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Leung, Mei Yung; Zhang, Hong; Skitmore, Martin

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**Effects of organizational supports on the stress of
construction estimating participants**

Mei-yung Leung

*Department of Building and Construction, City University of Hong Kong,
Tat Chee Avenue, Kowloon Tong, Hong Kong.*

, Hong Zhang

Faculty of Management, Xian University of Architecture and Technology, Xian, PRC.

, Martin Skitmore

*School of Urban Development, Queensland University of Technology, Gardens Point,
Brisbane Q4001, Australia.*

Please contact:

Dr. Mei-yung Leung

*Department of Building and Construction,
City University of Hong Kong,
Tat Chee Avenue, Kowloon Tong, Hong Kong
Tel: Int+ (852) 2788 7142
Fax: Int+ (852) 2788 7612
Email: bcmei@cityu.edu.hk*

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ABSTRACT

Forecasting the likely cost of construction work prior to tendering is well known as a hazardous task. Underestimates cause financial difficulties for clients and contractors with limited budgets and may cause projects to become unviable. Overestimates, on the other hand, result in an inefficient use of resources leading to underprovision of necessary facilities for clients and loss or bankruptcy for contractors. In such a situation, it is not surprising that the cost engineering activities can be stressful for those responsible.

Coping with the stresses involved requires action on the part of both the individuals affected and the organizations to which they belong. This paper examines the effect of organizational supports in the process of project estimation through a survey of construction cost engineers in Hong Kong. Using correlation analysis and regression analysis, it is found that: 1) the stressors of autonomy and feedback are directly related to the stress experienced by cost engineers; 2) informal organizational supports (particularly concerning relationship conflict, type A behaviour, work underload, lack of autonomy and unfair rewards and treatment) are far more effective than formal supports in reducing stress; and 3) lack of autonomy and lack of feedback are predictable variables affecting the stress of cost engineers. Cost engineering managers and supervisors need to carefully distinguish between those who prefer hands-on support and those who prefer hands-off support. A good communication and team decision-making process, and fair reward and treatment system may help establish close relationships among cost engineers in a company and ensure sufficient autonomy to cost engineers and the participants in the estimation process. Organizations need to control stressors, manage stress and arrange programmes at different stages of stress management.

Keywords: Estimate, Construction, Cost engineers, Organizational support, Stress, Stressor

INTRODUCTION

It is well known that the availability of precise estimates of likely project costs is one of the most important requirements of both customers (clients) and producers (constructors) in the construction industry today (Peurifoy and Oberlender 2002). To ensure the survival of construction companies, it is necessary for all the participants involved in the estimating process (including cost engineers, civil engineers, planners and procurement staff) to work closely together to produce the most accurate project cost prediction. Due to the risks involved, however, cost estimation is a highly stressful task for those involved, especially the cost engineers themselves.

Research to date has established a strong linkage between the individual coping behaviour of cost engineer stress and relative working performance (Leung 2004; Leung *et al.* 2005a, 2005b). Since construction cost estimation is a group activity involving several participants from a variety of backgrounds, it is believed that both individual and organizational stress management is needed to minimize stress levels (Quick *et al.* 1997). However, little is known of the type and effectiveness of methods used by construction organizations to manage the stress levels of their employees. The research reported in this paper aimed to rectify this by conducting a survey of construction cost engineers in Hong Kong in order to examine the relationship between stressors, organizational supports and the stress of cost engineers in the estimating process.

STRESSORS IN ORGANIZATIONS

In the course of construction cost estimation, cost engineers normally work in an organization, either a consultant firm or a contractor company. While the stressors of cost engineers have been studied, including personal/interpersonal, task and physical stressors (Leung *et al.* 2005b), the organizational dimension of stress management has been ignored. The nature of the cost estimating activity suggests four important types of stressors in the study.

Personal stressors: Each cost engineer has distinctive personal characteristics and could therefore have a unique level of resistance to stressors (Lee and Ashforth 1990). Some cost engineers are extremely competitive and time-focused (that is, they have what is usually

referred to as a *Type A* personality), and people characterized by this type of personality are more likely to be subjected to emotional distress and suffer from stress symptoms (Ganster 1986; Lee and Ashforth 1990). Stress may escalate when cost engineers also have to devote much of their time and energy to family, friends and the community (Quick and Quick 1984).

Task stressors: Cost engineers are often confronted with complications caused by changes in client's requirements, designs, laws or regulations. The problem is aggravated by task ambiguity, in the form of unclear scoping and task objectives, lines of responsibility and so on (Hackman and Oldham 1976). Excessive or insufficient workload is another source of task stress, which can result in depression, low self-esteem, dissatisfaction, a sense of futility and the intention to leave (Buller and Schuler 2000).

Physical stressors: These are related to the job setting, or the temperature and design of the office. According to Beehr (2000) and Cooper and Payne (1978), working in extreme temperatures or an overcrowded environment with too much or too little social interaction can also result in stress, which can subsequently affect physical or psychological health (Gmelch 1982; Furnham 1997; Mind Tools Ltd. 1996).

Organizational stressors: Organizational policy and climate vary greatly between companies. Any policies that do not take into account employees' feelings can cause them to feel considerable stress. Individuals may experience stress and job dissatisfaction if they have no authority to control their work (House and Mitchell 1974), if they are involved in conflicts with their supervisor (McGrath 1976), if they lack feedback (House and Mitchell 1974) and if they experience unfair rewards or treatment in the company (Maslach *et al.* 2001). Individuals often assume that their organization has appropriate policies in place related to their job duties. Once these policies are broken, employees will become dissatisfied with their job (Maslach *et al.* 2001).

ORGANIZATIONAL STRESS MANAGEMENT

Organizational stress management is a form of organizational philosophy applied in the workplace both to promote individual employees and to help them overcome threats in order to reduce the amount of stress and strain they experienced (Quick and Quick 1984; Zaccaro

and Riley 1987). This is achieved by addressing the structural conditions in the working environment that produce stress and by providing employees with self-management training. In this way, stress levels can be minimized, leading to an improvement in employee working performance and emotional well-being (Munz *et al.* 2001).

