Exploring and validating the internal dimensions of occupational stress: evidence from construction cost estimators in China

Xiong, Bo; Skitmore, Martin; Xia, Bo

Exploring and validating the internal dimensions of occupational stress: Evidence from construction cost estimators in China

Abstract: A recurring feature of modern practice is occupational stress of project professionals, with both debilitating effects on the people concerned and indirectly affecting project success. Previous research outside the construction industry has involved the use of a psychology perceived stress questionnaire (PSQ) to measure occupational stress, resulting in the identification of one stressor – *demand* - and three sub-dimensional emotional reactions in terms of *worry*, *tension* and *joy*. The PSQ is translated into Chinese with a back translation technique and used in a survey of young construction cost professionals in China. Principal component analysis and confirmatory factor analysis are used to test the divisibility of occupational stress - little mentioned in previous research on stress in the construction context. In addition, structural equation modelling is used to assess nomological validity by testing the effects of the three dimensions on organizational commitment, the main finding of which is that *lack of joy* has the sole significant effect. The three-dimensional measurement framework facilitates the standardizing measurement of occupational stress. Further research will establish if the findings are also applicable in other settings and explore the relations between stress dimensions and other managerial concepts.

Keywords: Occupational stress, principal component analysis, structural equation modelling, cost estimators, China.

Introduction

Occupational stress has been an important concept in organizational management since the increased awareness of the prevalence of mental disorders such as depression in the 1980s (Tennant, 2001). In the construction industry, because of the complexity and dynamic uncertainty of its projects and often, workers and professionals are frequently expected to confront and cope with stressful situations (Leung *et al.,* 2005a; Love *et al.,* 2010). This, together with the heavy workloads involved, can lead to serious occupational stress (Bowen *et al.,* 2012). In addition to concerns of the wellbeing of those affected, such as occupational illness and injuries (Lundstrom *et al*., 2002), the study of occupational stress is especially important in organisational terms for the effects on organizational commitment, production performance and even intentions to leave (Leiter and Maslach., 1988; Jamal., 1990; Boyas *et al.,* 2012).

Although identification and categorization studies of the *stressors* involved (i.e. working conditions causing stress) are not uncommon in construction management research (e.g. Leung *et al.,* 2005a; Richmond and Skitmore, 2006; Leung *et al.,* 2008a), the sub-dimensions of occupational stress (i.e. divisibility of *emotional reactions* caused by work conditions) have received little treatment to date. Additionally, occupational stress is widely regarded as a holistic concept with little regard for the dimensions involved. Hurrell and Mclaney (1988), for example, use the general term "strain" to describe the emotional reaction to stressful conditions. However, such reactions should not only include negative ones but also the joy of stress (Hanson, 1987).

Realizing a similar situation in psychosomatic research, Levenstein *et al.* (1993) developed a 30-question perceived-stress questionnaire (PSQ), validated with responses from 230 medical

subjects comprising in-patients, out-patients, students and health workers in Italy. Fliege *et al.* (2005) later used an adapted version with 650 German subjects also in the medical context to conduct a principal component analysis (PCA); identifying four underlying dimensions, comprising one stressor – *demand* - and three emotional reactions in terms of *worry*, *tension* and *joy* (Fliege *et al.*, 2005). However, this remarkable finding of exactly four dimensions has yet to be confirmed empirically in other contexts, the construct consisting of three emotional reactions validated and their effects determined.

This paper therefore firstly tests the applicability of an adapted Chinese PSQ by applying exploratory factor analysis, and then validates the three dimensional emotional reaction framework by conducting confirmatory factor analysis and structural equation modelling. Two hypotheses are firstly tested:

Hypothesis 1 Fliege *et al.'s* (2005) four categories, comprising *demand, worry*, *tension* and *lack of joy* are identifiable in the Chinese PSQ version.

Hypothesis 2 The three dimensional occupation stress framework of *worry*, *tension* and *lack of joy* is reliable and valid in this context.

These two hypotheses are derived from the adapted and translated measurement scale. Hypothesis 3 is developed to assess nomological validity in exploring relationships between these internal dimensions and a related construct of organizational commitment. The term organizational commitment is introduced for this purpose, since some researchers (e.g. Leiter and Maslach, 1988; Jamal, 1990) found a negative effect of occupational stress on organizational commitment. Additionally, organizational commitment is an important concept highly correlated with task performance and many other organizational behaviours,

including organizational citizen behaviour and turnover of employees (Porter *et al.,* 1974; Porter *et al.,* 1976; Chun *et al.,* 2013). This leads to

Hypothesis 3 The three internal dimensions of occupational stress negatively affect organizational commitment.

Literature review

Occupational stress and its effects

Occupational stress can be regarded as adverse subjective emotions experienced by employees when facing an imbalance between requirements and ability and other working conditions (Leung et al., 2008a, Bowen et al., 2014a). *Worry*, *tension* and *lack of joy* are found to be important components of such emotions (Fliege *et al.,* 2005*).* Occupational stress has become an important topic in construction during recent decades since the industry has a high exposure to uncertainties and many professionals experience high levels of stress. According to a survey on stress conducted by the Chartered Institute of Building (CIOB) in 2006, 68.2% of the 847 respondents admitted suffering stress and 26.6% of these sought medical help. It is also revealed that only 15% of respondents thought the industry had become less stressful and mental health was coped with well in workplace (Campbell, 2006). A more recent survey by Bowen (2014a) indicates 55% respondents of construction professionals in South Africa face high stress. Occupational stress can also result in poor mental health according to Love et al.'s (2010) survey among construction professionals in Australia. Occupational stress, which is described as emotional stress in Leung *et al*.'s (2010)

survey of stress among construction workers in Hong Kong, rather than demand-ability imbalance causing accidents and injuries.

The influence of occupational stress on people is less easy to understand. Evidence from a survey of 306 mainly American nurses indicates that perceived social support from co-workers improves reported job performance and reduces reported job stress (Abualrub, 2004), while Hon (2013), with evidence from 305 employees in 48 hotels and service organizations in China, finds co-worker support is a significant moderator between working-creativity-caused stress and service performance. Interestingly, AbuAlrub (2004) found job stress and job performance had a U shape relationship, with mainly American nurses reporting moderate job stress and believing their performance is worse than those reporting low/high job stresses - which is consistent with Hanson's (1987) statement that a medium stress level is needed for more efficient work output (Gunning and Cooke, 1996). Jamal (1984), on the other hand, in analysing sample data from 440 nurses working in Canada, proposes employee professional and organizational commitment as moderators in the stress-performance link, although this is only partially supported by the data. In construction research, Bowen *et al*. (2014a) examine four categories of effects of occupational stress in terms of psychological effects, physiological effects, sociological effects and substance usage (including alcohol, cigarettes and even illegal drugs) in a survey of construction professionals in South Africa.

