Integrated Model for the Stressors and Stresses of Construction Project Managers in Hong Kong

Mei-yung Leung[1]; Yee-Shan Chan[2]; and Jingyu Yu[3]

Abstract: Construction projects involve multistakeholders (e.g., architects, structural engineers, surveyors, contractors, suppliers, etc.) completing a large number of unpredictable tasks in a complex process within a limited period of time. Construction project managers (C-PMs) are the key persons in achieving project success throughout the construction process, as they are responsible for planning the construction program, organizing human resources, controlling operations and the budget, and forecasting probable difficulties. Hence, C-PMs always encounter a great deal of stress in construction projects. Apart from the subjective feelings experienced by individual C-PMs, C-PMs may also feel objective stress due to the deviation between their actual abilities and their expected abilities on tasks or projects. To understand the integrated relationships between the various stressors and stresses of C-PMs, a survey was conducted of 108 C-PMs in Hong Kong. This paper attempts to investigate the causal relationships between stressors and stresses (both subjective and objective). The study reveals seven stressors of C-PMs in the industry. Based on the results of a correlation coefficient, an optimized stressor–stress structural equation model is established. Four critical stressors were found to have significant impact on both the subjective and the objective stresses of C-PMs, including work overload, poor interpersonal relationships, poor work environment, and poor nonwork environment. A number of recommendations were made for both construction companies and individual C-PMs in their offices and at home in order to optimize their work performance in the real world.

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Introduction

Human resources are the most valuable assets of every organization in the world. Taking good care of these assets should be the primary task and duty of the stakeholders of the organization. However, it seems that most construction employers pay too much attention to the profit of an organization and ignore the importance of the health of their employees. According to the UK Health and Safety Executive (2006), 10.5 million working days are lost due to stress-related illnesses in the United Kingdom every year. This means that for every individual, an average of 30.1 working days are lost due to stress. The cost implication of work-related stress for employers is £381 million per annum (Cousins et al. 2004). It is obvious that stress has significant impact on not only the employees, but also the employers nowadays.

A construction project is a unique human endeavor which has mixed goals and objectives for the multistakeholders, who must complete specific projects or tasks within a limited time period. It is limited in time and scope, employs various resources, and involves many changes and uncertainties (Turner 1993; Munns and Bjeirmi 1996). Among the multiple stakeholders in construction projects, construction project managers (C-PMs) are required to be proficient in diverse skills, such as scheduling, cost controlling, social ability, negotiation, and so on, in order to plan, organize, and supervise project tasks involving design, construction, inspection, and maintenance. C-PMs are the only professionals who take over construction projects from the beginning (preconstruction stage—administering construction contracts and coordinating project teams) to the end (completion stage—providing feedback to clients, ensuring the settlement of claims, dealing with the final account, etc.). Hence, C-PMs have long been considered as key persons in the success of construction projects. Occupying such a crucial position in construction projects, C-PMs inevitably suffer a great deal of stress induced by the highly demanding time pressures and the dynamic social structure of construction projects.

The impacts of stress are highly significant in the construction industry (Leung 2004; Leung et al. 2005a,b, 2006; Haynes and Peter 2004; Loosemore and Waters 2004). A survey by the UK Chartered Institute of Building (CIOB 2006) reported that the majority of construction professionals (68%) suffer from stress, anxiety, or depression directly as a result of working in the construction industry. Further, over half of construction professionals (58%) in the survey felt that the construction industry today is more stressful than it was 5 years ago. These statistics show clearly how extensive stress is in the construction industry. However, there are still not many studies of the stressors that produce the stress of C-PMs.

This paper attempts to investigate the causal relationships between the stressors and the stress of C-PMs. To achieve this aim, the following objectives must be fulfilled: (1) stressors in the construction project management process must be identified; (2)

[1]Assistant Professor, Dept. of Building and Construction, City Univ. of Hong Kong, Tat Chee Ave., Kowloon Tong, Hong Kong.

[2]Research Student, Dept. of Building and Construction, City Univ. of Hong Kong, Tat Chee Ave., Kowloon Tong, Hong Kong.

[3]Research Student, Dept. of Economics, South China Univ. of Technology, Guangzhou, Peoples' Republic of China.

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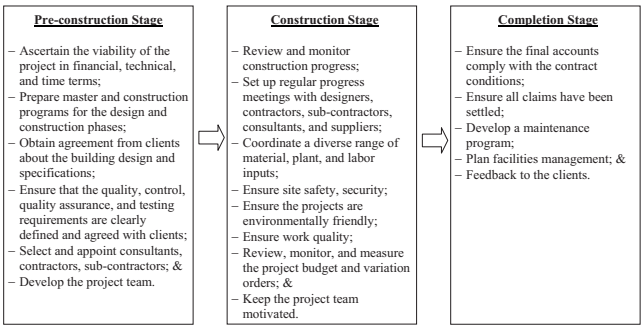

Fig. 1. Construction project managers' duties from preconstruction stage to completion stage (CIOB 1996; Fryer 2004; Walker 2002)

different types of stress in construction management must be identified; and (3) the impact of the stressors on different kinds of stress of individual C-PMs in the industry should be investigated.

