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## Introduction

The Association of Project Management (2017) defined Project management as "the application of processes, methods, knowledge, skills and experience to achieve the project objectives". In view of this definition, the project manager is responsible for the day-to-day management of the project and must be competent in managing the six aspects of a project, i.e. scope, schedule, finance, risk, quality and resources. All these tasks together with tight deadlines and observed long working hours with limited resources on site and intrinsic uncertainties of construction projects, play an important role in increasing occupational stress on the Construction Project Managers (C-PMs) and other similar professions (Bowen *et al.*, 2013a, 2013b, 2014, Leung *et al.*, 2011, Cattell et al., 2016). According to an occupational stress study in the construction industry, nearly 70% of construction professionals suffer from stress, anxiety, or depression (CIOB 2006). Therefore, there is clearly a need for more research on the impact of stress on construction professionals.

**Table 1** illustrates a historical trend of published papers related to stress by year, country, authors and journals. Serious research on stress topics in construction started in 1989 where Journal of Construction Engineering and Management (JCEM) and Construction Management and Economics (CME) published the most stress related papers. The number of academic research publications in a country may imply the extent to which that research area progresses in that particular location. In general, findings from these studies revealed that stress could be related to (a) physical conditions; (b) organisational culture; (c) interpersonal conflict; (d) personal characteristics (e) job nature; (f) role conflict; (g) work overload; (h) job ambiguity; (i) work environment; (j) family related issues.

**INSERT TABLE 1 HERE**

**Table 1** also shows that the impact of stress on C-PMs has rarely been investigated in the UK (only 8 out of 50 known papers related to the UK construction industry have been published and most of them are rather dated). Moreover, based on the literature review and the list of publications shown in Table 1, previously developed integrated models of work stress in construction have focused on examining the relationship between two or three sets of data and have largely been undertaken in Hong Kong and South Africa. For example, Leung et al (2009) developed an integrated model for the Stressors and Stresses of Construction Project Managers in Hong Kong; Chan et al (2014) examined the structural relationships between cultural values and coping behaviours of professionals in Hong Kong; and Bowen (2014) developed a structural equation model of occupational stress in South Africa.

Therefore, it was considered valuable to investigate this area of research in the UK construction industry and to include (within one study) four sets of factors, namely, i) Stressors; ii) Stress; iii) Stress-Coping Behaviour and iv) the Performance of C-PMs. In particular, this study seeks to investigate the sources of stress, how C-PMs deal with the stress that they are exposed to; how different types of stresses affect their performance; and the stress-coping behaviours adopted by the C-PMs in the UK. The ultimate aim of the study is to display the findings of the survey results in a causal model showing the relationship between these four sets of factors stated above.

## Literature review

### *Stress Experienced by C-PMs*

The concept of stress was first introduced by endocrinologist Hans Selye in 1936, who described it as a physical response to a negative impulse (distress) or positive impulse (eustress), being defined by himself as a 'nonspecific result of any demand upon the body' (Selye, 1980, p. 127). However, for the purpose of this paper, stress is defined as: 'the adverse reaction people have to excessive pressure or other types of demand placed on them' (Health and Safety Executive, 2007, p.1). It is based on the relationship between the person and his/her environment (Lazarus and Folkman, 1984).

Leung et al. (2009) divided stress into objective stress, physiological stress and burnout. Objective stress refers to the evaluation of a threat arising from cognitive factors. Physiological stress appears when the sources of stress are continuous. Therefore, stress becomes chronic, which implies that the physiological adjustments of one's body do not revert back to normal. Mind Tools Ltd. (2007) also affirmed that there are forms of stress with a short-term effect. They could occur during confrontational situations, difficult meetings or when prompted with controversial issues, but their effect may not be significantly relevant if the stress fades quickly. However, long-term stress can imply physical and psychological fatigue affecting one's health and/or undermining confidence or morale. Physiological and psychological problems could lead to behavioural change affecting a C-PM, which could have repercussions at work and on his/her personal life. This is a state of chronic emotional fatigue caused by long-term chronic stress or by a failure to obtain an expected reward (Leung *et al.*, 2011).