There are three basic ways in which individuals, groups and organizations can cope with stress. These address different stages in the stress process and comprise: 1) changing a potentially stressful situation before it occurs; 2) controlling the meaning of stressful experiences once they occur; and 3) managing the effects of the stress response (Cooper and Cartwright 1994, 1997; Murphy 1988; Munz *et al.* 2001; Pearlin and Schooler 1978; Zaccaro and Riley 1987). In stage 1, actions are taken to modify or reduce the negative impact of work stressors on the individual (Cooper *et al.* 1997; Cooper and Cartwright 1994; Rahe and Tolles 2002). Person and environmental 'fit' is obtained through this process to provide optimal levels of stress, performance and satisfaction. Stage 2 mainly focuses on stress management (Cooper *et al.* 1997; Rahe and Tolles 2002). This involves the employees' utilization of physical and psychological resources. As a result, their ability to cope with stress may be increased (Zaccaro and Riley 1987). During stage 2, personal stress and coping patterns are modified. In stage 3, the organization provides treatment, rehabilitation and recovery services for those individuals who have suffered serious ill health as a result of stress (Murphy and Hurrell 1987). Intervention, by means of employee assistance programmes and workplace counselling, are implemented at this level. This improves the individual's mental well-being and self-esteem, which is beneficial to both organizations and employees. Accordingly, loss of money due to worker absenteeism is also reduced. Again, this mainly focuses on stress management rather than stressor reduction and it is therefore possible that the employee may still suffer from work stress (Cooper and Cartwright 1997).

ORGANIZATIONAL SUPPORTS

Organizational supports can be viewed as employees' resources in the workplace. They are critical to the employees' emotional, psychological and physiological well-being, as well as being a source of job satisfaction (Lynch 1997). They help employees to redefine the harm of the stressful situation. In addition, they enhance their belief in their ability to cope with the situation by increasing their perception that others will provide the necessary resources (Cohen

and Wills 1985). Strong support from work peers can effectively relieve job strain and serve to mediate the effects of job distress (Cooper 1987; House 1981; Quick and Quick 1984). Moreover, it contributes to improved decision making (Maier 1967).

Lingard and Francis (2004) indicate that the effect of organizational supporting in mitigating stress in the construction industry depended upon the type of support. There are formal and informal requirements in all working relationships and this is no less so in organizational life when dealing with role and interpersonal demands. Consequently, organizational supports can be divided into formal and informal support systems (House 1981). The formal systems include informational support (to manage demands or problems), instrumental support (to assist the individual work directly), appraisal (to assess role performance and behavior) and emotional supports (to provide empathy and emotional caring) (House 1981). Informal supports, which include the support from work peers and supervisors in the practical working environment, should be complementary and supplemental to the formal support systems of an organization (Quick and Quick 1984). Organizational supports (either formal or informal supports) may affect personal stressor (e.g., distrust /family problem; Thompson et al. 2005; Bennett et al. 2001), task stressor (e.g., vague job duty; Lease 1999); physical stressor (e.g., crowded /noisy environment; Quick et al. 1997) and organizational stressor (e.g., lack of feedback/autonomy; Fitzgerald et al. 2002). Hence, organizational supports can consequently influence indirectly via the stressors (Thompson et al. 2005) or affect stress of cost engineers directly (Buunk 1999).

THE SURVEY

Method

Stress is regarded as a subjective feeling that work demands exceed the individual's belief in his/her capacity to cope (Cox, 1983). Since subjective feeling is normally induced by the objective sources, stress of construction cost engineers is measured objectively based on the deviation between expected abilities and perceived actual abilities when people encounter stress (Gmelch 1982). Stress becomes apparent when an individual's actual abilities are lower than what would have been expected in non-stressful situations (French and Caplan 1972; Kahn *et al.* 1964; McGrath 1976; Schuler 1980). This set of questions indicates the respondents' Rust-Out or Burn-Out status (Leung *et al.* 2005b). They reflect both the quantitative and

qualitative dimensions of their workload (Gmelch 1982). The respondents were therefore asked to rate their actual abilities ('a') and their expected abilities ('b') based on a seven-point Likert scale ranging from 1 ('none') to 7 ('a great deal'). The overall level of stress was then represented by the sum of differences between the 'a' and 'b' ratings. The alpha value of stress items is 0.664 which is within the acceptable internal consistency level. The statements used to measure the stress levels of the respondents are shown in Table 1.

<Table 1>

In response to the literature on the topic, the *stressors of the cost engineers* were grouped into 4 main categories: (1) Personal Stressors, (2) Task Stressors, (3) Organizational Stressors and (4) Physical Stressors. 7, 7, 9 and 3 items (references refer to Table 1) were designed to measure the four stressor categories respectively. Respondents were asked to rank their agreement with the items on a 7-point scale ranging from 1 (extreme disagreement) to 7 (extreme agreement). The sample size of 73 used in this study representing the sample to item ratio of 10:1, 10:1 and 8:1 for Personal Stressors (7 items), Task Stressors (7 items) and Organisational Stressors (9 items) respectively. These sample to item ratios are higher than the scale of 5:1 suggested by Ferretich (1990) and Knapp and Brown (1995), and are considered adequate by the factor analysis within the range of 50-60% samples with correct factor structure (Costello and Osborne 2005). Principle Component Analysis can be analysed by either Exploratory Factor Analysis method (EFA) or Confirmatory Factor Analysis method (CFA). Based on the extensive literatures, Confirmatory Factor Analysis is considered as valid method to reduce the large number of variables to a smaller number of factors. In the study, Exploratory Factor analysis method is firstly applied by SPSS programme (version 11), while Structural Equation Model with Confirmatory Factor Analysis (by LISREL programme) is also adopted as an alternative method for cross-validation of the principle components factors.

The services provided by companies were treated as *Formal Organizational Supports* from the organization, the extents of which were measured by the general availability of those services in the company. These services comprised three main categories: Emotional Support (S1), Career Development (S2) and Reward Systems (S3). S1 was measured by 'recreational activities', 'emotional counselling programme' and 'lifestyle training programme', while S2 was measured by 'estimating skill training', 'personal development programme', 'further study

allowance' and 'career counselling programme'. For S3, two items, 'overtime payment' and 'medical care', were provided. The formal supports for each respondent were counted according to the number of services provided by his/her organisation in these three categories.

6 items were designed to measure *Informal Organizational Supports* in the estimation process. Respondents were asked to rank their agreement with the items in 7-point scale ranging from 1 (extreme disagreement) to 7 (extreme agreement).

The survey was conducted with Hong Kong of professional construction cost estimation personnel. The respondents possess actual cost estimation experience on construction projects and were able to understand the questionnaire in English. Two hundred questionnaires were distributed by fax, electronic mail or in person during the period from October to December 2003 to various cost engineers working for developers, consultant firms, the public sector, main contractors and subcontractors. Seventy-three completed questionnaires were received, representing a response rate of 36.5%. Among these respondents, 23.3% are female; 34.2%, 4.1%, 57.5% and 4.1% obtained higher diploma, associate degree, bachelor degree and master degree respectively. Most of them are aged between 21 and 30 (49.3%) and between 30 and 40 (39.7%), with the remainder aged between 41 and 50 (11%). Thus the sample can be regarded as representative of cost engineers in Hong Kong.