Construction Project Managers

Due to the complex, demanding, and dynamic nature of construction projects, an indispensable specialist, the C-PM, is appointed to oversee projects from inception to completion. The roles of a C-PM include: analyzing data from designers, subcontractors, and suppliers; designing the best alternative construction methods; planning the construction procedures; forecasting the probable difficulties; monitoring the financial situation of the construction company; arranging the human resources and manpower; motivating the participants and ensuring cost effectiveness; controlling the construction process throughout the design, construction, and operation phases; producing a well-designed construction product; and satisfying various stakeholders' requirements regarding quality, performance, and cost (CIOB 1996; Jang et al. 2003; Olomolaiye et al. 1998; Walker 2002). The main duties of C-PMs from preconstruction stage to completion stage are shown in Fig. 1.

However, uncertainties and instabilities inevitably develop, in terms of human resources, materials, financial situations, site conditions, weather conditions, and so on. Too many resources and too tight a schedule have a significant impact on the profitability of a construction company, as extra monetary resources and tight deadlines generate higher construction costs. Similarly, inadequate resources (manpower, material, or budget) and inappropriate decision points can lead to a failure to complete the project on time, within budget, or to the required standard (Olomolaiye et al. 1998). In practice, C-PMs often find themselves trying to reconcile incompatible demands and conflicting expectations from people inside and outside the organization. This induces role conflicts and additional workloads for C-PMs in the industry (Lysonski et al. 1989; Nordqvist et al. 2004). In addition, client and design team often change the design at postcontract stage. C-PMs need further information and are often obliged to change decisions at the last moment (Nordqvist et al. 2004; Sutherland and Davidson 1993). Thus, stress can often and easily manifest itself as tension, dissatisfaction, reduced effectiveness, and so on (Djebarni 1996).

Stressors of C-PMs

In the construction management process, a C-PM has to plan, organize, and control a construction project with the multistakeholders in an organization, either in contractor companies or in consultant firms (Ritz 1994). The stressors of C-PMs can, thus, generally be categorized into four groups (Gmelch 1982; Leung et al. 2005b): (1) task stressors; (2) organizational stressors; (3) personal stressors; and (4) physical stressors.

Task Stressors

Task stressors usually refer to work overload, role conflict, and role ambiguity in the daily work of C-PMs. Work overload simply means that the job demands are too great for one individual (Margolis et al. 1974). The position of C-PMs requires them to make various important decisions, carry a great deal of responsibilities, and keep learning new knowledge and technology (e.g., the new project planning software—P3, new construction materials—high strength G100 concrete), which are all potential causes of work overload of C-PMs. Role conflict occurs when C-PMs are torn between conflicting job demands or doing things that they really do not want to do or do not think are part of the job specification (Beehr 1995; Kahn et al. 1964). Role ambiguity means a lack of clarity about the expectations of the work role and about the scope and responsibilities of the job (Beehr 1995; Rizzo et al. 1970). Both role conflict and role ambiguity can stimulate stress in C-PMs, especially when they do not want to carry out a particular construction project or task or where information about it is limited. Several studies found that role conflict and role ambiguity lead to poor communication and stress (Gmelch 1982).

Organizational Stressors

Organizational stressors refer to the sources of stress coming from and within an organization itself. These stressors include the organizational structure and a career-developing environment. Poor organizational structure covers the presence of bureaucracy and hierarchies, the omnipotence of rules, and unfair treatment by the organization in a construction company (James 1999; Gmelch 1982; Rogers 1975). The more complex the organizational structures in terms of rules and bureaucracy, the greater the intrapersonal conflict (Gmelch 1982). It would also inhibit one's personal creativity, which is, in fact, an essential element in the role of C-PMs. Career-developing environment indicates the culture of an organization, the degree of participation in the decision-making process, and the instability of the job of C-PMs (Karasek et al. 1998). Employees who have greater opportunities to participate in decision making can experience higher feelings of self-esteem and job satisfaction (French and Caplan 1970), and lower feelings of stress (Margolis et al. 1974). Therefore, a good career-developing environment is necessary if the stress of C-PMs is to be relieved.