Burnout on the other hand occurs as a result of a complex interaction of individual characteristics and issues in the work environment but, it is also associated with a complex interaction between experiences at work and other life domains, including family (Lingard,

2003; Lingard and Francis, 2005 & 2006; Yip and Rowlinson, 2009; Turner & Mariani, (2016). The symptoms of burnout include changes in the social life of individuals (i.e., C-PMs could avoid communicating with people at home or in their private life) (Leung *et al*., 2008a), low attitude to work (i.e., low motivation, low commitment and low accomplishment complaints) (Leung *et al*., 2008a) and withdrawal behaviour (i.e., being late for work, absenteeism and even quitting) (Leung *et al.,* 2011).

***Stressors affecting C-PMs***

Stressors are the sources of stress. Sutherland and Davidson (1989) were one of the first to identify the sources of stress among construction site managers in the UK. They classified the sources of managerial stress into, i) Role in organisation; ii) Career development; iii) Organisational structure and climate; iv) Relations with organisations; v) Intrinsic to job; vi) Organisational interface with outside. Subsequent research by Leung and colleagues (2005a, 2007, 2008b, 2008c, 2009 and 2010b) divided stressor into four categories, these are:

- Task stressors: they refer to work overload, role conflict and ambiguity in the day-to-day work of CPMs.
- Organisational stressors: they are the sources of stress coming from the organisation such as the organisation structure and the career-developing environment.
- Personal stressors: they include both intrapersonal and interpersonal stressors.
- Physical stressors: they refer to environmental sources of stress coming from the home and/or the work environment of CPMs.

Empirical research into stressors was also conducted by the HSE (2007) to analyse the work-related stress of (1,732) returned questionnaires from of a group of construction industry workers. (279) responses were returned from project managers, representing a (17.1 %),. The 'top three' stressors were:

- 'I have too much work to do in the time available'. (27,88 %) of the respondents found this aspect the most stressful.
- 'I am responsible for the safety of others at work' (16.35 %)

'I work long hours' (11.06 %). 50.8 hours were the average hours worked by C-PMs per week.

In a parallel survey by the CIOB (2006), it was acknowledged that 'too much work' was the main cause of stress (61.4%); 'Pressure' (59.9 %); 'ambitious deadlines' (59.7 %), 'lack of feedback' (56.8 %); 'poor communication' (55.7 %); 'inadequate staffing' (55.0 %) and 'conflicting demands' (52 %). Interestingly, Gunning and Cooke (1996) already set some major causes of stress that later fitted rather well with other surveys and research. The following was the main categories that were identified:

- Job characteristics: quantity of work, deadlines and responsibilities. It applies to the 3 main stressors stated by HSE (2007) and the 'too much work' and 'ambitious deadlines' factors stated by CIOB (2006)
- Role in the company: role ambiguity or conflict, lack of autonomy, etc. Related to the 'conflict demands' factor from the CIOB survey.
- Interpersonal relationships with colleagues, superiors, friends or family. 'Poor communication' from the CIOB survey would be included here.

- Career-developing pressures and internal pressure (such as perfectionism or fear of failure). This category fits with the factor 'pressure' from the CIOB survey as well as the work of El-Sabaa (2001) and Xiong et al (2015).

- Climate and structure of the company and/or position, where 'lack of feedback' and 'inadequate staffing' from the CIOB survey fit in.

- The interaction between work and private life. The stressors 'I have too much work to do for the time available' observed by HSE (2007) might indicate a negative impact on free time due to work overload.

***Performance of C-PMs***

Naturally, the role of C-PMs demands full-time involvement with the project from the beginning (if not earlier) until its completion (if not until later). The role of a C-PM spans from assessing the feasibility of a project at the preconstruction stage to responding to the needs of the client at the post-construction stage (CIOB, 2002). Apart from the objective tasks that C-PMs have to accomplish, they have to demonstrate hard skills such as planning, scheduling, cost control, decision making, prioritisation as well as well-developed interpersonal skills such as leadership, communication and conflict management. (APM, 2017). Therefore, decision making under stress becomes defective (CIOB, 2002). Instead of undertaking careful analysis, individuals under stress find themselves trapped in a vicious circle of non-productivity. It may result in faulty decisions made hastily or in defensive reactions because stress accelerated decisions made by construction managers.