Factor Analysis of Stressors

The questionnaire contained 25 items of stressors divided into 4 categories: (1) Personal Stressors, (2) Task Stressors, (3) Organizational Stressors and (4) Physical Stressors. The items in each category were analyzed by Confirmatory Factor Analysis with varimax rotation (eigenvalue = 1 was used as a cut-off). 8 factors were generated under the four stressor categories: Type A Behaviour (F1) and Relationship Conflict (F2) under the Personal Stressor category; Work Underload (F3) and Role Ambiguity (F4) under the Task Stressor category; Lack of Autonomy (F5), Unfair Reward and Treatment (F6) and Lack of Feedback (F7) under the Organizational Stressor category; and Poor Working Environment (F8) under Physical Stressor category. The variables with significant factor loadings greater than 0.5 (Hair 1992), together with their associated coefficient alpha reliabilities, are listed in Table 2.

<Table 2>

Owing to the limited sample size ($n < 100$), only those items with factor loading greater than 0.6 were accepted as the principle stressors (Rahim *et al* 2000; Pallent 2001). These, together with the coefficient alpha reliabilities, are summarised in Table 2. As shown in the table, the majority of the items, including Type A behavior (F1), Relationship Conflict (F2), Work Underload (F3), Lack of Autonomy (F5), Unfair Reward and Treatment (F6) and Lack of Feedback (F7), load into the appropriate stressors. The alpha of Factor 4 is lower than 0.6 which is out of the acceptable range and, thus, is deleted in the following analysis. To further ensure the validation of each stressor, Structural Equation Model for each stressor category was also established. Table 3 indicates that the items load into the three stressor categories appropriately.

Table 3 Fit Indices of the Structural Stressors–Stress Models for Client’s Estimators

Model	df	χ^2	Df/ χ^2	GFI	AGFI	CFI
Personal Stressors	11	15.64	0.70	0.94	0.85	0.96
Task Stressors	8	23.14	0.36	0.90	0.75	0.76
Organizational Stressors	24	23.13	1.04	0.93	0.88	1.00

Note: df =Degree of Freedom; χ^2 = chi square; RMSEA = Root mean square residual; GFI = Goodness of Fit Index; AGFI = Adjusted Goodness of Fit Index; and CFI = Comparative Fit Index).

Factors for Organizational Supports

As mentioned, the formal supports were measured based on the number of servicing items in three main categories: Emotional Support (S1), Career Development (S2) and Reward Systems (S3), while 6 items were designed to measure two Informal Supports (Workgroup Supports and Superior Supports) in estimation process. Workgroup Supports (S4) and Superior Supports (S5) are clearly classified with high Alpha value (>0.80) (see Table 4).

<Table 4>

Correlation Analysis and Regression Analysis

Bivariate correlation was used to identify relationships among organizational supports, stressors and stress. In addition, regression analysis was carried out to identify their relationships.

Stressors–Stress Relationship

As shown in Table 5, only Lack of Autonomy (F6) stressor has significant relationships with the stress of cost engineers (0.412, $p < 0.001$).

<Table 5>

Organizational Supports–Stress Relationship

Two organizational supports (S4 and S5) are negatively correlated to stress, which suggests that more organizational supports produce less stress. Both Work Group Support (S4) and Superior Support (S5) have significant effects on stress (-0.341, -0.344; $p < 0.001$).

Inter-relationships among Organizational Supports

The results show that there are significant relationships among three formal organisational supports (S1, S2 and S3) (S1-S2: 0.491, S1-S3: 0.326 and S2-S3: 0.455; $p < 0.001$) and between the two informal organisation supports (S4 and S5) (0.519, $p < 0.001$).

Organizational Supports–Stressors Relationship

Table 4 shows that Work Group Support (S4) has significant negative association with Relationship Conflict (F1; -0.332, $p < 0.01$); Lack of Autonomy (F6; -0.261, $p < 0.01$) and Unfair Reward and Treatment (F7; -0.301, $p < 0.01$) stressors, while Superior Support (S5) is significantly related to Work Underload (F3; -0.295, $p < 0.05$) and Lack of Autonomy (F6; -0.549, $p < 0.01$) stressors negatively and Type A Behaviour (F2; 0.427, $p < 0.01$) stressor positively. On the other hand, Emotional Support (S1) has a negative relationship with Lack of Feedback (F5; -0.286, $p < 0.05$) stressor. This analysis reveals that informal supports are relatively more important than formal supports in organizational stress management, while, among the three formal supports, emotional support (S1) is comparatively more important for cost engineers in organizational stress management than the other two formal supports.

The regression models of stressors against organizational supports are shown in Table 5. Since no equation was established for the dependent variable F8, the model for the corresponding

stressor is not shown in the table. According to Table 6, Work Group Support (S4) and Superior Support (S5) are the most effective organizational supports. They are able to predict many stressors for cost engineers, including Type A Behaviour (F1), Relationship Conflict (F2), Work Underload (F3), Lack of Autonomy (F6) and Unfair Reward and Treatment (F7). Apart from the informal supports, Emotional Support (S1) also acts as a predictor variable of Lack of Feedback (F5).

<Table 6>

Organizational Support–Stressor–Stress Relationship

As it was supposed that stressors and supports from organizations or peers may affect employee's stress levels, a linear regression model utilizing stressors and supports as independent variables was fitted to further identify predictor variables of stress (see Table 6). The results revealed that Lack of Feedback (F5), and Lack of Autonomy (F6) can predict the stress of cost engineers ($r^2=0.215$; $p<0.001$).

DISCUSSION

Based on the results of the correlation and regression models, the Organizational Support–Stressor–Stress Model for cost engineers is summarized in Figure 1.

<Figure 1>

Effects of Organizational Supports on Stress

It is interesting to note that emotional programme, career development and reward system may motivate employees to implement the job (House 1981) but cannot reduce the stress of cost engineers in the estimation process. Formal supports have no significant nor direct relationship to stress levels, inviting the conclusion that organizations need to focus more on providing informal supports than formal supports to reduce cost engineer stress. Informal supports (S4 and S5) are negatively related to the *stress* level (see Figure 1), suggesting that informal supports reduce the stress level of cost engineers. However, it should be mentioned at this point that (1) there is a close relationship among the three formal supports; and (2) the formal

supports may influence an individual's stress level indirectly through the feedback process. Although it seems that the effect of reducing stress would not be significant in the presence of formal supports, this study has found no evidence to indicate what might happen if formal supports were being withdrawn. Hence, *both formal and informal supports* are still recommended for the stress management of cost engineers. In particular, it is most likely that informal supports are provided due to the good nature of the managers and supervisors involved. This might not always be the case and withdrawing formal supports might result in informal supports also being withdrawn, which would clearly be a detriment of all concerned.

Effects of Organizational Supports on Stressors

Of the formal supports, only Emotional Support relates to Lack of Feedback stressor. Emotional activities and programmes can enhance the communication process between supervisors and cost engineers. Hence, consultant firms and contractor companies are encouraged to *arrange various types of activities* for their employees in order to maintain relationships among cost engineers in the organization.