Personal Stressors

Personal stressors include both intrapersonal and interpersonal stressors. Intrapersonal stressors usually refer to an individual's personal behavior (Type A behavior). Individuals with Type A behavior are considered to be more competitive, aggressive, hasty, time driven, impatient, insecure of status, generally hostile, and incapable of relaxing (Friedman and Roseman 1974; Evans 1990). On the other hand, good interpersonal relationships at work have been recognized as key abilities for C-PMs to achieve good performance (Bresnen et al. 1986; Djebarni 1996; Djebarni and Lansley 1995). Workgroup cooperation signifies close and harmonic interpersonal relationships between C-PMs and their

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subordinates, colleagues, and supervisors. However, a poor workgroup relationship leads to lower job satisfaction and higher psychological stress. Hence, workgroup cooperation is definitely important in helping C-PMs to relieve their stress appropriately.

Physical Stressors

Physical stressors refer to the environmental sources of stress existing in either the work or the home environment of C-PMs. On the construction site, C-PMs are usually obliged to work in poor physical conditions, such as extremely high or low room temperatures, inappropriate lighting, a lack of privacy, and so on (Leung et al. 2005b; Gmelch 1982; Kornhauster 1965). Sound is generally considered a physical entity, but noise on site is a psychological concept defined as unwanted sound. Excessive noise can cause various health problems (e.g., hearing loss and high blood pressure), and can negatively affect psychosocial relationships and work performance (Lebo and Oliphant 1968). In addition, temperature influences thermal comfort. Both temperature and lighting in the working office affect health, subjective feelings, and stress levels, and consequently influence the work performance and social behaviors of C-PMs in the construction management process (Lewy et al. 1982). A poor home environment refers to poor functioning at home or in other nonjob situations (Organ 1979). Apart from the work environment, the home environment of C-PMs should also be considered, as a poor home environment can influence the personal health and stress of C-PMs directly.

Subjective and Objective Stresses

When talking about stress, it is common for people to refer to individuals' subjective feelings, which depend very much on one's perceptions. However, this conception does not show a complete picture of the stress of individuals. Therefore, two types of stress are defined in this study: subjective stress and objective stress.

The aforementioned subjective feelings may be categorized as subjective stress, which can be measured by the degree of satisfaction with the environment, feelings of depression, and the degree of confidence in an organization (Leung 2004; Leung et al. 2005a, b). It refers to the subjective responses of individuals to external demands that are somehow related to person-in-environment models. The experiences of response, the stressors, and the subjective interpretation of relationships between stimulus and environment influence an individual's stress levels subjectively. Thus, perception is a product of the interpretations of stressors and of the individual's resources to deal with it (Tomei et al. 2006).

On the other hand, objective stress refers to the deviation between the actual and expected abilities of an individual (Leung et al. 2005a,b; Gmelch 1982; Kahn et al. 1964; French and Caplan 1973). It relates to the individual's perception of his or her ability to carry out tasks or assignments. For the C-PM, objective stress may occur when the deviation between the expected and the actual deadlines for a task, the cost saving of a project, levels of difficulties, complexity of works, and the level of responsibility of the work involved in a specific construction project are very great.

Research Methodology

In order to investigate the stressors–stress relationships of general C-PMs in Hong Kong, a questionnaire was designed and disseminated to construction personnel (C-PMs) who had direct experience in project management in various construction organizations. The questionnaires were distributed by fax, e-mail, or in person to C-PMs between October and December 2005. Out of 500 distributed questionnaires, 108 were returned, representing a response rate of 21.6%. The respondents were working in a variety of construction companies including main contractors (60.3%), subconstructor (6.4%), developers (21.8%), consultant firms (7.7%), and public sector organizations (3.8%). Half of the respondents (49.4%) had amassed over 20 years' experience in the construction industry, 44.4% of them had 11–20 years' experience, whereas the remaining respondents (6.2%) had 6–10 years' experience. The age of the majority of the respondents was between 40 and 49 (58.8%), whereas, 23.8% were aged 30–39 and 15% were aged 20–29. Only 2.5% of the respondents were younger than 20 years old.

The subjective stress levels of the C-PMs were measured using a 7-point Likert scale ranging from 1 to 7, in which 1 stood for "no impact" and 7 stood for "a great deal of impact" (Banks et al. 1980; Maslach and Jackson 1996). The objective stress level of the C-PMs was measured based on the scale developed by Gmelch (1982). The respondents were requested to rate their actual ability (A) and their expected ability (B) regarding seven items (e.g., number of tasks and level of difficulty of work). The overall objective stress would then be calculated by summing the differences between the ratings of (A) and (B) on the seven items.