Leung et al (2008a) identified key C-PM performance as follows:

- Task performance: it includes the performance of a C-PM at three classic levels: cost, time and quality and time. The overall construction outcome will depend on the decisions that a C-PM makes in regard to the profit of a project (cost), meeting the client's demands (quality) and the control of the project duration and the effectiveness of the planned schedule (time).

- Interpersonal performance: several parties are involved in construction projects (client, contractor, sub-contractors, consultants, etc.). The communication among them directly affects not only their relationship but whether the project will be successful or not and C-PMs are the link among the parties. Stress could induce a lack of concern for colleagues, disrespect for or distrust of those who are working together with the C-PM and that will affect his/her performance.

- Organisational performance: stress can have a negative effect not only on C-PMs but on their organizations. When working under stress, C-PMs might exhibit withdrawal behaviours, such as absenteeism from project meetings, lack of commitment and a reduced sense of belonging to the organisation or even quitting (Djebarni, 1996). It may occur when there is a difference between the C-PM´s personal values and the ones of his/her orgnaization and the consequences of this type of stress could negatively affect the firm directly, especially in financial terms.

On the other hand, Gmelch and Chan (1994) and Djebarni (1996) asserted that a moderate level of stress leads to a positive performance. Insufficient stress leads to lack of concentration, boredom and lack of motivation or initiative to make someone's best. Subsequent research studies have confirmed that there is an inverted U-shaped relationship that shows levels of performance depending on the levels of stress (Gmelch, 1982; Leung *et al.* 2005b; 2008a). These studies confirmed that low levels of stress would lead to

boredom and low level of productivity while high-stress levels would make the individual unhappiness or anxiety and a moderate level of stress would help to attain optimal performance.

***Stress-coping behaviours of C-PMs***

Lazarus and Folkman (1984) defined 'coping' as any conscious effort by an individual to overcome or to deal with a given stressful event. The coping strategies implemented by a C-PM may depend on how he/she appraises a stressful situation, personality, environmental factors and experience, which will result in an enhanced or decreased psychological adjustment (Haynes and Love, 2004, Aitken and Crawford, 2007).

There are commonalities in several researchers into the subject of coping behaviour. For example, Lazarus and Folkman, (1984); (Djebarni, 1996); Haynes and Love, (2004); Ng el al (2005; Leung *et al.,* (2006); Yip el al (2008); Smith et al, (2011); Chan *et al.*, (2012); Chan et al, (2014), all confirmed that, there are two fundamental and differentiated types of stress-coping behaviour. These are:

- Problem-focused coping: it includes all the cognitive behaviours adopted to deal with stressors through modifying the own problem´s mentality or environmental conditions (Djebarni, 1996). This coping behaviour means confronting the source of stress, removing the stressor, seeking instrumental support, planning and scheduling or appraising a problem (Leung *et al.,* 2006).

- Emotion-focused coping: it refers to the adoption of activities or actions to manage distressful emotions maintaining moderate levels of arousal (Lazarus and Folkman, 1984). They include emotional support-seeking, escape-avoidance, regulation, self-control and denial/escape (Ng el al (2005, Chan *et al.*, 2012).

In a survey conducted by Gunning and Keaveney, (1998) in Northern Ireland, the coping strategies that were identified as being mostly adopted were as follows:

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|---|---|---|
| 1 | Think objectively about situation and control feelings | 72% |
| 2 | Find out more about problem | 66% |
| 3 | Take immediate action on basis of present understanding of problem | 63% |
| 4 | Draw on past experiences | 59% |
| 5 | Follow formal channels of procedures | 55% |
| 6 | Make a plan of action and follow it | 47% |
| 7 | Seek advice from superiors at work | 35% |
| 8 | Reduce tension by physical activity | 28% |
| 9 | Go on as if nothing happened | 26% |
| 10 | Become more involved in non-work activities | 23% |
| 11 | Express anger to person who causes problem | 12% |
| 12 | Wait and see before progressing | 9% |
| 13 | Become more involved in family life | 7% |
| 14 | Make myself feel better by eating, drinking taking medication | 5% |