In this study, the effect of occupational stress on organizational commitment is targeted to validate the divisibility of occupational stress. The term "commitment" is widely used in analysing both organizational and individual behaviours but no commonly acknowledged definition has been developed (Becker, 1960). For example, the activities of a committed person may be a result of considering "generalized cultural expectations" (e.g. a trustworthy

person do not change jobs frequently) and "impersonal bureaucratic arrangements" (e.g. the economic loss of quitting the current job) (Becker, 1960). However, the term "organizational commitment" discussed here is not concerned with various definitions of general commitment but the commitment related behaviours of employees characterized by: (1) acceptance and appreciation of goals and values of the organization; (2) willingness to make extra efforts for the success of the organization; and (3) a strong desire to stay in the organization (Mowday *et al.,* 1979). Some academics (e.g. Porter *et al.*, 1974) point out that organizational commitment takes longer to build but is more stable. Chun *et al.* (2013) analyse data from 3821 employees of 130 Korean companies and find organizational commitment positively affects the financial performance of these companies via a mediation effect of organizational citizen behaviour. Porter *et al.* (1974) conducted a longitudinal study to examine the relationships between organizational commitment, job satisfaction and turnover with evidence from psychiatric technician trainees, and found that general attitudes concerning organizational commitment are important in deciding whether to stay or leave (Porter *et al.,* 1974) and that the level of organizational commitment declines before leaving the current job (see Porter *et al.*, 1976).

For the relationship between occupational stress and organizational commitment, Leiter and Maslach (1988) found a significant negative effect of occupational stress on organization commitment with empirical cases from 52 nurses and support staff in a small hospital (Leiter and Maslach 1988). Similarly, Jamal (1990) found low organizational commitment and high turnover intention when employees face high occupational stress and stressors, with empirical observations of a large hospital in Canada with around 350 nurses. A recent survey in Iran conducted by Aghdasi *et al*. (2011) also found a significantly negative effect of occupation

stress on organizational commitment when exploring the relationship between emotional intelligence and organizational commitment and the mediating effect of occupation stress.

Stressors and coping strategies

Hurrell and McLaney (1988) point out that job stressors lead to psychological, physiological and behavioural reactions of employees. In stress related research, the importance of identifying internal and external stressors has been widely acknowledged (Levenstein *et al.,* 1993). For example, the 15-stressor inventory developed in Jamal's (1984) study measuring the relationship between occupational stress and job performance of Canadian nurses categorize the 15 stressors into four types in terms of role ambiguity, role conflict, overload and resource inadequacy. Another psychometric instrument developed by Hurrell and Mclaney (1988) categorizes 13 occupational stressors into workload, responsibility, role demands and conflict. In construction, Leung *et al.* (2005a) find work overload, role conflict, job ambiguity and working environment to be the ones most affecting stress levels of consultant cost estimators (quantity surveyors) in Hong Kong. Organizational support factors are also regarded as antecedents of stressors with this group, with stressors such as lack of autonomy acting as mediators between organizational support and employee stress (Leung *et al.,* 2008a). Gunning and Cooke (1996) surveyed 39 construction professionals and 22 lecturers active in the Northern Ireland construction industry and found "working to impossible deadlines", "client demands" and "hiring/firing staff" to be three main causes of stress. Love *et al.* (2010) find work-support to be an important predictor of occupational stress of consultants in the Australian construction industry too, with lack of support resulting in the generally poor mental health status of those affected (Love *et al.,* 2010). Bowen *et al.* (2012) evaluate the status of some stressors including job demands, job control, job support, job certainty and opportunities, and the general work environment among South African

construction professionals. Ng *et al.*'s (2005) research on measuring the manageability of stress in relation to Hong Kong construction projects categorized 33 stressors into seven groups of work-nature related stressors, work-time related stressors, organisation policy related stressors, organisation position related stressors, situational/environmental stressors, relationship related stressors and personal stressors.

Negative effects of occupational stress occur when insufficient resources are available to cope with stressors (Cohen *et al.,* 1983). The act of coping, describes the situation when people defend themselves from threats to current psychological conditions, such as integrity, and has gained in popularity since 1960s (Lazarus, 1993). In the Ways of Coping Questionnaire developed by Folkman and Lazarus (1988), eight coping categories are presented: confrontive coping, distancing, self-controlling, seeking social support, accepting responsibility, escape-avoidance, planned problem solving and positive reappraisal. As mentioned earlier , only 26.6% of the stressed people in the 2006 CIOB survey sought medical advice and the mostly dependent coping mechanism is the support from other colleagues (CIOB, 2006). Yip and Rowlinson's (2006) exploratory factor analysis of the stress coping behaviours of construction professionals in Hong Kong identified four main categories of rational problem solving, resigned distancing, support seeking and passive wishful thoughts. adverse coping behaviours such as the consumption of alcohol, cigarettes and illegal drugs have already been mentioned Africa (Bowen *et al*., 2014a). The study of appropriate coping strategies is therefore an associated common topic. Aiming to help project participants better cope with stresses, Ng *et al.* (2005), for example, conducted a questionnaire survey to measure the manageability of the stressors most confronted by Hong Kong construction project participants. Richmond and Skitmore (2006) also provide 14 stress coping strategies such seeking social support, improving communication and taking exercise

for 50 identified potential stressors by conducting interviews with project managers in the Australian IT industry. In coping strategy selection, Haynes and Love (2004) found that active coping is more useful than other strategies such as social coping and self-control in their survey of male project managers in Australia.

Measures of occupation stress and divisibility

Hurrell *et al.* (1998) divide occupational stress research into two main types: research studies on occupational stressors faced by employees in their working environment, and studies of employees' emotional reactions (e.g. stain) to working conditions. Although it is debatable whether the measurement of stress should concentrate on stressors or stress reactions, it is acknowledged that both approaches provide useful different perspectives (Hurrell *et al.,* 1998; Fliege *et al.,* 2005). Therefore, some basic questions such as what is "occupational stress" and "what dimensions should be included?" are also worth exploring.

The divisibility of occupational stressors has been widely acknowledged and applied (Kahn *et al.,* 1964; Porter *et al.,* 1974; Jamal, 1990; Leung *et al.,* 2005a) as well as the difference between stressors and stress, but occupational stress is still seen as a holistic concept in most studies. For example, in Jamal's (1990) study examining the effects of stress and stressors on employee job satisfaction, organizational commitment and turnover intention among nurses in Canada, total scores of eight stress-related items are used in further analyses. Since occupational stress can be regarded as a result of the imbalance between job demands and actual ability of employees (Bowen *et al*. 2014a), the total score of ten items measuring such imbalance is used to describe occupational stress in Leung *et al*. (2008a) and Leung *et al*.'s

(2008b) study of construction cost engineers. However, such imbalance is more similar to a stressor rather than an emotional reaction. In Bowen *et al.*'s (2014a) study of the stress effects of construction professionals in South Africa, only a single 10-point scale was applied to measure stress levels. Therefore, it is critical to contribute to the body of knowledge to provide more attention to measurement-related issues of occupational stress (Hurrell *et al.,* 1998).

