they lack of enough evidence to be valid and have to be removed. Therefore, there remain 6 effective factors (dimensions), respectively: The Work Itself, Family-Work, Occupation Development, Organization Style, Interpersonal Relationship and Role Management. Thus the rationality of work stress scale dimension is verified. The Work Itself is due to the heavy workload, tight time, heavy responsibility and poor safety; Family-work is due to lack of communication with families in a long term, work site far from the family or have heavy family burden; Occupation Development refers to workers feel poor working stability; Organization Style refers to some of the workers feel their own rights can’t be guaranteed in some unreasonable system; Interpersonal Relationship refers to the relationship between colleagues or leadership is not harmony, or work without supporting and understanding of the leadership; Role Management refers to the uncertainty of their work duties or cannot adjust from different work requirements.

As shown in Table 4, the cumulative explanation of these six factors was 72.495%, namely the extracted six kinds of working pressure factors can summarize 72.495% the information of original variables for workers' job pressure. The construct validity of the questionnaire is ideal. The explanatory rate of the work itself, family-work and occupational development were 21.722%, 16.022% and 14.544% respectively. The explanatory rate of organizational style, interpersonal
relationship and role management were 7.256%, 6.944% and 5.967% respectively. This indicates that the Work Itself is the main source of work stress for construction staff. Family-Work and Occupation Development are the most important source of workers occupational stress. While the explain rate of Organizational Style, Interpersonal Relationship and Role Management are relatively low.

| Table 4. Construction industry staff work stress questionnaire total variance explained. |
|--------------------------------|--------------------------------|
| Component | Initial Eigenvalues |
|--------------------------------|--------------------------------|
| Total | Variance % | Accumulation % |
|--------------------------------|--------------------------------|
| 1 | 3.919 | 21.772 | 21.772 |
| 2 | 2.881 | 16.022 | 37.794 |
| 3 | 2.618 | 14.544 | 52.388 |
| 4 | 1.306 | 7.256 | 59.594 |
| 5 | 1.250 | 6.944 | 66.538 |
| 6 | 1.074 | 5.967 | 72.495 |

3.2. Reliability analysis

Reliability analysis of occupational stress questionnaire uses SPSS19.0 statistical analysis software. Then we validate the internal consistency of the work stress questionnaire by the ‘Cronbach’s coefficient. It is generally believed that Cronbach’s coefficient reached 0.7; the result is credible [15]. In this study, the reliability coefficients are all above 0.7, as shown in Table 5, so, the questionnaire reliability meets the requirements.

| Table 5. Reliability statistics of the questionnaire for construction workers’ job stress. |
|--------------------------------|--------------------------------|
| variable name | Cronbach’s Alpha | Cronbach’s Alpha based on the standard term | term numbers |
|--------------------------------|--------------------------------|
| The work itself | .791 | .753 | 4 |
| Family-work | .727 | .783 | 3 |
| Occupational development | .843 | .761 | 2 |
| organization style | .695 | .723 | 3 |
| interpersonal relationship | .675 | .712 | 3 |
| role management | .698 | .706 | 3 |
| Occupational stress | .731 | .742 | 18 |

3.3. Descriptive statistical analysis

According to the results of the factor analysis for the occupational stress questionnaire, this questionnaire contains 6 dimensions, 18 items, the descriptive statistics of each item and the dimension’s score are determined as shown in Table 6.

| Table 6. Descriptive statistical of workers’ occupational stress. |
|--------------------------------|--------------------------------|
| Factor | Occupational stress questionnaire items | N | Mean value | Standard deviation |
|--------------------------------|--------------------------------|
| The work itself | C1 My work is very complex, big workload | 124 | 3.284 | .633 |
| | C2 worry about his safety during working | 124 | 3.651 | .775 |
| | C3 I often work overtime work | 124 | 3.176 | .684 |
| | C4 Work responsibility, afraid of accountability | 124 | 3.053 | .798 |
| | Dimension mean | | 3.291 |
| Family –work | C18 I felt I bear the burden of family economic income is very heavy | 124 | 3.170 | .789 |
| | C19 Nature of work need to separation, can’t take care of family responsibility | 124 | 3.325 | .699 |
C20 Family understanding and support for work is not enough  124  2.926  .759