## Research Design and Methodology

### Theoretical framework

#### *Stress-related Factors Influencing C-PMs*

The aim of this research is to develop an integrated model that explains the strength of the relationship between stress, stressors, stress-coping behaviours and performance of C-PMs in the UK. **Figure 1** shows the relationship among the key research factors where the performance of C-PMs is exposed as a dependent variable and the independent variables are the level of stress and stress-coping behaviour. The key research questions that needed to be answered were: how does stress affect the work of a C-PM in the UK? What type of stressors generates the different levels of stress? What kinds of coping behaviours do C-PMs adopt to deal with the stress? What is the effect of stress on the performance of C-PMs?

The next section will explain how components of the research framework were measured in this research.

**INSERT FIGURE 1 HERE**

### The research sample

A questionnaire was designed and randomly disseminated to some 150 construction project managers by e-mail using the survey-monkey tool of which 44 questionnaires were fully completed. The respondents to the questionnaire were mainly men (43, representing 97.7 %), with only one C-PM female responded (2.3 %). This fact reflects a male dominance gender in the UK construction industry which confirms the CIOB report that was conducted in 2006. It has to be highlighted that "Gender" does play a part when it comes to

risk factor for occupational stress in construction profession as revealed in an earlier study by Loosemore et al (2004) and later by Sang et al (2007). The age of the respondents was equally distributed from 30 to 60 years of age. In terms of their highest completed education, most respondents held a postgraduate degree (27 C-PMs, representing 61.4 %), while respondents with an undergraduate degree (13 CPMs, being 29.5 %) represented the second largest group. The respondents were mainly employed by SMEs representing 34.1 % (15 respondents) or firms larger than 200 employees, being 38.6 % (17 respondents). Most of the C-PMs that returned the completed questionnaire estimated the average contract value of the projects they were involved within the last 5 years range between £1m - £30m. The respondents had mainly between 21 and 30 years of experience in the construction industry (17 respondents) and up to 20 years of experience (36 respondents) working as a C-PM.

The questionnaire was designed to include variables of the research model that is shown in **Figure 1** and were measured as follows:

## Measurement of the Research variables

### *Measuring Stressors*

Four types of stressors were measured in this study, namely, task stressors, organisational, personal and physical. The different statements of this section of the questionnaire (26 in total) were adapted from previous research by Leung and colleagues (2005a, 2007, 2008b, 2008c, 2009 and 2010b) and were made to fit the types of stressors adopted for this research: these are as follows:

- Task stressors: those related to the day-to-day work (work overload, role conflict and ambiguity, responsibilities, etc.) (7 factors)

- Organisational stressors: generated from the organisation (organisation structure, career-developing environment, bureaucracy, etc.) (6 factors)
- Personal stressors: including both intrapersonal and interpersonal stressors (6 factors)
- Physical stressors: those affecting home and work environment (7 factors)

A seven -point Likert scale was used to measure the stressors level, where 1 stood for 'strongly disagree' and 7 stood for 'strongly agree'. The average score obtained was used to indicate the degree of stressors. The results section below explains how the data was analysed and presented to ensure reliability.

***Measuring Stress***

In this section of the questionnaire, the method used by Leung et al.'s (2008b, 2008c and 2009) was adopted to measure the level of stress. Three types of stress factors were identified, namely, objective stress, burnout, and physiological stress. In order to measure the level of objective stress, the discrepancy between a person's expected and actual abilities to handle stressors was assessed Gmelch, (1982). The respondents were requested to rate their actual ability (A) and their expected ability (B) in various dimensions i.e., the number of tasks, the responsibility of the work, the level of difficulty of the work, etc., selecting ratings from 1 (none) to 7 (a great deal) Leung et al., (2006). The overall objective stress was calculated by summing the differences between the ratings of (A) and (B). The results section below explains how the data was analysed and presented to ensure reliability.