Results

Factor Analysis of Stressors

Following the practice in the literature, the stressors of the C-PMs were categorized into four groups: (1) task stressors; (2) organizational stressors; (3) personal stressors; and (4) physical stressors. Seven, six, six, and six items from these four categories, respectively, were subjected to principal factor analysis with varimax rotation (eigenvalue-1 cutoff) using SPSS version 11.0. The respondents were asked to rate the degree of their agreement on a 7-point scale ranging from 1 (extreme disagreement) to 7 (extreme agreement). With a sample size of 108, the item ratios ($N:P$) of personal stressors (six items), task stressors (seven items), organizational stressors (six items), and physical stressors (six items) were 15:1, 18:1, 18:1, and 18:1, respectively, which are adequate for the scale of 10:1 suggested by Nunnally (1978). Therefore, the validity of these sets of factor analyses was beyond question. The items were loaded onto the appropriate factors, whereas role conflict and role ambiguity were combined and formed a new factor named poor role congruence. Poor role congruence generally refers to various role-related variables of stress and usually represents the degree of combined role conflict and role ambiguity (Rizzo et al. 1970). All items and factors contained factor loadings and alpha values higher than 0.6. Eight factors were finally generated, including work overload (S1), poor role congruence (S2), poor organization structure (S3), career-developing environment (S4), workgroup cooperation (S5), Type A behavior (S6), poor work environment (S7), and poor home environment (S8). Cronbach's alpha was then used to ensure the

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Table 1. Scale Items, Factor Loadings, and Coefficient Alpha Reliabilities for the Stressors

Factors (stressors)	Nature	Item	Description	Factor loading	Alpha (α)
			Task stressors		
S1 Work overload	+	1.	My job takes up most of the time I should have for relaxation.	0.700	0.710
	+	2.	All the time there is constant pressure to work.	0.779	
	+	3.	I have a lot of responsibility in my job.	0.780	
	+	4.	My job requires that I keep learning new things.	0.674	
S2 Poor role congruence	+	5.	My beliefs often conflict with those of the organization.	0.812	0.659
	+	6.	I am often caught between different parties by conflicting demands.	0.723	
	+	8.	My job responsibilities are unclear and inconsistent.	0.750	
			Organizational stressors		
S3 Poor organization structure	+	9.	I am working in a politicized environment.	0.824	0.710
	+	10.	The company that I am working for is bureaucratic.	0.781	
	+	11.	I often feel unfairly treated by the organization.	0.616	
S4 Career-developing environment	+	13.	My company provides me with a stable job, job focus, and promotion opportunities.	0.691	0.635
	+	14.	I participate in issues affecting the organization; that is, I am involved in decision-making.	0.797	
	+	12.	I feel comfortable with the climate and culture of this organization.	0.663	
			Personal stressors		
S5 Workgroup cooperation	+	15.	I have a good relationship with my superiors.	0.726	0.7204
	+	16.	My subordinates are trustworthy and friendly.	0.746	
	+	17.	My colleagues trust and respect me.	0.849	
S6 Type A behavior[a]	+	*18.*	*It is difficult for me to let go of work, even when there are opportunities.*	*0.731*	*0.5891*
	+	*19.*	*It is hard for me to focus on one activity for a long time (>10 mins)*	*0.731*	
	+	*20.*	*People sometimes say that I easily lose my temper.*	*0.750*	
			Physical stressors		
S7 Poor work environment	+	21.	My office is too crowded.	0.710	0.805
	+	22.	My office is too noisy.	0.888	
	+	23.	The temperature in my office is often too cold/ too low.	0.694	
	+	24.	There are many interruptions and disturbances in my work environment.	0.843	
S8 Poor home environment	+	25.	My home environment needs adjustment.	0.845	0.7901
	+	26.	I am not satisfied with my home environment.	0.939	

Note: All items were measured on a 7-point scale ranging from "disagree strongly" to "agree strongly" Kaiser–Meyer–Olkin=0.706 for task stressors, 0.795 for organizational stressors, 0.612 for personal stressors, and 0.676 for physical stressors. % variance explained is 57.2% for task stressors, 63.0% for organizational stressors, 52.7% for personal stressors, and 71.3% for physical stressors.

The data in italics denote items with factor loadings less than 0.60 or factors with Cronbach's alpha coefficient less than 0.6 were deleted from the above data analysis.

[a]Factor removed from the further analysis due to the low Alpha value (<0.6) obtained.

reliability of the eight generated stressors. All factors contained an alpha value higher than 0.6, except Type A behavior (S6), which was then deleted. The factor loadings of items and the reliability of the eight factors are summarized in Table 1.

Correlation between Stresses and Stressors

Pearson correlation analysis was applied to find the interrelationships between the stressors, subjective stress, and objective stress. Table 2 shows the intercorrelations between subjective stress, objective stress, and the seven stressors. The results indicated that there were positive significant relationships between subjective stress and "work overload" (S1: 0.201, $p=0.05$), "poor role congruence" (S2: 0.274; $p=0.01$), "poor organization structure" (S3: 0.215; $p=0.05$), "poor working environment" (S7: 0.359, $p=0.01$), and "poor home environment" (S8: 0.231; $p=0.05$). On the other hand, positive significant correlations were also found between objective stress and four stressors, which were work overload (S1: 0.201, $p=0.01$), poor role congruence (S2: 0.238, $p=0.05$), poor work environment (S7: 0.281, $p=0.01$), and poor home environment (S8: 0.248, $p=0.01$).