Levenstein *et al.* (1993) developed a perceived stress questionnaire (PSQ) to explore the divisibility of occupational stress, but which has been criticised by Fliege *et al.* (2005), however, for overlapping occupational stress and stressors. Nevertheless, the developed PSQ reveals the existence of internal dimensions of occupational stress. Additionally, Fliege *et al.* (2005) admit that their PSQ version includes one occupational stressor, *demands*, and three other emotional stress reactions. This study develops a Chinese PSQ version based on their work and aims to demonstrate the divisibility of occupation stress.

Research method

An adapted questionnaire was developed based on the PSQ constructed by Levenstein *et al.* (1993) and Fliege *et al.* (2005). To assure content validity in the Chinese context, a translation and back translation technique was applied. Principal component analysis, confirmatory factor analysis and structural equation modelling were used for testing construct validity .

Perceived stress questionnaire

The PSQ developed by Levenstein *et al.* (1993) and Fliege *et al.* (2005) was used as the main instrument in the study. After analysing the results of Fliege *et al*'s factor analysis and considering the likely drawbacks and suitability of these items in the Chinese context, a modified 4x4 (four dimensions of stress, with each containing four items) version was conjectured for the Chinese cost estimator context. Also, while Fliege *et al.*'s PSQ refer to the respondent as "you", the respondent were address as "I" in this study make it easier for Chinese respondents to report more personal emotional reactions. Additionally, the four-scale questionnaire response format used in Levenstein *et al.* (1993) was changed to a seven-point Likert scale format to elicit more finely grained information. Furthermore, a "don't know" option, omitted from Levenstein *et al.*'s and Fliege *et al*'s versions, was offered in the questionnaire as a standard procedure for those unable to answer corresponding questions.

The main part of the questionnaire is presented in Table 1. According to Fliege *et al.*'s (2005) categorization, Q1-Q4 belongs to *demands*, Q5-Q8 to *worry*, Q9-Q12 to *tension* and Q13-Q16 belongs to *joy*. Q13-Q16 was reversed in the analysis and named as AQ13-AQ16 indicating the *lack of joy* dimension to be consistent with Levenstein *et al.*'s categorization.

Table 1: Perceived stress questionnaire

No.	Occupational stress	1-not at all to 7 very intensive	Don't know
Q1	I have too many things to do	1 2 3 4 5 6 7	□
Q2	I do not have enough time for myself	1 2 3 4 5 6 7	□
Q3	I feel under pressure from deadlines	1 2 3 4 5 6 7	□
Q4	I feel I am in a hurry	1 2 3 4 5 6 7	□
Q5	I have many worries	1 2 3 4 5 6 7	□
Q6	My problems seem to be piling up	1 2 3 4 5 6 7	□

Q7	I fear I may not manage to attain my goals	1 2 3 4 5 6 7	□
Q8	I feel frustrated	1 2 3 4 5 6 7	□
Q9	I feel tense	1 2 3 4 5 6 7	□
Q10	I feel mentally exhausted	1 2 3 4 5 6 7	□
Q11	I have trouble relaxing	1 2 3 4 5 6 7	□
Q12	I find it hard to feel calm	1 2 3 4 5 6 7	□
Q13	I feel I am doing things I really like (R)	1 2 3 4 5 6 7	□
Q14	I am light hearted (R)	1 2 3 4 5 6 7	□
Q15	I feel safe and protected (R)	1 2 3 4 5 6 7	□
Q16	I am full of energy (R)	1 2 3 4 5 6 7	□

Note: Adapted from Fliege *et al*. (2005).

Translation and back translation

Translation and back translation is a widely accepted technique in cross-cultural research since translation quality and equivalence between source and target versions are critical (Brislin, 1970). Despites of its importance, this technique was not yet widely acknowledged and used in construction research. Siu *et al.* (2003), for example, apply the technique in a safety attitudes questionnaire used in some European studies when measuring the role of age on safety attitudes and performance among Hong Kong construction workers (Siu *et al.*, 2003). Ding and Ng (2007) also apply the technique in validating their translated Chinese version of McAllister's trust scale. Because of differences in cultural backgrounds and languages, the translation of questionnaires from English to Chinese needs be carried out with care in this research. A two-stage translation and back translation technique was therefore adopted. For the first stage, a Chinese version of the questionnaire was translated from the English version by a bilingual PhD candidate with knowledge of PSQ, with the preliminary Chinese draft emerging after several rounds of discussions with a bilingual member of university academic staff. For the second stage, another pair of bilingual assistants (i.e. PhD student and academic staff) *without* prior knowledge of the PSQ English version of the

questionnaire, translated the Chinese questions back to English. The two English versions were then compared for significant inaccuracies (Table 2). The discrepancies found were then corrected to produce the final version.

Table 2: Translation and back translations

No.	Final Chinese version	Back translation-1	Back translation-2
Q1	我有太多事情要做	I have a lot of things to do.	I have too many works to do
Q2	我感到留给自己的时间不够	I feel that I have limited time to myself.	I feel not enough time for myself
Q3	我感到来自截止日期的压力	I feel the pressure from deadlines.	I feel deadline pressure
Q4	我感觉自己很着急	I feel that I am in a hurry.	I feel I am in a hurry
Q5	我有很多担心	I have many worries.	I have a lot of concerns
Q6	我的问题似乎越堆越多	It seems that my problems are increasing.	My problems seem to be accumulating
Q7	我担心我不能实现我的目标（们）	I am afraid that I cannot achieve my goals.	I am concerned about not realising my objective(s)
Q8	我感到受挫与沮丧	I feel frustrated and depressed.	I feel frustrated and depressed
Q9	我感到紧张	I feel nervous.	I feel nervous
Q10	我感觉到精神上的疲惫	I feel mentally exhausted.	I feel mentally exhausted
Q11	我在放松身心上存在问题	I have some problems on relaxing my body and mind.	I have problem in physical and psychological relaxation
Q12	我很难冷静	It is hard for me to keep calm.	I have difficulty in calming down
Q13	我感觉我在做自己真正喜欢的事情	I feel I am doing the things that I like.	I think I am doing the work that I truly like
Q14	我很轻松	I feel relaxed.	I am very relaxed
Q15	我有安全感	I feel a sense of security.	I feel secure
Q16	我感觉充满能量	I feel that I am full of energy.	I feel energetic