A seven-point Likert-type scale was used to measure the burnout levels and physiological stress levels of the C-PMs as adopted by Greenberg, (2003) and (Wharton

2004). The respondents were requested to rate their agreement with the statements, ranging from 1 (much less than usual) to 7 (much more than usual). The average score obtained was used to indicate the degree of burnout and physiological stress level. The results section below explains how the data was analysed and presented to ensure reliability.

***Measuring C-PM Performance***

Three types of performance are taken into consideration to measure the performance of C-PMs, namely, task, interpersonal and organisational.

- Task performance: at three levels: cost, quality and time (3 factors)
- Interpersonal performance: referring to communication and relationship with colleagues, subordinates, superiors, client, sub-contractors, etc. (2 factors)
- Organisational performance: referring to personal behaviours in comparison with the company's demands (3 factors)

An eight-factors scale was used to measure the performance of the C-PMs. Respondents were asked to rate their performance on a seven-point Likert-type scale ranging from 1 (strongly disagree) to 7 (strongly agree). The results section below explains how the data was analysed and presented to ensure reliability.

***Measuring stress- coping behaviour***

Two types of stress-coping behaviour were measured, namely, problem- focused and emotion-focused behaviour.

***Measuring Problem-focused behaviour***

In order to measure the problem-focused behaviour, the discrepancy between a person's expected and actual impact of doing several activities or actions was assessed. The different

statements of this section of the questionnaire were adapted from previous research by Djebarni (1996) and Leung *et al.,* (2006). and were made to fit the types of problem-focused behaviour adopted for this research. The respondents were requested to rate their actual behaviour (A) and their expected behaviour (B) in various dimensions. The overall problem-focused behaviour was calculated by summing the differences between the ratings of (A) and (B). The 11 statements had to be rated on a 7-point Likert-scale (from 'no impact' (1) to 'a great deal' of impact (7)). Since each statement was rated twice (expected and actual impact), the final rating ranged from 0 (same impact) to 6 (the highest difference between expected and actual impact). The results section below explains how the data was analysed and presented to ensure reliability.

***Measuring emotion-focused behaviour***

This section measures the difference between the C-PM's perception of the expected and actual impact of doing several activities or actions in regard to the second type of stress-coping behaviour, namely, emotion-focused behaviour. The different statements of this section of the questionnaire were adapted from previous research by Lazarus and Folkman (1984), Ng el al (2005), Chan *et al.* (2012) and were made to fit the types of emotional-focused behaviour adopted for this research.

The method used was the same as with the problem-focused behaviour above. In this section, Ten statements were assessed by the respondents on a 7-point Likert scale (for the expected and actual impact). Thus, the final rating ranged from 0 (same impact) to 6 (highest impact). The results section below explains how the data was analysed and presented to ensure reliability.

## Data Analysis and Results

### *Reliability and Factor Analysis of stressors*

Following the practice in the literature and, in particular, the work of Leung (2009) in Hong Kong, the stressors of the C-PMs were categorised into 4 groups (task, organisational, personal and physical). The sum of all these items (26) is appropriate for obtaining adequate feedback from respondents but too many to develop an understandable framework. In order to reduce the number of variables in the model, the four types of stressors (7, 6, 6 and 7 items respectively) were subjected to exploratory factor analysis using SPSS version 21.0 to extract factors best representing the four standards areas. Given the known overlap of the stressor areas represented in the 4 groups, the Varimax rotation method was employed to ensure maximal loading on the factors extracted. Varimax and other rotation methods, are not specific to SPSS, as they are general exploratory factor analysis (EFA) terms. Detail description of this analysis and rotations are not described in this paper as they are beyond the scope of its content. However, more detail can be found in Costello & Osborne (2005).

All items were loaded onto the appropriate factors, generating ten in total, these are: 'role conflict' (TS1), 'work overload' (TS2), 'responsibility overload' (TS3), 'poor organisational structure' (OS1), 'career-developing environment' (OS2), 'workgroup cooperation' (PS1), 'type A behaviour' (PS2), 'poor work environment' (PHS1), 'lack of cleanness' (PHS2) and 'poor home environment' (PHS3).