In addition, the results revealed significant correlations between poor work environment (S7) and three other stressors, which include work overload (S1: 0.363, $p=0.01$), poor role congruence (S2: 0.352, $p=0.01$), and poor organization structure (S3: 0.410, $p=0.05$). At the same time, work overload (S1: 0.240, $p=0.05$), poor role congruence (S2: 0.225, $p=0.05$), poor organization structure (S3: 0.195, $p=0.05$), and poor work environment (S7: 0.334, $p=0.01$) were positively significantly correlated to poor home environment (S8). Poor role congruence (S2) was negatively related to "career-developing environment" (S4: −0.225, $p=0.01$) and "workgroup cooperation" (S5: −0.196, 0.05), but positively related to poor organization structure (S3: 0.492, $p=0.01$). Meanwhile, career-developing environment (S4)

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Table 2. Correlation between Stressors and Stresses

Factors	Sub. str.	Obj. str.	S1	S2	S3	S4	S5	S7	S8
Subjective stress (Sub. str.)	—	—							
Objective stress (Obj. str.)	0.145	—							
S1 Work overload	0.201*	0.424**							
S2 Poor role congruence	0.274**	0.238*	0.187						
S3 Poor organization structure	0.215*	0.096	0.173	0.492**					
S4 Career-developing environment	−0.056	0.078	0.155	−0.276**	−0.519**				
S5 Workgroup cooperation	0.098	−0.079	0.175	−0.196*	−0.141	0.207*			
S7 Poor work environment	0.359**	0.281**	0.363**	0.352**	0.410**	−0.025	−0.010		
S8 Poor home environment	0.231*	0.248**	0.240*	0.225*	0.195*	−0.121	0.015	0.334**	1

Note: ∗=correlation is significant at the 0.05 level (two-tailed) and ∗∗=correlation is significant at the 0.01 level (two-tailed).

was negatively related to poor organization structure (S3: −0.519, $p=0.01$) but positively related to workgroup cooperation (S5: 0.207, $p=0.05$).

Structural Equation Model for Stressors and Stresses

To develop an integrated model of stressors and stresses for C-PMs, Lisrel 8.0 was applied (McManus et al. 2002). The fit indices of the structural equation models are shown in Table 3. According to Kline (1998), at least four fit indices are required to quantify the degree of the fit of a model. Nevertheless, six commonly used fit indices [i.e., relative chi square (x^2/DoF), root-mean-square error of approximation (RMSEA), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), Bentler comparative fit index (CFI), and incremental fit index (IFI)] were used in this study in order to obtain a well-fitted model. Models with a high degree of fit can be indicated by a small RMSEA value, and models with a RMSEA lower than 0.8 are considered to be reasonably well fitted (Bollen and Long 1993). The relative chi square is recommended to be within the range of 2:1 and 3:1 for an acceptable model (Carmines and John 1981). The higher the values of GFI, AGFI, CFI, and IFI, the better fitted are the models (Diamantopoulos and Siguaw 2000).

In this study, three structural equation models were generated (see Table 3): Model I (the original model established based on the relationships found in the correlation analysis; refer to Table 2), Model II [a modified model with the removal of two latent variables [poor organization structure (S3) and career-developing environment (S4)] and their relationships with both subjective and objective stresses], and Model III [an optimized model with additional relationships from poor work environment (S7) to poor home environment (S8), from both S7 and S8 to poor role congruence (S2) and workgroup cooperation (S5) respectively, and from workgroup cooperation (S5) to poor role congruence (S2)].

The goodness-of-fit indices indicated that Model I was poor fit model (x^2/DoF=1.81, RMSEA=0.087, GFI=0.61, AGFI=0.56, CFI=0.58, IFI=0.59). Thus, Models II and III were further developed to obtain better overall fit indices. Model III was the optimized model which contained the lowest RMSEA values (0.063) and x^2/DoF(1.43), and the highest GFI values, AGFI, CFI, and IFI (0.81, 0.75, 0.83, and 0.83 respectively).

Discussion

The stressor–stress model was established using a structural equation model based on the results of the correlation analysis, whereas the stressors were formed by factor analysis. Although the subjective and objective stresses represent definitions of stress, the result of structural equation modeling analysis shown that both types of stresses are induced by work overload (S1), poor role congruence (S2), workgroup cooperation (S5), poor work environment (S7), and poor home environment (S8) of the C-PMs, either directly or indirectly. The structural equation model of subjective stress, and the stressors is illustrated in Fig. 2.