Data collection and demographics

To validate the developed PSQ with empirical evidence from China, a questionnaire applying the snowball sampling technique was used as recommended in Shi *et al.,* (2014) to approach potential participants rather than direct delivery to companies, due to the sensitive questions asked in the PSQ. Young cost estimators are targeted to validate the PSQ as it is impossible to cover all construction populations in China. As indicated in some surveys including Love *et al.* (2010) and Bowen *et al.* (2014a), different construction professionals differ largely in stress levels and related effects. Construction cost estimators, with huge responsibilities and high stress levels in construction projects, have been targeted as subjects in several previous studies (e.g. Leung *et al.,* 2005a, 2005b, 2008a, 2008b; Bowen *et al.,* 2012). Haynes and Love (2004) found that less working experience is a significant predictor of high occupational stress, while such a negative effect is not significant in Bowen *et al.* (2014b). It is reasonable, therefore, to assume that young (i.e. inexperienced) cost estimators have higher risks of becoming stressful at work due to the imbalance between lack of experience and high demands. In Winefield and Anstey's (1991) survey of the occupational stress of general practitioners, emotional exhaustion and depression of respondents younger than 40 are much higher than those elder. Boyas *et al.* (2012) also found among child protection workers that occupational stress levels and coping mechanisms differed greatly by age groups, attributing this to differing social capital. Similarly, young doctors familiar with a doctor's daily work find their job to be less stressful, emphasizing the effect of experience (Bolanowski, 2005). Since five years' experience is generally acknowledged as the necessary time for practitioners to master construction cost estimation skills (Skitmore *et al.,* 1990), potential respondents were restricted to having no more than five years' working experience. 144 valid responses were used for further analyses. Of these, 74 (51.4%) are male and 69 (47.9%) are female (1

missing data); 42 (29.2%) are younger than 25, 100 (69.4%) range from 25 to 34 and 1 (0.7%) from 35 to 44 (1 missing data); and for their highest educational level, 13 (9%) possessed diplomas, 109 (75.7%) a bachelor's degree and 22 (15.3%) a master's degree.

Data reliability

Cronbach's alpha is used to evaluate the internal consistency of the questionnaire items. The overall value is 0.885, with 0.845, 0.834, 0.790 and 0.753 for the *demands* (Q1-Q4), *worry* (Q5-Q8), *tension* (Q9-Q12) and *lack of joy* (AQ13-AQ16) dimensions respectively. Since all these values are larger than the 0.7 cut-off value (Cronbach, 1951), the whole and the parts of the questionnaire are considered to be acceptably consistent. Since the Cronbach alpha value is affected by length of scale, the matrix of correlations of individual items is also examined for confirming scale reliability (Ding and Ng, 2007). With a mean of the absolute values of item-item correlations of 0.329 (SD=0.182), the results indicate an acceptable level of reliability.

Although PCA deals well with non-normal distribution situations (Wang and Du, 2000), tests on sample distributions are still useful to reflect information concerning the population distribution. Additionally, multivariate normality is an inherent assumption when using the default maximum likelihood estimation method in structural equation modeling (SEM) (Maccallum *et al.,* 1992, Xiong *et al*., 2015). The sample skewness and kurtosis statistics can be used to test the normality of distribution of variables and both should lie within the [-1, +1] interval (Hair, 2006). Here, the skewness and kurtosis values of all 16 variables are within the range of -0.86 to 0.45 and -0.54 to 0.46 respectively, which indicates the normal distribution assumption to be satisfied.

Data analysis and discussion

Tests of these hypotheses are carried out with a sample of 144 predominately young cost estimators working in the Chinese construction industry. As will be seen, the first two hypotheses are supported and hypothesis 3 is supported partially as a structural equation model indicates that only the *lack of joy* has a significantly negative effect on organizational commitment.

Principal component analysis

Consistent with Levenstein *et al.* (1993) and Fliege *et al.*'s (2005) exploratory study using PCA, the PCA confirms the hypothesized four-dimensional structure of the PSQ, with a 0.840 Kaiser-Mayer-Olkin measure of sampling adequacy higher than the cut-off value of 0.5 (Hair, 2006) and a highly significant $p<0.0001$ for Bartlett's test for sphericity, indicating that the items are suitable for factor analyses. The forced 4-factor solution applying varimax rotation, a widely applied orthogonal rotation method maximizing the sum of the variances of the squared loadings (Abdi, 2003) and used in Leventein *et al.* (1993) and Fliege *et al.* (2005), explains 70.1% of the overall variance, with components 1, 2, 3 and 4 accounting for 38.1%, 16.6%, 10.0% and 5.4% respectively. The allocated components, means (*M*), standard deviations (*SD*) and communalities (h^2) of the items are summarised in Table 3. For clarity, the largest factor loadings of each item are shown in bold.

Table 3: PCA with varimax rotation

Items	Components				Item parameters		
	1	2	3	4	*M*	*SD*	h^2
Q1	0.009	**0.856**	0.019	-0.109	5.72	1.19	0.75
Q2	0.092	**0.879**	0.063	0.108	5.59	1.44	0.80

Q3	0.042	**0.74**	-0.106	0.366	5.49	1.45	0.70
Q4	0.256	**0.643**	0.108	0.524	5.22	1.43	0.77
Q5	0.327	0.47	0.077	**0.645**	5.26	1.41	0.75
Q6	0.379	0.297	0.077	**0.699**	4.60	1.50	0.73
Q7	0.402	-0.044	0.244	**0.706**	4.76	1.71	0.72
Q8	**0.789**	-0.045	0.2	0.344	3.78	1.67	0.78
Q9	**0.789**	0.149	0.187	0.258	4.08	1.63	0.75
Q10	**0.663**	0.304	0.384	0.184	4.44	1.58	0.71
Q11	**0.695**	0.13	0.345	0.022	3.86	1.64	0.62
Q12	**0.683**	-0.023	-0.072	0.245	3.32	1.71	0.53
AQ13	0.182	-0.102	**0.625**	-0.007	3.42	1.38	0.43
AQ14	0.147	0.371	**0.776**	-0.038	3.99	1.40	0.76
AQ15	0.108	0.068	**0.822**	0.171	3.55	1.40	0.72
AQ16	0.155	-0.279	**0.667**	0.395	3.38	1.27	0.70

Discussion-PCA results

With the exception of Q8 – "I feel frustrated and depressed" – the PCA supports the

hypothesised 4x4 structure. This anomaly is discussed below in terms of the four dimensions

involved, together with the relationship of the results with the findings of previous studies of

stress emotional reactions.

The *tension* dimension, comprising Q8-Q12, explains the largest proportion of variance

(38.1%) in the data, which is consistent with Jamal's (1984) view of job-related *tension* being

regarded as occupational stress. According to Fliege *et al.*'s (2005) original categorization,

Q8 ("I feel frustrated") is not included in this dimension but in the *worry* dimension. This

may be due to Fliege *et al*'s selection of 5 items from Levenstein *et al.*'s (1993) original 13

items for this dimension. If we carry out a semantic analysis between Q5-Q7 and Q8,

however, it is easy to see that there are no words of "worry", "afraid" or "fear" in Q8.