Informal supports are significantly associated with stressors. Cost engineers who receive Work Group Support (S4) are more likely to enjoy Autonomy and Reward at work, but less likely to experience Relationship Conflict. This result reflects the benefits of gaining advice, guidance and assistance from work peers. Teamwork is also very important for estimation tasks. In the estimation process, cost engineers need to work with different experts such as project managers, planners, procurement staff, engineers, etc. A collaborative estimating team can definitely improve their autonomy, specify jobs, establish good relationship, share workload and reduce their stress.

Cost engineers who receive Superior Support (S5) are more likely to have Autonomy with the reduction of Work Underload (i.e. higher workload). The construction industry's contribution to GDP in Hong Kong has decreased to 5.6 % in 2005 from 10.8 % in 1997 due to the recession. A lot of construction companies have rapidly streamlined their organizational structure to maintain a profitable and effective construction process. Work Underload represents that the company might be facing an economic crisis shortly. Superior support refers to a good communication, recognition and understanding between supervisors and cost engineers. With sufficient and adequate superior

support, their sub-ordinates are more understand the organisational difficulties and may initiate appropriate actions for the organisation accordingly. One of the main lessons learned from this study is that managers and supervisors need to aware of the *predominance of their role* in communicating and supporting their staff/supervisees to estimate projects and, subsequently, reduce stress, in which legitimate sociological differences exist.

Another interesting finding is that cost engineers with Type A Behaviour are more likely to receive Superior Support (S5). Type A persons are described as highly competitive, hard driving, achievement-oriented, and with a pattern of perfectionism (Friedman and Rosenman 1974; Schafer 2000). Individuals with type A behaviour tend to yearn for superior-performance. In fact, type A persons are becoming more and more prevalent in Hong Kong. They are being encouraged and praised, and sometimes even treated as the main criteria for promotion. Hence, type A behavior is treated as good working performance and appreciated as such by supervisors, making it more likely that they will receive more Superior Support.

Prediction of Stress

Workgroup Support, Superior Support, Lack of Feedback and Lack of Autonomy are the direct sources of stress for cost engineers. Lack of Autonomy and Lack of Feedback are the factors which predict the stress of cost engineers. Work group support and superior support may enhance communication with colleagues and supervisors, while autonomy may reduce the stress of cost engineers (Claessens *et al.* 2004). Too much feedback may establish constriction to cost engineers. Managers should allow *adequate feedback, flexibility and freedom to cost engineers* during the estimation process.

RECOMMENDATIONS

Practical Implications

Organizations can manage stress for the benefit of both the individual and the organization. The results of this study suggest that organizational stress management may be considered in terms of three different levels: primary, secondary and tertiary levels. These address different

stages in the stress process.

At the first stage, organizations can avert potentially stressful situations before they occur. At this stage, the organization tries to *control the stressors* that occur. In this study, it is shown that spreading autonomy and moderate feedback can reduce stress directly. Construction companies and consultant firms need to give cost engineers sufficient autonomy in their work and prevent managers from providing too much feedback, which may be considered as a kind of confinement of autonomy. In this way, the cost engineers can successfully apply their abilities to project estimates (Beehr 1995; Cartwright and Cooper 1997; Claessens *et al.* 2004).

At the second stage, the organization mainly focuses on *managing stress* once it has occurred. Our analysis indicates that informal organizational supports have the most effect on cost engineers at this stage. Here, the organization's task is to decrease the sense of stress perceived by the cost engineer. *Informal supports* in the organization, including work peer support and superior support, may be required for the cost engineers to work with autonomy (Cartwright and Cooper 1997; Houkes 2001; Beehr 1995; Janssen *et al.* 2001; Jamal and Baba 2001). Workgroup support, on the other hand, relies on the organization's ability to provide a friendly and trustful atmosphere. A *systematic organizational structure* and *team decision-making* process are recommended to enable cost engineers working together to effectively carry out their inter-supporting role. As superior support determines the relationship between cost engineers and their superiors, so *supervisors are in a position to communicate and provide attention to the problems of those* in their charge to help them to deal with stress-related problems and give recognition for good work.

At the final stage, treatment, rehabilitation and recovery services need to be provided by the organization for those who have suffered from serious ill health as a result of stress (Murphy and Hurrell 1987). *Organizational intervention* in the form of recreational activities, consulting programmes for career or emotional development, lifestyle training and so on (emotional support) are required at this level of stress management to improve job security and feedback for cost engineers. This is likely to be beneficial for both organizations and employees as it will improve individuals' mental well-being and self-esteem.

Further Research

Though this study provided some important findings, some issues have not been dealt with due to sampling and methodological constraints. The relatively small sample size of the present study may limit the generalizability of the results. However, it should be pointed out that all respondents have estimation experience with different construction organisations such as developers, consultant firms, contractors, public sector, etc. The scales used for the measurement of stressors, stress and organizational supports have been broadly used previously for stress management (e.g., Gmelch 1982; Schuler 1980; Djebbarbi 1996). Four stressor catalogues were formed based on the extensive literature review. The subject (sample size) to item ratios in the factor analysis are from 8:1 to 10:1 which are classified in the acceptance range with 50-60% samples with correct factor structure (Costello and Osborne 2005). It is similar to other stress management studies (Cole et al. 2001 - 6:1; Jepson and Forrest 2006 - 7:1; Lyne et al. 2000 - 5:1; Stuber and Kazak 1997 - 7:1; Ernst et al. 2004 - 4:1; Marshall 2004 - 7:1) and other construction management studies (Shen and Liu 2003 - 36 (2:1); Steven *et al.* 2003 - 67 (2:1); Rahman and Kumaraswamy 2005 - 73 (3:1); Soetanto *et al.* 2006 - 52 (2:1); Tam *et al.* 2006 - 114 (4:1)). The study, thus, reflects the norm in the similar studies. Furthermore, only the items with factor loading higher than 0.5 were used in the data analysis (Rahim *et al.* 2000) and all factors were proved within the reliability range for social science study ($\alpha > 0.6$) (Pallent 2001) which represented their internal consistent in the study. In view of the above discussion points, the research method could assure the results from being biased by any differential response to the measured variables.

In practice, some other construction professionals such as architects, structural engineers and building services engineers are also involved in the estimation process (Smith 1995). Further study on the stress management of each professional discipline in the construction industry is thus recommended in order to understand the overall stress management in the industry so as to optimize overall construction performance throughout construction process. However, the present study provides useful baseline information about the effects of organizational supports in the context of stress management for cost engineers and points to the direction for future large-scale studies in the industry.

As stress can be defined subjectively based on individual perceived feeling (Largo-Wight et al.