The Kaiser-Meyer-Olkin was used for measuring the sampling adequacy. Items contained factor loadings higher than 0.5 are adequate (as recommended by Hair *et al.* (2005). Kaser-Meyer-Olkin for task stressors was 0.559, for organisational stressors 0.682,

for personal stressors 0.599 and for physical stressors 0.673, while the variance explained were 71.97%, 70.45%, 64.54% and 78.70% respectively. All the items studies have contained factor loadings higher than 0.5 and therefore, none of them were deleted for further analysis. Then, Cronbach's alpha was applied to ensure the reliability of the ten generated stressors and, following Hair *et al.*' (2005) observation, the ones with values under 0.6 were deleted (TS3 and PS2).

***Reliability and Factor Analysis of stresses***

Following the methodology adopted by Leung (2009) in Hong Kong, the items of the questionnaire regarding objective stress, burnout and physiological stress were subjected to the varimax rotation as well. The Kaiser-Meyer-Olkin value for performance was 0.590 and its variance explained was 55.883%. As a result, three items of objective stress and burnout were deleted due to their low factor loading (under 0.5 as Hair *et al.* (2005) suggests). Consequently, Cronbach's alpha values were calculated to confirm the reliability of the factors, which were accepted because their values (0.866, 0.725 and 0.692 for 'objective stress', 'burnout' and 'physiological stress') were higher than 0.6 (Hair *et al.,* 2005).

**C-PMs Performance**:

The eight-item performance scale was subjected to factor analysis with varimax rotation. As described in the literature above, 3 factors were generated: 'task performance' (TP), 'interpersonal performance' (IPP) and 'organisational performance' (OP). The Kaiser-Meyer-Olkin value for performance was 0.716 and its variance explained was 75.16%.

**Stress-coping behaviours:**

Both problem-focused and emotion-focused coping behaviour items were subjected to varimax rotation. This analysis created four factors in total for the problem-focused behaviour: 'control action' (PF1), 'thinking action' (PF2), 'support seeking' (PF3) and 'alternative thinking' (PF4). For the emotion-focused behaviour another four factors were generated: 'avoiding action' (EF1), 'emotional discharge' (EF2), 'relax seeking' (EF3) and 'escape' (EF4). The Kaiser-Meyer-Olkin value for the problem-focused behaviour was 0.678 and 0.522 for the emotion-focused behaviour, with a variance explained of 72.15% and 68.77% respectively. Two items were removed from further analysis due to their low factor loading (under 0.5). Consequently, Cronbach's alpha was applied to ensure the reliability of the generated factors stressors and the ones with values lower than 0.6 were deleted (PF1, EF3 and EF4).

***Correlation Analysis***

The interrelationship between stressors, stresses, stress-coping behaviours and performances of CPMs was established by applying the Pearson correlation analysis. The results indicated that 'objective stress' (OBS) had a positive significant relationship with 'interpersonal performance' (IPP: 0.352, ρ= 0.05) and a negative significant relationship with 'career-developing environment' (OS2: -0.398, ρ= 0.01). In addition, there were some positive significant correlations regarding 'burnout' (BO): with 'role conflict' (TS1: 0.421, ρ= 0.01), with 'poor home environment' (PHS3: 0.311, ρ= 0.05), with 'organisational performance' (OP: 0.339, ρ= 0.05) and with 'avoiding action' ((EF1: 0.419, ρ= 0.01). The last type of stress: 'physiological stress (PHS) had a positive significant correlation with 'alternative thinking' (PF4: 0.412, ρ= 0.01) and negative with 'task performance' (TP: -0.426, ρ= 0.01).

'Organisational performance' had a positive significant relationship with 'role conflict' (TS1: 0.527, ρ= 0.01), 'poor organisational structure' (OS1: 0.545, ρ= 0.01) and 'poor work environment' (PHS1: 0.332, ρ= 0.05). To finish with performances, 'interpersonal performance' was correlated with 'workgroup cooperation' (PS1: 0.37, ρ= 0.05).