Additionally, two Chinese words are used to represent "frustrated" exactly and they are back

translated as "frustrated and depressed". Therefore, it is reasonable to include Q8 in the

tension dimension. Also worth mentioning is the slightly low communality value (0.53) of

Q12 and a slight increase (0.009) of Cronbach's alpha value if deleted. This indicates an inconsistent understanding of "calm" by the respondents, possibly related to the fact that "calm" refers not only to "not excited or nervous" but also to "reasonable and wise" in the Chinese culture, which is significantly influenced by Confucius' wisdom[1]. Therefore, some minor changes may be necessary for future applications of Q12.

The *demands* dimension, comprising Q1-Q4, explains 16.6% of the variance in the data. Cronbach's alpha value is rather high (0.845) but would not increase if any item is deleted. According to Fliege *et al.*'s (2005) explanation, this dimension is actually an extra stressor dimension that is similar to the term "overload" mentioned in many stressor studies (e.g. Jamal, 1984; Leung *et al.*, 2005a) and different in nature to the other three dimensions.

The *lack of joy* dimension, comprising AQ13-AQ16, explains 10.0% of the variance, and has an acceptable Cronbach alpha value of 0.753, but would be increased a little (by 0.007) if AQ13 is deleted. Additionally, the communality of AQ13 is comparatively low (0.43), indicating some confusion among respondents when answering Q13 ("I feel I am doing the things that I like"), which is similarly reflected in Levenstein *et al.*'s (1993) factor analysis results where the factor loading on this item in the *lack of joy* factor is also comparatively low.

The *worry* dimension, comprising Q5-Q7, explains 5.4% of the variance, and has a high Cronbach alpha value (0.803) that would not increase if any item was deleted. The issue of

---

[1] Also, as stated in the Bible, "Fools give full vent to their rage, but the wise bring calm in the end" (Proverbs 29:11 New International Version).

Q8 is discussed above. To remain in the *worry* dimension, the wording of Q8 needs to be changed to such as "I am afraid of/fear frustration" with a greater emphasis on "worry".

Investigating the differences among variables is a very informative way to understand the multi-attributes of the sample. As shown in Table 3, items under the *demands* sub-dimension among participants have comparatively high mean values, indicating the young cost engineers experience a general "overload" feeling. The average value of this sub-dimension (5.52) is higher than that (4.13) of the "work overload" feeling among their counterparts in Hong Kong according to a 7 point Likert scale survey by Leung *et al.* (2005a). Additionally, Leung *et al.* (2005a) found that the "work overload" factor is the most predictive stressor of stress of construction cost estimators in Hong Kong. This difference may be related to the extensive construction work needed to cope with Mainland China's rapid urbanization, where the sub-sector of construction cost consultancy reached CNY 80.685 billion and 237,100 employees in 2011 after a 10% annual increase rate for several years (Shi *et al.,* 2014). With such a fast increasing market and following needs to recruit new employees, therefore, it is not surprising to find that current employees experience high "demands". According to the results shown in Table 3, young construction cost estimators also experience intense *worry* but with a little less *tension* and less still *lack of joy*.

Validation with SEM

Although the PSQ developed by Levenstein *et al.* (1993) and Fliege *et al.* (2005) helps in a obtaining a deeper understanding of occupational stress, the internal dimensions of occupational stress need further construct validation. Since the PCA results confirm the applicability of the PSQ, confirmatory factor analysis (CFA) is applied for testing hypothesis 2 and hypothesis 3. In order to test nomological validity and understand the potential

different effects of the three different emotional reactions, organizational commitment was introduced as the dependent variable in SEM to test hypothesis 3. Five items were used, such as Mowday *et al's* (1979) organization commitment measure of "I really care about the fate of this organization".

A CFA model is firstly developed to test the reliability and validity of a construct consisting of three sub-dimensions of occupational stress in terms of *worry*, *tension* and *lack of joy*. Since the CFA model, as presented in Table 4, is a good fit, a further SEM model is developed to test hypothesis 3. Because the weightings of manifest variables on latent variables in the CFA are quite similar to those in the SEM, only the weightings in the SEM are presented in Table 4 for the sake of clarity and simplicity.

Confirmatory factor analysis

Confirmatory factor analysis is a specific application of structural equation modelling to validate established measurement constructs or model validation (Xiong et al., 2015). For example, Molenaar *et al*. (2009) validated their five-dimensional framework to measure corporate safety culture by applying CFA. Wong *et al*. (2008) also applied CFA to validate a three-dimensional framework to measure trust in construction contracting, while Ding *et al*. (2012) validated a two-dimensional trust framework by CFA with empirical evidences in construction. In this study, a three-dimensional framework for measuring occupational stress is developed and tested with CFA. In such studies, model fit, reliability and the validity of the constructs are critical for validating the developed models (Xiong *et al.*, 2015). The overall model fit as presented in Table 5 is generally satisfactory. To assure the reliability of constructs, Cronbach's alpha is still useful in determining the internal consistency of constructs. An alternative is composite reliability, CR, where

$$CR = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + \sum Var(e_i)} \qquad (1)$$

as indexed in Bagozzi and Yi (1988) and recommended as a more informative statistic in the SEM context for its ability to assess internal consistency of indicators within a construct. A value larger than 0.7 indicates good quality (Bagozzi and Yi 1988). As Table 4 indicates, all CR values are acceptable.

Construct validity tests normally include *convergent validity* and *discriminant validity*. Convergent validity measures the extent of positive correlations of one manifest variable (MV) with other MVs within same constructs, since MVs should share a comparatively high proportion within the same constructs (Hair, 2014). To assess convergent validity, the standardized regression weights and squared multiple correlations (SMCs) for each item are calculated. As presented in Table 4, all the standardized regression weights are highly significant and above 0.5, ranging from 0.538 to 0.853, indicating acceptable validity (Xiong *et al.,* 2014). It is worth mentioning that the standardized regression weights of Q12 and AQ13 are close to the threshold, which is consistent with previous PCA results. They are still kept to ensure the completeness of measurements as their deletion does not leading to any improvement in the CFA and SEM results. Discriminant validity (that constructs in the model are significantly different) can be confirmed by comparing the unconstrained model and constrained alternatives. Since the unconstrained model is significantly better than the model equally constrained correlations between constructs (Chi-square (df=2)= 40.967, p=0.000), it is reasonable to regard these constructs as different ones. Since this study aims to validate the divisibility of occupational stress, nomological validity, another useful although little mentioned construct validation, is recommended by applying structural equation modelling (Ding and Ng, 2007).