2005) or emotional exhaustion (Goliszek 1992; Lee and Ashforth 1996), further investigation of the effect of organizational supports on subjective stress and the comparison between subjective stress and the current study (objective stress) is recommended to understand the overall stress management of construction professionals.

The physical stressor (poor working environment) had no direct or indirect relationship to stress in this study, even though in a previous study of cost engineers, we found that they did. Perhaps, “stressors of environment are not so much a matter of the stressors themselves, but of a person’s ability to control them” (Gmelch 1982, p.23). An individual’s personality is important in determining his or her responses to environmental stressors. Therefore, an individual’s personality is important in determining his or her responses to environmental stressors. Physical stressors are always present; however, with the type A behaviour of the individual, the effect of physical stressors towards the stress of the individual would be reduced. Further study for the interaction of stressors, especially physical and personal, on the stress of cost engineers is thus recommended.

CONCLUSION

Construction cost engineers normally work in an organization (either a consultant firm or a contractor company) when carrying out the estimating task. This paper confirms that (inter-) personal stressor (Relationship Conflict and Type A Behavior), task stressors (Work Underload), organizational stressors (Lack of Autonomy, Unfair Reward and Treatment and Lack of Feedback) and organizational supports (Formal and Informal) are either directly or indirectly related to stress. Informal supports have more significant effects than formal supports on the stressors of cost engineers, while lack of autonomy and lack of feedback are the predictors of their experience of stress.

In conclusion, this study revealed that, in general, the more organizational supports that are provided, the less stress occurs. Managers need to control stressors for cost engineers early on in the process. A systematic organizational structure, sufficient flexibility, fair reward system, sufficient communication and appropriate feedback are recommended to establish a good platform for cost engineers working together well. As a senior staff, managers in estimation consulting firms also need effectively carry out their supporting role on the job. Consultant

firms and contractor companies, meanwhile, are encouraged to arrange various programmes and channels for enhancing the relationship and communication between supervisors and cost engineers.

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REFERENCES

- Beehr, T. A. (1995). *Psychological stress in the workplace*, 1st Edition, Routledge, London.
- Beehr, T. A. (2000). "Work stress and coworker support as predictors of individual strain and job performance." *Journal of Organizational Behavior*, 21(4), 391.
- Bennett, P., Lowe, R., Matthews, V., Dourali, M. and Tattersall, A. (2001). "Stress in nurses: Coping managerial support and work demand." *Stress and Health*, 17, 55-63.
- Buller, P. F. and Schuler, R. S. (2000). *Managing Organizations and People*, Cincinnati: South-Western College.
- Buunk, B. P. (1991). "Companionship and support at work: A microanalysis of the stress-reducing features of social interaction." *Basic and Applied Social Psychology*, 12(3), 243-258.
- Cartwright, S. and Cooper, C. L. (1997). *Managing workplace stress*, 1st Edition, Sega Publications, London.
- Claessens, B. J. C., Eerde, W. V., Rutte, C. G. and Roe, R. A. (2004). "Planning behavior and perceived control of time at work." *Journal of Organizational Behavior*, 25, 937-950.
- Calnan, M., Wadsworth, E., May, M., Smith, A., Wainwright, D. (2004). "Job strain, effort-reward imbalance, and stress at work: competing or complementary models?" *Journal of Public Health*, 32(2), 84-93.
- Cohen, S. and Wills, T. A. (1985). "Stress, social support, and the buffering hypotheses." *Psychological Bulletin*, 98, 310-357.
- Cole, Frank L., Slocumb, Elaine M. and Mastery, Jean Muldoon (2001). "A measure of critical care nurses' post-code stress." *Journal of Advanced Nursing*, 34(3), 281-288.
- Cooper, C. L. (1987). "The experience and management of stress: job and organizational determinants." In Riley A. W. and Zaccaro S. J. (ed.), *Occupational Stress and Organizational Effectiveness*, New York: Praeger Publishers, 53-70.
- Cooper, C. L. and Cartwright, S. (1994). "Healthy mind, healthy organization – a proactive approach to occupational stress." *Human Relations*, 47, 4, 455-471.
- Cooper, C. L. and Cartwright, S. (1997). "An intervention strategy for workplace stress." *Journal of Psychology*, 49, 11-28.
- Cooper, C. L. and Payne, R. (1978). *Causes, Coping and Consequences of Stress at Work*, Chichester: Wiley.
- Cooper, C. L., Dewe, P. J. and O'Driscoll, M. P. (1997). *Organizational Stress: A Review and Critique of Theory, and Applications*, London: International Educational and Profession Publisher.
- Costello Anna B. and Osborne Jason W. (2005). "Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis." *Practical Assessment, Research and Evaluation*, 10(7).
- Cox, T. (1983). *Stress*. Macmillan, London.
- Dewe, P. (1991). "Measuring work stressors: the role of frequency, duration and demand." *Work and stress*, 5, 2, 77-91.
- Djebbari, R. (1996). "The impact of stress in site management effectiveness." *Construction Management and Economics*, 14(4), 281-294.
- Ernst M. E. (2004). "Nurses' job satisfaction, stress, and recognition in a pediatric setting." *Pediatric*, 30(3), 219-227.
- Evers, Arne, Frese, Michael and Cooper, Cary L. (2000). "Revisions and further developments of the occupational stress indicator: Lisrel results from four Dutch studies." *Journal of Occupational and Organizational Psychology*, 73, 221-240.
- Ferketich S. (1990). "Focus on psychometrics. Internal consistency estimates of reliability." *Research in Nursing and Health*, 13, 437-440.