Work overload has long been recognized as a key source of occupational stress and, simultaneously, would affect both the health and job satisfaction of individuals (Quinn et al. 1971; Porter and Lawler 1965). In the construction industry, C-PMs normally need to cope with dynamic and innovative technologies (i.e., new laws or regulations, various software such as P3 planner, etc.), consider the extensive expenses involved in the project, make various difficult decisions, and tolerate exhaustion due to an excessive number of site visits. Therefore, individual C-PMs who face work overload are stressed due to the demanding and complex tasks, and their perception of their inabilities to deal with these tasks (objective stress). If they consider that their actual ability is inadequate to achieve the demanding tasks, it will simultaneously induce their subjective bad feelings (subjective stress) about the task or project.

Moreover, poor role congruence is the other key stressor affecting the subjective and objective stresses of C-PMs directly. It refers to both role conflict and role ambiguity (Rizzo et al. 1970). In Kahn et al.'s (1964) research, they identified six possible causes of the role conflict and role ambiguity experienced by the

Table 3. Fit Indices of the Stressors–Stress Structural Equation Model

Model	Dof	x^2	x^2/Dof	RMSEA	GFI	AGFI	CFI	IFI
I	764	1,385.74	1.81	0.087	0.61	0.56	0.58	0.59
II	198	300.82	1.52	0.070	0.80	0.74	0.81	0.82
III	194	276.68	1.43	0.063	0.81	0.75	0.83	0.83

Note: x^2=chi square; RMSEA=root mean square residual; GFI=goodness-of-fit index; AGI=adjusted goodness-of-fit index; CFI=comparative fit index; and IFI=incremental fit index.

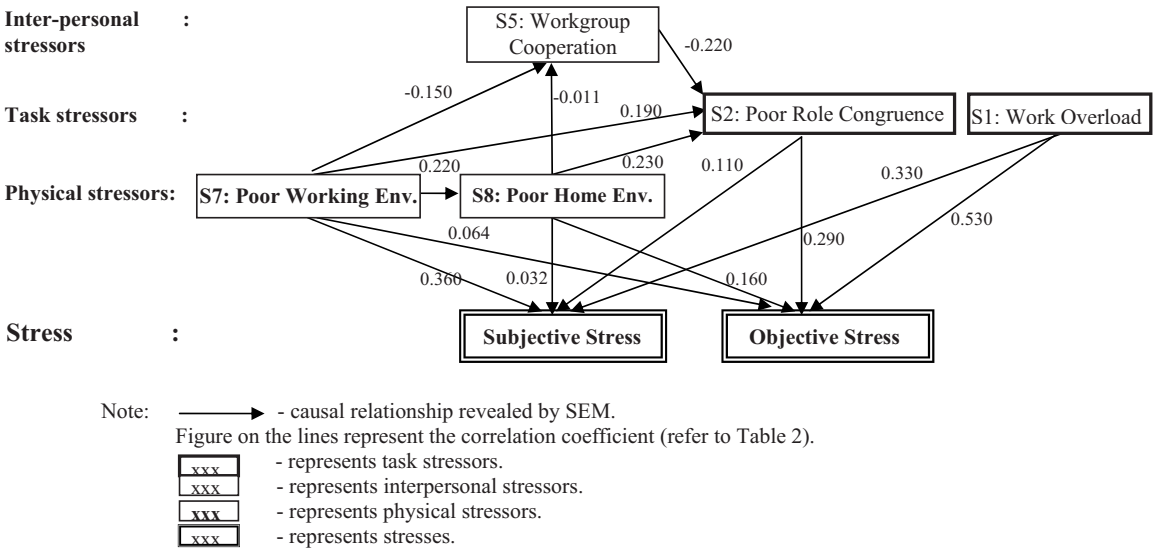

Fig. 2. Integrated stressor–stress model for C-PMs

C-PMs, they studied: (1) the C-PMs were working in a changing organization, in which in a period of recession the majority of construction companies had diminished in size and suffered from a lack of jobs; (2) individuals experienced expectations that differed between clients, other project managers, consultants, contractors, subcontractors, direct supervisors, subordinates, and so on; (3) the C-PMs worked for more than one supervisor, especially on large construction projects (e.g., several directors or contract managers in a joint venture project); (4) they needed to supervise their project team members successfully; (5) the C-PMs were required to make innovative decisions, especially because construction management was never a routine task; and (6) the C-PMs needed to coordinate action between various departments either internally, within construction firms (e.g., the estimation department, materials departments, plants departments, etc.) or between construction firms (e.g., clients, contractors, subcontractors, design consultancies, etc.). These six causes of role conflict and ambiguity are intrinsic and inevitable elements of the roles of C-PMs. It is therefore necessary for C-PMs to clarify their roles (i.e., acquisition of adequate information about job responsibilities, job scope, job objectives, and the expectations of workgroups in the construction management process). In fact, the negative causal relationship between workgroup cooperation and poor role congruence found in this study indicates a need for the interpersonal cooperation training of C-PMs in order to reduce role conflict and role ambiguity.