Table 4. Standardized regression weights

Item	Standardized regression weights				SMC	CR
	Worry	*Tension*	*Lack of joy*	OC		
Q5	0.714				0.510	
Q6	0.811				0.658	0.808
Q7	0.764				0.583	
Q8		0.852			0.727	
Q9		0.853			0.728	
Q10		0.777			0.603	0.856
Q11		0.633			0.401	
Q12		0.538			0.289	
AQ13			0.538		0.289	
AQ14			0.654		0.428	0.766
AQ15			0.786		0.618	
AQ16			0.693		0.480	
Q17				0.708	0.501	
Q18				0.840	0.705	
Q19				0.779	0.607	0.887
Q20				0.819	0.671	
Q21				0.758	0.575	

Structural equation modelling

In some studies, the CFA phase is usually undertaken as a first step before placing directional relationships between constructs in the model (Xiong *et al.,* 2014). Since a good model fit is achieved in the CFA phase, a further SEM model is developed to test Hypothesis 3. As indicted in Table 5, the model fit is acceptable. The final results are presented in Figure 1 and Table 4. The correlations between emotional reactions are also tested and presented as broken lines in Figure 1, where the observed variables such as Q5 are shown in rectangles; latent variables such as *worry* are shown in ellipses; with directional arrows reflecting effects of sub-dimensions of occupational stress on organizational commitment. It is found that only *lack of joy* has a significantly negative effect on organization commitment, with the other two emotional reactions having no significant effects.
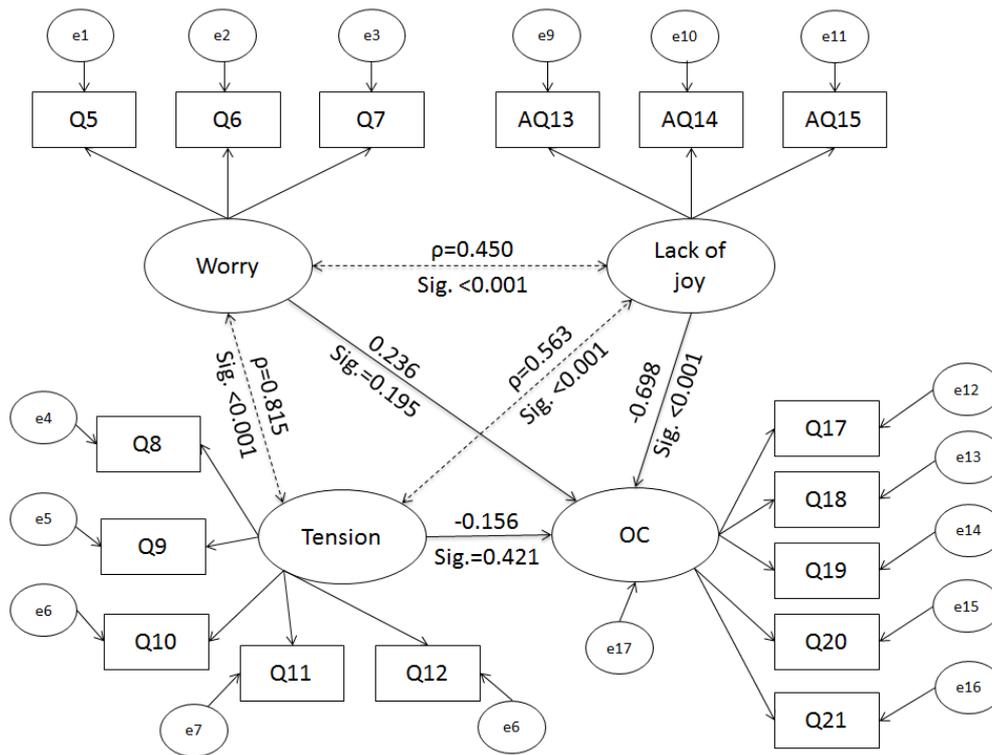
Figure 1 Effects of dimensions of stress on organizational commitment

Table 5. Goodness of fit

Goodness of fit measure	Criteria	CFA	SEM
χ^2/df	<5.0	2.255	2.078
Absolute fit			
RMSEA	<0.1	0.093	0.087
AGFI	>0.8	0.822	0.785
SRMR	<0.08	0.065	0.062
Incremental fit			
CFI	>0.9	0.918	0.902
IFI	>0.9	0.919	0.904
Parsimonious fit			
PNFI	>0.5	0.667	0.690
PGFI	>0.5	0.578	0.621

Discussion of the CFA and SEM results

The CFA results validate the three sub-dimension construct of occupational stress, which supports Hypothesis 2. It is also noticed that *worry* and *tension* are highly correlated but *lack of joy* is less correlated. The high correlation agrees with many previous studies, since occupational stress is simply regarded as a mix of *tension* and *worry* (Hurrell Jr *et al.,* 1998). As richer meanings have been identified in occupational stress (Levenstein *et al.,* 1993, Fliege *et al.,* 2005), it will be necessary to take into account its multi-dimensional nature in subsequent research.

The SEM results reveal that the three emotional reactions have different effects on organizational commitment. *Lack of joy* has a largely negative effect on organizational commitment (as *lack of joy* increases, organizational commitment decreases) but *worry* and *tension* do not. This is generally consistent with previous studies of Leiter and Maslach (1988), Jamal (1990) and Aghdasi *et al.* (2011) in that occupational stress negatively affect sorganizational commitment, while this study finds that the main contributor is *lack of joy* other than *worry* and *tension*. Acknowledging the differences between *lack of joy* discussed here and the term "job satisfaction", these findings are consistent with Tett and Meyer (1993), where job satisfaction was found to be highly correlated with organizational commitment and turnover (Tett and Meyer, 1993). Similarlly, Currivan (1999) found greater intensity of job stressors comprising role ambiguity, role conflict and workload leads to lower job satisfaction, which also leads to weaker organizational commitment (Currivan, 1999). It is surprising to find that *worry* and *tension,* although highly correlated with workloads, do not have a significant effect on organizational commitment, as greater workloads have been

found to lead to weaker organizational commitment in some previous studies (e.g. (Currivan, 1999; De Cuyper and De Witte, 2006).

This puzzling paradox demonstrates the necessity to understand the sub-dimensions of occupational stress in terms of *worry*, *tension* and *lack of joy*, since these emotional reactions may have different causes and effects. An additional stepwise principal component regression analysis as used in Gan *et al.* (2015) was conducted to predict organizational commitment not only with *worry*, *tension* and *lack of joy* but also *gender*, *experience* and even *demands* in a second test. The result is same in that only *lack of joy* is significant predictor. The insignificant effects of *worry* and *tension* on organizational commitment, may possibly be attributed to a U-shape relationship between stress and job performance and stress and organizational relationship (AbuAlrub, 2004; Leung *et al.,* 2005b). As Leung *et al*. (2005b) point out, a moderate stress level would result in better performance among cost estimators, while stress measured as the imbalance between actual ability and job expectations is more a proxy for job fit rather than stress level (Lauver and Kristof-Brown, 2001).