- Fitzgerald, S. T. Haythornthwaite, J. A., Suchday, S. and Ewart, C.K. (2002). "Anger in young black and white workers: Effects of job control, dissatisfaction, and support." *Journal of Behavioral Medicine*, 26(4), 283-296.
- French, J. R. P. and Caplan, R. D. (1972). Organizational stress and individual strain. In A. J. Marrow (ed.), *The failure of success*. New York: AMACOM, 30-66.
- Friedman M. and Rosenman R. H. (1974). *Type A: Your Behavior and Your Heart*. Knopf, Me York.
- Furnham, A. (1997). *The Psychology of Behavior at Work: The Individual in the Organization*, Hove, East Sussex : Psychology Press.
- Ganster, D. C. (1986). "Type A behavior and occupational stress." *Journal of Organizational Behavior Management*, 8, 61 –84.
- Goliszek, A. (1992). *60 Second Stress Management*, New Horizon Press, London.
- Gmelch, W. H. (1982). *Beyond Stress to Effective Management*, New York, John Wiley & Sons.
- Hackman, J. R. and Oldham, G. R. (1976). "Motivation through the design of work: test of a theory." *Organizational Behavior and Human Performance*, 16, 250-279.
- Hair, J. F. (1992). *Multivariate Data Analysis*, 3rd ed., New York: Macmillan.
- Houkes, I., Janssen Peter P. M., Jan de J. and Nijhuis Frans J. N. (2001). "Work and individual determinants of intrinsic work motivation, emotional exhaustion, and turnover intention: a multi-sample analysis." *International Journal of Stress Management*, 8(4).
- House, J. S. (1981). *Work Stress and Social Support*, Reading, MA: Addison-Wesley.
- House, J. S. and Mitchell, T. R. (1974). "Path-goal theory of leadership." *Journal of Applied Psychology*, 81(4), 429-435.
- Jamal, M. and Baba, V. V. (2001). "Type-A behavior, job performance, and well-being in college teachers." *International Journal of Stress Management*, 8 (3), 231-240.
- Janssen Peter P. M., Bakker Arnold B. and Ad de J. (2001). "A test and refinement of the demand-control-support model in the construction industry." *International Journal of Stress Management*, 8(4), 315-332.
- Jepson, Emma and Forrest, Sarah (2006). "Individual contributory factors in teacher stress: the role of achievement striving and occupational commitment." *British Journal of Educational Psychology*, 76(1), 183-197.
- 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*, New York: Wiley.
- Knapp, T. R. and Brown, J. K. (1995). "Focus on psychometrics. Ten measurement commandments that often should be broken." *Research in Nursing and Health*, 18, 465-469.
- Largo-Wight, E., Peterson, P. Michael and Chen, W. William (2005). "Perceived problem solving, stress, and health among college students." *American Journal of Health Behavior*, 29(4), 360-370.
- Lease, S. H. (1999). "Occupational role stressors, coping, support, and hardiness as predictors of strain in academic faculty: an emphasis on new and female faculty." *Research in Higher Education*, 40(3).
- Lee, R. T. and Ashforth, B. E. (1990). "On the meaning of Maslach's three dimensions of burnout." *Journal of Applied Psychology*, 75(6), 743-747.
- Lee, R. T. and Ashforth, B. E. (1996). "A Meta-Analytic Examination of the Correlated of the Three Dimensions of Job Burnout." *Journal of Applied Psychology*, 81(2), 123-133.
- Leung, M. Y. (2004). "An international study on the stress of estimators." *The Hong Kong Surveyor*, 15(1), 49-52.
- Leung, M. Y., Olomolaiye, P., Chong, A. and Lam, C. C. Y. (2005a). "Impact of stress on estimation performance in Hong Kong." *Construction Management and Economics* (in

- press).
- Leung, M. Y., Skitmore, M., Ng, S. T. and Cheung, S. O. (2005b). "Stressors of cost estimation in Hong Kong." *Construction Management and Economics*, 22 (in press).
- Lingard, Helen and Francis, Valerie (2004). "The Work-life experiences of office and site-based employees in the Australia construction industry." *Construction Management & Economics*, 22(9), 991-1002.
- Lynch, J. J. (1997). *The Broken Heart: The Medical Consequence of Loneliness*, New York: Basic Books.
- Lyne, Kenneth D., Barrett, Paul T., Williams, Christine and Coaley, Keith (2000). "A psychometric evaluation of the occupational stress indicator." *Journal of Occupational and Psychology*, 73(2), 195-200.
- Maier, N. R. F. (1967). "Assets and liabilities in group problem solving: the need for an integrative function." *Psychological Review*, 74(4), 239-249.
- Marshall, G. N. (2004). "Posttraumatic stress disorder symptom checklist: factor structure and English-Spanish measurement invariance." *Journal of Traumatic Stress*, 17 (3), 223-230.
- Maslach, C., Schaufeli, W. B. and Leiter, M. P. (2001). "Job burnout." *Annual Review of Psychology*, 52, 397-422.
- McGrath, J. E. (1976). "Stress and behavior in organizations." *Handbook of Industrial and Organizational Psychology*, M. Dunnette, eds., Chicago: Rand McNally College Pub. Co., 1351-1395.
- Mind Tools Ltd. (1996). "Understanding the importance of optimum stress levels." <http://www.mindtools.com/smoptstr.html>, viewed 10th October 2002.
- Munz, D. C., Kohler, J. M. and Greenberg C. I. (2001). "Effectiveness of a comprehensive worksite stress management program: combining organizational and individual interventions." *International Journal of Stress Management*, 8(1), 49-62.
- Murphy, L. R. (1988). *Workplace Interventions for Stress Reduction and Prevention, Causes, Coping and Consequences of Stress at Work*, Chichester: John Wiley & Sons.
- Murphy, L. R. and Hurrell, J. J. (1987). "Stress measurement and management in organizations development and current status." *Occupational Stress and Organizational Effectiveness*, Riley A. W. and Zaccaro S. J., eds., New York: Praeger Publishers, 29-52.
- Pallent, J. (2001). *SPSS Survival Manual: a Step by Step Guide to Data Analysis Using SPSS for Windows (Version 10)*, Crows Nest.
- Pearlin, L. I. and Schooler, C. (1978). "The structure of coping." *Journal of Health and Social Behavior*, 19 (1), 2-21.
- Peurifoy, R. L. and Oberlender, G. D. (2002). *Estimating Construction Costs*, New York: McGraw.
- Quick, J. C. and Quick, J. D. (1984). *Organizational Stress and Preventive Management*, New York: McGraw-Hill.
- Quick, J. C., Quick J. D., Nelson, D. L. and Hurrell, J. J. (1997). *Preventive Stress Management in Organizations*, Washington, D.C.: American Psychological Association.
- Rahe, R. H. and Tolles, R. L. (2002). "The brief stress and coping inventory: a useful stress management instrument." *International Journal of Stress Management*, 9, 61-79.
- Rahim, M. A., Buntzman, G. F. and White, D. (2000). "An empirical study of the stages of moral development and conflict management styles." *International Journal of Conflict Management*, 10(2), 154-172.
- Rahman, M.M. and Kumaraswamy, M.M. (2005). "Relational selection for collaborative working arrangements." *Journal of Construction Engineering and Management*, 131(10), 1087-1098.
- Rizzo, John R., House, Robert J. and Lirtzman, Sidney I. (1970). "Role conflict and ambiguity in complex organizations." *Administrative Science Quarterly*, 15(2), 150-164.