The study revealed that there is no direct relationship between workgroup cooperation and both subjective and objective stresses, and in this it deviates from previous research studies (Leung et al. 2005b; Gmelch 1982; French and Caplan 1970). However, the structural equation model still indicates that workgroup cooperation can reduce the role congruence of C-PMs and indirectly affects both subjective and objective stresses negatively. It shows that workgroup cooperation acts as a buffer for both types of stress by diminishing the role conflict and role ambiguity suffered by C-PMs. Workgroup cooperation refers to adequate communication, trust, and harmonic relationships between C-PMs and others in the workplace. It is understandable that role ambiguity and conflict can be avoided or reduced through sufficient and appropriate communication between individuals within the workgroup. Thus, good workgroup cooperation can have a negative impact on both the objective and the subjective stress levels of individual C-PMs through minimizing role conflict and role ambiguity. Moreover, workgroup cooperation has long been recognized as a major component in achieving a good performance from managers (Djebarni 1996; Djebarni and Lansley 1995), as C-PMs play a role of pivotal coordinator for various construction tasks between clients, the project team, suppliers, contractors and subcontractors, and so no (CIOB 1996). They need to contact, discuss, and clarify all uncertainties arising in the construction process with the relevant parties.

Further, physical stressors, both in the work environment and in the home environment, were also found to be positively significantly related to the subjective and objective stress of C-PMs. Different individuals have different tolerance levels to adverse conditions (Gmelch 1982). However, the circumstances in which some tasks are carried out can create stress for most individuals and it is then considered that a C-PM has a "poor" work environment. When talking about "work environment," people usually refer to the office environment and such elements as the temperature, the lighting, the noise, the staff density and the degree of privacy possible. Numerous studies have found that extreme temperature, lighting, and noise, and high staff density and lack of privacy can lead to stress for an individual (Leung et al. 2005b; Gmelch 1982; Selye 1976), especially for C-PMs who are required to work in noisy, crowded, and extremely hot or cold sites for a certain period of time. On the other hand, the results also reveal that the home environment also induces stress for C-PMs to a certain extent. In the study, a poor home environment refers to poor functioning at home (e.g., insufficient free space and/or settings that ignore the importance of personal privacy). It causes affected individuals to perform less well on the job and, thus, induces stress gradually (Organ 1979). Hence, continuously working in a poor work environment and living in a poor home environment can impact negatively on a C-PM's work performance (objective stress) and trigger his or her subjective feelings (subjective stress). In fact, a poor work environment does not only relate to poor job performance and negative subjective feelings, but also induces absenteeism, high accident rates, and higher staff turnover (Cmelch 1982).

Poor work and home environments also impair workgroup cooperation and induce role congruence problems in C-PMs. This

finding conforms to the previous research (Baron 1994) that found a negative relationship between a poor physical environment and interpersonal relationships. If C-PMs are working for a prolonged period of time in a noisy, too hot or too cold, and too bright or too gloomy environment, it is understandable that they would become irritable and impatient. This might then induce interpersonal stressors (Baron 1994; Leung et al. 2005b) such as unwillingness to communicate with others or an atmosphere of poor communications, or more seriously, conflicts with other stakeholders in the project. In addition poor communications causes role congruence problems including both role conflict and role ambiguity for C-PMs, thus initiating a vicious cycle.

Recommendations

Research Implications

These finding have some important implications for managing the stress level of C-PMs. As physical stressors act as a key source of stress for C-PMs, construction companies have to provide a comfortable environment, either in the office or on site, for C-PMs. It is therefore suggested that room temperatures should be maintained at a constant and moderate level (e.g., the Hong Kong government issued guidelines in October 206 instructing all department to follow the "25.5 degree room temperature guideline;" HKSAR Environmental Protection Dept. 2006) and provide sufficient lighting (natural and artificial) in the offices of C-PMs. As it is impossible to eliminate noise on construction sites, sufficient sound insulation materials are required to minimize any noise to the work of C-PMs (Leung et al. 2005b). Although site offices may only be used for 1 or 2 years, acoustic insulation wall and ceiling panels are still essential, especially for some C-PMs working on one site all day long. In most cases, the invasion of one's personal space by another person is an unpleasant and stressful experience (Hayduk 1983; Sommer 1969; McAndrew 1993). Therefore, adequate space management with sufficient privacy for C-PMs is very important. An appropriate seating plan and work environment can assist C-PMs to concentrate on their tasks in the office, can sustain their morale and health, and can also improve their work performance on the project (Hathaway et al. 1992; Park 1998; Rose 1994).