Conclusion

The applicability of a revised PSQ based on Levenstein *et al.* (1993) and Fliege *et al.*'s (2005) studies in China is demonstrated, which means Hypothesis 1 is supported. A translation and back translation technique and principal component analysis are used to firstly validate the questionnaire data. This confirms it can be used in future studies, in contrast with many previous studies that suffer from measurement deficiencies concerning occupational

stress. In order to record distinct stressor and emotional reactions, a further three-dimensional framework for measuring occupational stress is developed.

The second contribution is that the divisibility of occupational stress is demonstrated in this study, which means Hypothesis 2 is supported. The three sub-dimensions in terms of *worry*, *tension* and *lack of joy* are developed and validated by structural equation modelling. Since the model comprising three emotional reactions is supported with CFA, further research would benefit from treating occupational stress as a multi-dimensional concept. The measurement issue is always a most critical in this kind of research and some previous studies use one or several stressors such as workload and ability imbalance to indicate occupational stress. Such practices could be reasonable in some situations, but would be problematic when exploring the relationship between stressors and stress. Some research directly asks for respondents' general perception of stress, which may be defined differently from person to person and hard to measure without the help of more observable measured items. This new framework identifies the core characters and manifest variables of occupational stress, which helps the standardization of occupational stress measurement and provides a standard way to develop a measurement framework.

Another theoretical implication of this study is that sub-dimensions may act differently in organizational contexts. As proposed in Hypothesis 3, three dimensions are presumed to negatively affect organizational commitment, while only *lack of joy* has significantly negative effect. Therefore, more exact descriptions should be used when examining and describing the relationship between occupational stress and occupational stressors or other organizational influences.

It should also be noted that the empirical work in this study is limited to the specific context of construction professionals in China, although findings from this research may also interest researchers outside the construction field. Further research will benefit from applying the findings of this research in other settings and exploring relationships between the sub-dimensions of occupational stress with other managerial factors. In addition, much work remains to be done in identifying uncovered dimensions of occupational stress and improve measurement accuracy.

Acknowledgement

References

Abdi, H. (2003) Factor rotations in factor analyses. Encyclopedia for Research Methods for the Social Sciences. Sage: Thousand Oaks, CA, 792-5.

AbuAlRub, R F. (2004) Job stress, job performance, and social support among hospital nurses. *Journal of Nursing Scholarship*, **36**(1), 73-8.

Aghdasi, S., Kiamanesh, A. R., and Ebrahim, A. N. (2011). Emotional Intelligence and organizational commitment: testing the mediatory role of occupational stress and job satisfaction. *Procedia-Social and Behavioral Sciences*, **29**, 1965-1976.

Bagozzi, R P. and Yi, Y. (1988) On the evaluation of structural equation models. *Journal of the Academy of Marketing Science*, **16**(1), 74-94.

Becker, H S. (1960) Notes on the concept of commitment. *American journal of Sociology*, 32-40.

Bolanowski, W. (2005). Anxiety about professional future among young doctors. *International Journal of Occupational Medicine and Environmental Health*, **18**(4), 367-374.

Bowen, P., Edwards, P. and Lingard, H. (2012) Workplace stress experienced by construction professionals in South Africa. *Journal of Construction Engineering and Management*, **139**(4), 393-403.

Bowen, P., Edwards, P., Lingard, H., and Cattell, K. (2014a). Workplace Stress, stress effects, and coping mechanisms in the construction industry. *Journal of Construction Engineering and Management*, **140**(3).

Bowen, P., Govender, R., & Edwards, P. (2014b). Structural equation modeling of occupational stress in the construction industry. *Journal of Construction Engineering and Management*, **140**(9).

Boyas, J., Wind, L. H., and Kang, S. Y. (2012). Exploring the relationship between employment-based social capital, job stress, burnout, and intent to leave among child protection workers: An age-based path analysis model. *Children and Youth Services Review*, **34**(1), 50-62.

Brislin, R W. (1970) Back-Translation for Cross-Cultural Research. *Journal of Cross-Cultural Psychology*, **1**(3), 185-216.

Campbell, F. (2006). Occupational stress in the construction industry.*Berkshire, UK: Chartered Institute of Building*.

Chun, J S., Shin, Y., Choi, J N. and Kim, M S. (2013) How does corporate ethics contribute to firm financial performance? The mediating role of collective organizational commitment and organizational citizenship behavior. *Journal of Management*, **39**(4), 853-77.

Cohen, S., Kamarck, T. and Mermelstein, R. (1983) A global measure of perceived stress. *Journal of Health and Social Behavior*, 385-96.

Cronbach, L J. (1951) Coefficient alpha and the internal structure of tests. *Psychometrika*, **16**(3), 297-334.

Currivan, D B. (1999) The Causal Order of Job Satisfaction and Organizational Commitment in Models of Employee Turnover. *Human Resource Management Review*, **9**(4), 495-524.

De Cuyper, N. and De Witte, H. (2006) Autonomy and Workload Among Temporary Workers: Their Effects on Job Satisfaction, Organizational Commitment, Life Satisfaction, and Self-Rated Performance. *International Journal of Stress Management*, **13**(4), 441-59.

Ding, Z. and Ng, F. (2007) Reliability and validity of the Chinese version of McAllister's trust scale. *Construction Management and Economics*, **25**(11), 1107-17.

Ding, Z., Ng, F., Wang, J., and Zou, L. (2012). Distinction between team-based self-esteem and company-based self-esteem in the construction industry. *Journal of Construction Engineering and Management*, **138**(10), 1212-1219.

Fliege, H., Rose, M., Arck, P., Walter, O B., Kocalevent, R-D., Weber, C. and Klapp, B F. (2005) The Perceived Stress Questionnaire (PSQ) reconsidered: validation and reference values from different clinical and healthy adult samples. *Psychosomatic Medicine*, **67**(1), 78-88.

Folkman, S., and Lazarus, R. S. (1988). *Manual for the ways of coping questionnaire*. Consulting Psychologists Press.

Gan, X., Zuo, J., Ye, K., Skitmore, M., and Xiong, B. (2015). Why sustainable construction? Why not? An owner's perspective. *Habitat International*, 47, 61-68.

Gunning, J G. and Cooke, E. (1996) The influence of occupational stress on construction professionals. *Building Research & Information*, **24**(4), 213-21.

Hair, J F. (2006) *Multivariate data analysis*. Upper Saddle River, N.J: Pearson Prentice Hall.