- Schafer, Walt (2000). "Thriving under pressure." *Inside Chico State*, 31(6).
- Schuler, S. (1980). "Definition and conceptualization of stress in organizations." *Organizational Behavior and Human Performance*, 25, 184-215.
- Shen, Q. and Liu, G. (2003). "Critical success factors for value management studies in construction." *Journal of Construction Engineering and Management*, 129(5), 485-491.
- Sims Jr., Henry P., Szilagyi, Andrew D. and Keller, Robert T. (1976). "The measurement of job characteristics." *Academy of Management Journal*, 19(2), 195-212.
- Smith, A. J. (1995). *Estimating, Tendering and Bidding for Construction*, London: Macmillan.
- Soetanto, R., Dainty, A. R. J., Glass, J. and Price, A. D. F. (2006). "Empirical evaluation of structural frame performance criteria: realizing the potential of hybrid concrete construction." *Journal of Construction Engineering and Management*, 132(3), 278-290.
- Steven, M., Trost, M., Garold, D. and Oberlender, F. (2003). "Predicting accuracy of early cost estimates using factor analysis and multivariate regression." *Journal of Construction Engineering and Management*, 129(2), 198-204.
- Stuber, Margaret L. and Kazak, Anne E. (1997). "Predictors of posttraumatic stress symptoms in childhood cancer survivors." *Pediatrics*, 100(6), 958-965.
- Tam, Viviam W. Y., Tam, C. M., Yiu, Kenneth T. W. and Cheung, S. O. (2006) Critical factors for environmental performance assessment (EPA) in the Hong Kong construction industry. *Construction Management and Economics*, 24(11), 1113-1123.
- Thompson, B. M., Kirk, A. and Brown, D. F. (2005). "Work based support, emotional exhaustion, and spillover of work stress to the family environment; A study of policemen." *Stress and Healthy*, 21, 199-207.
- Zaccaro, S. J. and Riley, A. W. (1987). "Stress, coping and organizational effectiveness." *Occupational Stress and Organizational Effectiveness*, Riley, A. W. and Zaccaro, S. J., eds., New York: Praeger Publishers, 1-28.

Table 1 Statement for the Measurement of Stress Level

Statement	Expected Ability	Actual Ability
1. The number of deadlines	a) I have to meet	___ b) I am capable of meeting ___
2. The degree to which	a) my skills are used	___ b) my skills could be used ___
3. The number of tasks	a) I have to do	___ b) I am capable of doing ___
4. The level of difficulty	a) of my work	___ b) I am capable of handling ___
5. The quality of work	a) I have to produce	___ b) I am capable of producing ___
6. The scope and responsibility	a) of my job	___ b) I am capable of handling ___
7. The amount of work in an ordinary day	a) I have to do	___ b) I am capable of doing ___
8. The degree of complexity	a) of my assignment	___ b) I am capable of handling ___
9. The number of projects	a) I have to do	___ b) I am capable of doing ___
10. The number of people	a) I have to work with to get my job done	___ b) I would like to work with to get my job done ___

Table 2 Scale Items, Factor Loadings and Coefficient Alpha Reliabilities for the Stressors

Factors	Nature	Items	Factor loading	Alpha
<u>Personal Stressors</u> (Evers <i>et al.</i> 2000; Gmelch 1982)				
F1	Type A Behavior	— 1. I am an achievement-oriented person who has the need to win.	.674	0.698
		— 2. I do not go home before I have finished what I have planned.	.802	
		— 3. I demand a lot of the quality of my work.	.873	
F2	Relationship Conflict	— 4. I seldom delegate tasks because others cannot complete the tasks as well as I can.	.760	0.703
		— 5. There often seems to be a lack of trust between myself and my subordinates.	.749	
		— 6. I am often caught between conflicting demands from my supervisor and staff.	.692	
		— 7. My beliefs often conflict with those of the organization.	.697	
<u>Task stressors</u> (Gmelch 1982; Rizzo <i>et al.</i> 1970)				
F3	Work Underload	— 8. I frequently find my work boring and repetitive.	.820	0.701
		— 9. I feel my skills and abilities are not being used well.	.842	
		+ 10. I have a lot of responsibility in my job.	.683	
F4	Role Ambiguity	+ 11. I understand exactly what is expected of me.	.597	0.474
		— 12. I am not sure I have divided my time properly among task.	.654	
		— 13. There is constant pressure to work every minute, with little opportunity to relax.	.788	
<u>Organisational Stressors</u> (Sims <i>et al.</i> 1976; Dewe 1991; Calnan <i>et al.</i> 2004)				
F5	Lack of Autonomy	— 14. I have to refer matters upwards when I can really deal with them adequately myself.	.742	0.766
		— 15. My boss often deals with me in an autocratic and over demanding manner.	.867	
		— 16. I was given insufficient authority to do my job properly.	.826	
F6	Unfair Reward and Treatment	— 17. I find the reward I get is relatively low when compared to the external market.	.774	0.739
		— 18. I often feel that the organization treats us unfairly.	.815	
		— 19. I find the reward I get does not balance with the effort I pay.	.821	
F7	Lack of Feedback	— 20. It is hard to receive information from my supervisor on my job performance.	.888	0.735
		+ 21. I can get feedback from my supervisor on how well I'm doing.	.747	
		— 22. I have no opportunity to find out how well I am doing on my job.	.796	
<u>Physical stressor</u> (Gmelch 1982)				
F8	Poor Working Environment	— 23. The lighting in the office is too dim.	-	0.856
		— 24. My office is too noisy.	-	
		— 25. My office is too crowded.	-	

Note: All items were measured on a seven-point scale ranging from 'disagree strongly' to 'agree strongly'. Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Cumulative variance of Personal Stressors, Task Stressors, Organizational Stressors = 58.34%, 58.34% and 69.02% respectively.

'xxx' - Items with the factor loadings lesser than 0.50 are deleted in the following data analysis.

Table 3 Fit Indices of the Structural Stressors–Stress Models for Client’s Estimators

Model	df	χ^2	Df/ χ^2	GFI	AGFI	CFI
Personal Stressors	11	15.64	0.70	0.94	0.85	0.96
Task Stressors	8	23.14	0.36	0.90	0.75	0.76
Organizational Stressors	24	23.13	1.04	0.93	0.88	1.00

Note: df = Degree of Freedom; χ^2 = chi square; RMSEA = Root mean square residual; GFI = Goodness of Fit Index; AGFI = Adjusted Goodness of Fit Index; and CFI = Comparative Fit Index).