Construction companies also need to consider the home environment of C-PMs. Companies are recommended to provide a housing subsidy to C-PMs in order to enhance the morale and sense of belonging of C-PMs in the company. In Hong Kong, about one in five middle-level managerial employees are entitled to housing benefits from their organizations (HKSAR Census and Statistics Dept. 2006). The private life and personal home environment of C-PMs, if congenial, can reduce their stress levels and sustain the good health they need in their workplaces.

In order to build up and strengthen the cooperation between C-PMs and their workgroups, in-house activities, such as urban outdoor recreation activities, family and friends programs, and coffee-break relaxation sessions (Finnicum and Zeiger 1998; Kohler and Munz 2006; Gmelch 1982; Leung et al. 2005b) are recommended to provide relaxing and harmonious conditions in which C-PMs can communicate with and gain a deeper understanding of their supervisors, colleagues, and subordinates. In fact, sufficient communication can also decrease the chance of C-PMs suffering from role conflict and ambiguity.

In addition, regular progress meetings are recommended to stakeholders for preventing C-PMs suffering from poor role congruence and work overload. During the meeting, C-PMs should not only report their work progresses to stakeholders, but also express the workload difficulties and role problems encountered. In this way, the employers can clarify their specific roles and job allocation of individual C-PMs. As construction projects are ever-changing and never identical, constant monitors and reviews of C-PMs' work are very essential to prevent then from overload and role problems.

Further Research

The data collected for the self-report measurements used in this study may be in part of uncertain reliability, and a potential risk of common method variance exists. However, it should be noted that all of the survey respondents were professional C-PMs with extensive practical experience in construction management. Moreover, the stressors and stress items were generated as a result of an extensive review of the literature. The scales adopted in this study have been broadly used in previous stress management research (Gmelch 1982; Quick and Quick 1984; Cooper and 1981). Therefore, the results in the study are not biased by the differing responses to the measured variables.

In previous research, Type A behavior was considered one of the key stressors of managers (Wong 2005; Kivimaki 1996). However, this stressor cannot be factorized in this study. To investigate its impact on both the objective stress and the subjective stress of C-PMs, further study of this stressor should be conducted as this will facilitate a better understanding of the overall pattern of stressors of C-PMs in the industry.

There are many projects under construction in Dubai, the United Kingdom and China (projects in China, for example, are currently under way in Beijing, Shanghai, Shantung, Hangzhou, Gaungzhou, and Macau). The rapid development of cities has increased the demands on construction professionals all over the world, especially in China. For example, Macau, a city which is a near neighbor, has absorbed many construction professionals from Hong Kong in recent years (The Standard 2004, 2005). Hence, it is predicted that the phenomenon of professionals working away from their home town will become more and more common in the construction industry. The impact of stressors on the stress levels of C-PMs who work in different regions with different cultures may vary. Therefore, further study on cross-cultural stress management for C-PMs in both Hong Kong and China is recommended in order to investigate the impact of acculturation on the stress of C-PMs who work overseas, and enhance their working performance in the foreign environment.

Conclusion

Construction projects generally involve complex tasks among multistakeholders, such as clients, architects, engineers, surveyors, suppliers, contractors, and foremen, in a dynamic environment. This study has identified four main categories of stressors (task stressors, organizational stressors, personal stressors, and physical stressors) of C-PMs. Organizational stressors, including organization structure and career-developing environment, are sources of stress that originate within the organization itself. Personal stressors cover the behavioral types of C-PMs and workgroup cooperation among colleagues, supervisors, and superiors of C-PMs, whereas task stressors, including work overload and poor role congruence, are generated from the daily work and the role of C-PMs. Lastly, physical stressors, involving both work

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and home environments, can be triggered by noisy, excessively hot or cold, and crowded work and home environments.

Of the seven stressors identified, four (work overload, workgroup cooperation, poor work environment, and poor home environment) were found to induce both objective stress and subjective stress significantly and directly, whereas workgroup cooperation was the only stressor that was found to affect the stress levels of C-PMs indirectly. Poor work and home environments induce role congruence problems and poor workgroup cooperation. Workgroup cooperation can be considered as a buffer of stress in that it reduces the role of congruence problems of C-PMs. A number of recommendations, such as a comfortable working environment (e.g., sufficient lighting, constant temperature, sound insulation panels, good space management providing sufficient privacy), housing subsidy, in-house activities, and employment of psychological consultants, are recommended in order to adjust the stress levels of C-PMs and, subsequently, to improve their performance and the productivity of construction projects.

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