Hair, J F. (2014) *A primer on partial least squares structural equation modeling (PLS-SEM)*. Thousand Oaks, Calif: SAGE Publications.

Hanson, P. (1987) *The joy of stress*. A Pan Original.

Haynes, N. S., and Love, P. E. (2004). Psychological adjustment and coping among construction project managers. *Construction Management and Economics*, **22**(2), 129-140.

Hon, A H Y. (2013) Does job creativity requirement improve service performance? A multilevel analysis of work stress and service environment. *International Journal of Hospitality Management*, **35**, 161-70.

Hurrell, J J J. and McLaney, M A. (1988) Exposure to job stress--a new psychometric instrument. *Scandinavian Journal of Work, Environment & Health*, **14 Suppl 1**, 27.

Hurrell Jr, J J., Nelson, D L. and Simmons, B L. (1998) Measuring job stressors and strains: where we have been, where we are, and where we need to go. *Journal of Occupational Health Psychology*, **3**(4), 368.

Jamal, M. (1990) Relationship of job stress and Type-A behavior to employees' job satisfaction, organizational commitment, psychosomatic health problems, and turnover motivation. *Human Relations*, **43**(8), 727-38.

Kahn, R L., Wolfe, D M., Quinn, R P., Snoek, J D. and Rosenthal, R A. (1964) Organizational stress: Studies in role conflict and ambiguity.

Lauver, K. J., & Kristof-Brown, A. (2001). Distinguishing between employees' perceptions of person–job and person–organization fit. *Journal of Vocational Behavior*, **59**(3), 454-470.

Lazarus, R. S. (1993). Coping theory and research: Past, present, and future. *Psychosomatic Medicine*, **55**(3), 234-247.

Leiter, M P. and Maslach, C. (1988) The impact of interpersonal environment on burnout and organizational commitment. *Journal of Organizational Behavior*, **9**(4), 297-308.

Leung, M. Y., Chan, Y. S., and Yuen, K. W. (2010). Impacts of stressors and stress on the injury incidents of construction workers in Hong Kong. *Journal of Construction Engineering and Management*, **136**(10), 1093-1103.

Leung, M-y., Zhang, H. and Skitmore, M. (2008a) Effects of organizational supports on the stress of construction estimation participants. *Journal of Construction Engineering and Management*, **134**(2), 84-93.

Leung, M. Y., Chan, Y. S., Chong, A., and Sham, J. F. C. (2008b). Developing structural integrated stressor–stress models for clients' and contractors' cost engineers. *Journal of Construction Engineering and Management*, **134**(8), 635-643.

Leung, M Y., Ng, S T., Skitmore, M. and Cheung, S O. (2005a) Critical stressors influencing construction estimators in Hong Kong. *Construction Management and Economics*, **23**(1), 33-44.

Leung, M. Y., Olomolaiye, P., Chong, A., and Lam, C. C. (2005b). Impacts of stress on estimation performance in Hong Kong. *Construction Management and Economics*, **23**(9), 891-903.

Levenstein, S., Prantera, C., Varvo, V., Scribano, M L., Berto, E., Luzi, C. and Andreoli, A. (1993) Development of the Perceived Stress Questionnaire: a new tool for psychosomatic research. *Journal of Psychosomatic Research*, **37**(1), 19-32.

Love, P E., Edwards, D J. and Irani, Z. (2010) Work stress, support, and mental health in construction. *Journal of Construction Engineering and Management*, **136**(6), 650-8.

Lundstrom, T., Pugliese, G., Bartley, J., Cox, J., and Guither, C. (2002). Organizational and environmental factors that affect worker health and safety and patient outcomes. *American Journal of Infection Control*, **30**(2), 93-106.

MacCallum, R C., Roznowski, M. and Necowitz, L B. (1992) Model modifications in covariance structure analysis: the problem of capitalization on chance. *Psychological Bulletin*, **111**(3), 490.

Mowday, R T., Steers, R M. and Porter, L W. (1979) The measurement of organizational commitment. *Journal of Vocational Behavior*, **14**(2), 224-47.

Molenaar, K. R., Park, J. I., and Washington, S. (2009). Framework for measuring corporate safety culture and its impact on construction safety performance. *Journal of Construction Engineering and Management*, **135**(6), 488-496.

Porter, L W., Crampon, W J. and Smith, F J. (1976) Organizational commitment and managerial turnover: A longitudinal study. *Organizational Behavior and Human Performance*, **15**(1), 87-98.

Porter, L W., Steers, R M., Mowday, R T. and Boulian, P V. (1974) Organizational commitment, job satisfaction, and turnover among psychiatric technicians. *Journal of Applied Psychology*, **59**(5), 603.

Richmond, A. and Skitmore, M. (2006) Stress and coping: a study of project managers in a large ICT organisation. *Project Management Journal*, **37**(5), 5-16.

Shi, L., Ye, K., Lu, W. and Hu, X. (2014) Improving the competence of construction management consultants to underpin sustainable construction in China. *Habitat International*, **41**, 236-42.

Siu, O-l., Phillips, D R. and Leung, T-w. (2003) Age differences in safety attitudes and safety performance in Hong Kong construction workers. *Journal of Safety Research*, **34**(2), 199-205.

Skitmore, M., Stradling, S., Tuohy, A. and Mkwezalamba, H. (1990) *The accuracy of construction price forecasts*. University of Salford.

Tennant, C. (2001) Work-related stress and depressive disorders. *Journal of psychosomatic research*, **51**(5), 697-704.

Tett, R P. and Meyer, J P. (1993) Job satisfaction, organizational commitment, turnover intention, and turnover: path analyses based on meta‐analytic findings. *Personnel Psychology*, **46**(2), 259-93.

Wang, F. and Du, T. (2000) Using principal component analysis in process performance for multivariate data. *Omega*, **28**(2), 185-94.

Winefield, H. R., and Anstey, T. J. (1991) Job stress in general practice: practitioner age, sex and attitudes as predictors. *Family Practice*, **8**(2), 140-144.

Wong, W. K., Cheung, S. O., Yiu, T. W., and Pang, H. Y. (2008). A framework for trust in construction contracting. *International Journal of Project Management*, **26**(8), 821-829.

Xiong, B., Skitmore, M., Xia, B., Masrom, M A., Ye, K. and Bridge, A. (2014) Examining the influence of participant performance factors on contractor satisfaction: A structural equation model. *International Journal of Project Management*, **32**(3), 482-91.

Xiong, B., Skitmore, M., Xia, B. (2015) A critical review of structural equation modeling applications in construction research. *Automation in Construction*, **49**(Part A), 59-70.

Yip, B., and Rowlinson, S. (2006). Coping strategies among construction professionals: cognitive and behavioural efforts to manage job stressors. *Journal for Education in the Built Environment*, **1**(2), 70-79.