Table 4 Factors for the Organizational Supports

	Factors	Items	Alpha
S1	Emotional Supports	1. Recreational activities (e.g., BBQ and trip). 2. Counseling programme on career or emotion. 3. Lifestyles management training (e.g., relaxation and health promotion)	-
S2	Career development	4. Estimating skills training courses or talks. 5. Personal development training (e.g., computer and mandarin). 6. Further study allowance. 7. Career counselling programme.	-
S3	Reward supports	8. OT payment 9. Medical care.	-
S4	Workgroup Supports	10. My colleagues would like to help me out with a problem. 11. This workgroup has a generally friendly atmosphere. 12. People in this workgroup work well together.	0.84
S5	Superior Supports	13. My immediate supervisor gives prompt attention to problems on my job. 14. My supervisor knows my jobs well enough to help me if I have problem. 15. My supervisor gives me recognition when I do a good job.	0.85

Note: S1, S2 and S3 were countered based on the no. of services provided by the organisation

Table 5 Correlations among Stressors, Stress and Organizational Supports

Stress/Stressors	Stress	Formal Supports			Informal Supports	
		S1	S2	S3	S4	S5
		Emotional Support	Career Development	Reward System	Work Group Support	Superior Support
S1 Emotional support	0.016	-				
S2 Career development	0.052	0.491**	-			
S3 Reward system	-0.060	0.326**	0.455**	-		
S4 Work group support	-0.341**	0.013	-0.025	0.039	-	
S5 Superior support	-0.344**	-0.161	-0.138	-0.114	0.519**	-
F1 Type A Behaviour	-0.062	-0.132	0.018	-0.174	0.158	0.427**
F2 Relationship Conflict	0.044	-0.071	0.174	0.108	-0.332**	-0.116
F3 Work Underload	0.018	-0.026	0.036	-0.129	-0.151	-0.295*
F5 Lack of Feedback	-0.180	-0.286*	-0.204	0.104	0.038	-0.102
F6 Lack of Autonomy	0.412**	0.048	0.225	0.080	-0.261**	-0.549**
F7 Unfair Reward & Treatment	0.197	-0.043	-0.005	-0.023	-0.301**	-0.148
F8 Poor Working Environment	-0.012	-0.051	-0.015	0.025	0.003	-0.114

Note: * - Correlation is significant at the 0.05 level (two-tailed).

** - Correlation is significant at the 0.01 level (two-tailed).

Table 6 Regression Analysis among Stressors, Organizational Supports and Stress

Dependent variable	Model	B	sig	Sig.	R	R ²
F1 Type A Behavior	(Constant)	6.988	0.000	0.000	0.427	0.182
	S5	0.410	0.000			
F2 Relationship Conflict	(Constant)	19.468	0.000	0.004	0.332	0.110
	S4	-0.339	0.004			
F3 Work Underload	(Constant)	14.438	0.000	0.011	0.295	0.087
	S5	-0.296	0.011			
F5 Lack of Feedback	(Constant)	11.410	0.000	0.014	0.286	0.082
	S1	-1.227	0.014			
F6 Lack of Autonomy	(Constant)	18.736	0.000	0.000	0.549	0.301
	S5	-0.529	0.000			
F7 Unfair Reward & Treatment	(Constant)	14.676	0.000	0.010	0.301	0.090
	S4	-0.234	0.010			
Stress	(Constant)	-4.352	0.188	0.000	0.464	0.215
	F6	0.834	0.000			
	F5	-0.424	0.049			

Note: F1 – F7, refer to Table 2;

S1 - Emotional Support; S2 - Career Development; S3 - Reward System; S4 - Workgroup Support; and S5 - Superior Support.

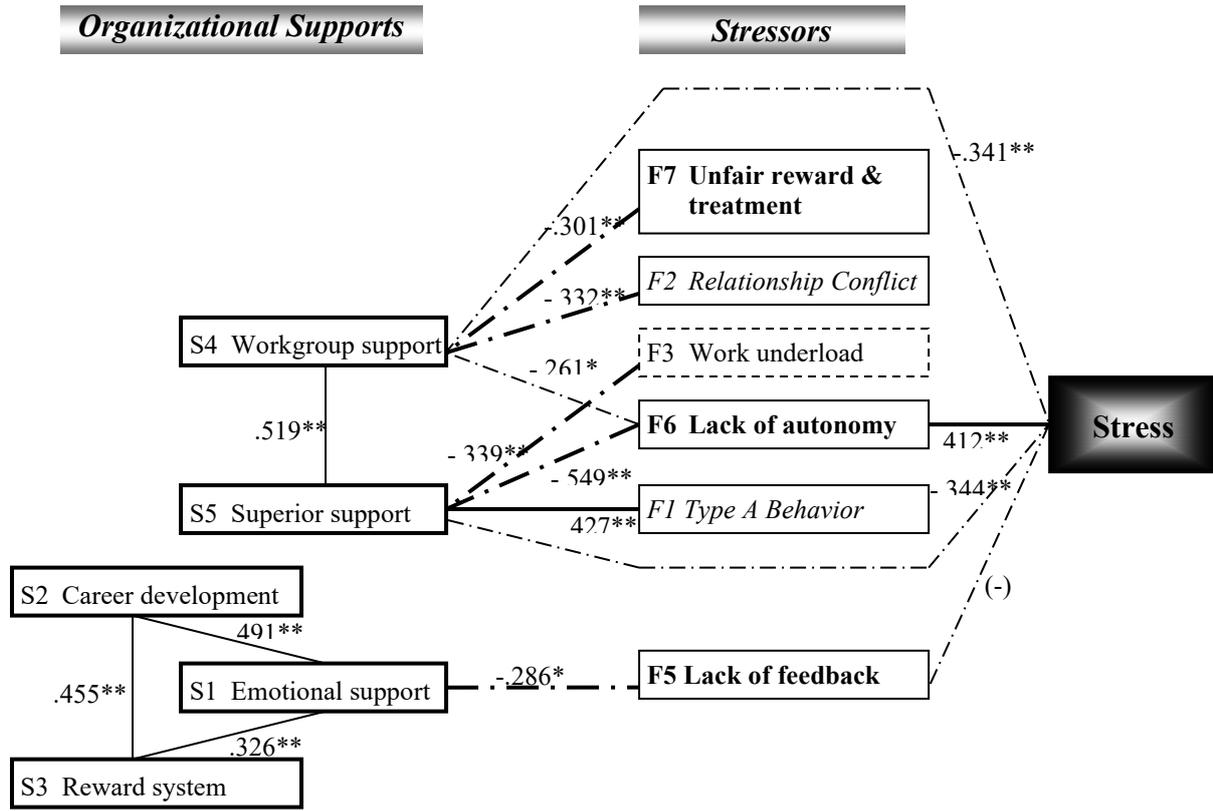


Figure 1 Organizational Support–Stressor–Stress Model for Cost Engineers

Note: F1, F2, F3, F5, F6, F7 and F8 – Stressors (refer to Table 2).

- xxx - Positive stressors /organizational supports ; and xxx - Negative stressors.
- xxx - (inter)Personal stressors ;
- xxx - Task stressors ; and
- xxx - Organisational stressors ;
- xxx - Physical stressors (refer to Table 3).
- S1 - S5 - Organisational Supports (refer to Table 4).
- .xxx - Correlation coefficient (refer to Table 5).
- - Positive relationship shown in correlation *or* regression models (refer to Tables 5 & 6);
- - Positive relationship shown in correlation *and* regression models;
- - Negative relationship shown in correlation *or* regression models; and
- . . - - Negative relationship shown in correlation *and* regression models.