Career development  
C13 More concern on the development of their future career  124  3.412  .517
C14 Work stability is poor, worried that after the end of the project cannot find another project  124  3.856  .427

Organizational Style  
C15 My rights and interests cannot be guaranteed sometimes.  124  3.067  .726
C16 Organization wage system is not reasonable  124  3.062  .875
C17 The organization has not responded to my performance.  124  2.859  .899

Interpersonal Relationship  
C9 Have conflict or unpleasant with colleagues  124  2.983  .994
C10 Lack of leadership to support their own  124  2.883  .950
C11 Leaders are unwilling or unable to help me with my work.  124  2.536  .923

Role Management  
C6 My work has no clear explanation and explanation.  124  2.693  1.112
C7 Sometimes the leaders have different requirements of the work  124  2.706  1.083
C8 Sometimes being assigned to the different work at the same time  124  2.943  .966

Occupational Stress  
The score of the occupational stress  3.118

According to the score standard of occupational stress, score 1-5 in turn represent: do not feel the occupational stress; feel the light occupational stress; feel the moderate occupational stress; feel the high occupational stress; and feel the serious work stress. From the statistical analysis of the results, we can find a total score of 3.118 points of the occupational stress, the overall of the construction project staff feel moderate occupational stress. The professional development gets the highest score, 3.634 points, and the closet to a high degree of occupational stress. The Work itself and Family - Work dimension score, respectively, 3.291 points and 3.207 points, to be higher than the moderate level of occupational stress. Organization style, interpersonal relationship and role management scores are not more than 3 points are 2.996 points, 2.801 points and 2.781 points, slightly lower than the moderate level of occupational stress, which explain these three factors have little effect on construction workers’ job stress.

4. Discussion
The most important factor of work pressure on construction workers is the pressure from The Work Itself. The construction industry is facing enormous competitive pressure, they must ensure the quality of the project, but also need to improve work efficiency. To reach these purposes, some construction units may require the workers to work overtime. As we all know construction industry is a high-risk industry, so workers have to face the threat of production accidents. Accordingly, the contractor should arrange work and rest time reasonably, do not allow workers to work overtime. At the same time, the construction company should provide safety equipment fully and create a good atmosphere of safety.

The Family-Work dimension is also one of the important structural factors. Construction projects always in remote areas, so the workers have to follow the project and leave far from home. They have not enough time to contact with their families. Besides, most of the workers also face heavy family burdens. These are virtually increasing the occupational stress. The construction company should focus more on workers’ family situation. For those workers who have experienced a number of big changes or events and become overstressed, the construction company should transfer these workers to safer post until they calm down.
The Career Development is another important source of occupational stress. It is decided by the nature of the construction industry, each cycle of construction projects is different, and so many construction units often face no project status. The most basic thing is the stability of work can’t be guaranteed, which will give the workers a strong psychological burden. In order to avoid the workers’ worries of whether they can get a stable job, the construction company needs to keep their project stable, so as to eliminate the menace of the future changes. Construction unit should carry out psychological health education regularly to support the workers take a positive attitude in face of such stress.

Organizational Style, Interpersonal Relationship and Role Management, these three dimensions have little influence on the occupational stress of workers in construction project. But they still need to take seriously. However, some construction companies have not enough attention to the protection of the workers’ interest, corporate culture, and humanistic care. These factors might cause occupational stress, too. Construction unit should improve their management level, create a corporate culture environment, and care about the mood of workers to ensure safety in construction.

5. Conclusion
This research compiled the occupational stress questionnaire for the workers in China's construction project. Factor analysis using SPSS software, the KMO and Bartlett test shows that the occupational stress questionnaire is suitable for factor analysis. For reliability analysis, the reliability coefficient is above 0.7, which meets the requirement of reliability. Statistical analysis of the results of the occupational stress finds a total score of 3.118 points, represent most of the construction project workers feels moderate occupational stress.

The factors that constitute the occupational stress of workers in the construction project are: Work Itself, Family-Work, Career Development, Organizational Style, Interpersonal Relationship and Role Management. One of the most important factors is the Work Itself, followed by Family-Work and Career Development. Finally, according to different factors, some suggestions can be applied to manage and control occupational stress of workers.

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