There was no internal correlation within the three types of stress, nor within the three types of performances. However, the next correlations were found within stress-coping behaviour factors: 'emotional discharge' (EF2) which was positively correlated to 'support seeking' (PF3: 0.334, ρ= 0.05) and to 'alternative thinking' (PF4: 0.389, ρ= 0.01.

Moreover, 'emotional discharge' (EF2) had a positive significant correlation with 'poor home environment' (PHS3: 0.323, ρ= 0.05). 'Avoiding action' (EF1) had a positive correlation with 'poor organisational structure' (OS1: 0.315, ρ= 0.05), which in turn had a negative correlation with 'thinking action' (PF2: -0.477, ρ= 0.01).

There were several interrelationships within the stressors, 'Poor work environment' (PHS1) was positively correlated with 'poor organisational structure' (OS1: 0.36, ρ= 0.05) and there was a positive correlation between 'poor home environment' (PHS3) and 'work overload' (TS2: 0.297, ρ= 0.05). On the other hand, 'lack of cleanness' (PHS2) was negatively correlated with 'career-developing environment' (OS2: -0.366, ρ= 0.05). 'Role conflict' (TS1) was positively correlated with 'poor organisational structure' (OS1: 0.338, ρ= 0.05) and negatively with 'career-developing environment' (OS2: -0.405, ρ= 0.01 and 'workgroup correlation' (PS1: -0.396, ρ= 0.01).

***Interpretation of the correlation matrix***

As 'role conflict' affects organizational performance and is related to burnout, there is a need for C-PMs to clarify their roles, in particular, acquisition of adequate information about job responsibilities, job scope, job objectives, the expectations of workgroups in the

construction management process and indeed job redesign Yip and Rowlinson (2009) . Several studies such as Leung (2009) and (Gmelch 1982), found that both role conflict and role ambiguity can lead to poor communication and 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. Therefore, role problems and other similar difficulties like too much work or lack of authority (factor relevant to C-PMs interviewed by HSE (2007) and to the research conducted by EL-Sabaa (2001) on project managers) should be reported at management meetings by the C-PMs and dealt with by stress management workshops or counselling meetings. According to Ben-Zur and Michael (2007), Eastburg et al (2006) and Love et al., 2010), social support has found to be associated with decreased burnout of general professionals and good mental health of construction professionals. Thus, Leung et al., (2009) recommended that construction employers need to organize some regular non-work related organization gatherings and sharing sections to facilitate the interpersonal relationships and supports between the workgroup.

The significant impact of "Workgroup cooperation", "Lack of cleanness" and "Work environment" on "organizational and interpersonal performances" indicates that group formation at work place need to be well thought through. Workgroup cooperation can be considered as a buffer of stress in that it reduces the role of congruence problems of C-PMs. These factors (together with outdoor group activities) foster good teamwork and are necessary to adjust the stress levels of C-PMs and, subsequently, improve their performance and the productivity of construction projects. Moreover, as poor physical environment acts as a source of the stressors of the surveyed C-PMs in the UK, a comfortable and suitable working environment is also important (Gallstedt et al 2003). For example, a well-designed office layout, either on-site or in office with a moderate and constant temperature, sound insulation facilities, and hearing protection equipment are

strongly recommended in order to avoid a stressful work environment. Leung et al (2009) added the need of sufficient lighting, good space management, sufficient privacy, housing subsidy, in-house activities, and employment of psychological consultants.

As 'career-developing environment' and 'poor organizational structure' have an impact on organizational performance and objective stress, companies need to ensure that C-PMs feel properly treated within the organizational hierarchy. Naturally, if a C-PM feels that there is no possibility of progressing, then his/her commitment, sense of belonging to the company and loyalty may fail. This finding corresponds closely with an earlier study by Weiss (1983) and El-Sabaa, S. (2001) who emphasised that career development difficulties and problems involving the organizational structure are significant sources of stress. Needless to say, the more complex the organizational structure in terms of rules and bureaucracy, the greater the intrapersonal conflict (Gmelch 1982). Leung et al (2009) added that, it would also inhibit one's personal creativity, which is 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 and El-Sabaa, S. 2001). 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.

***Developimg the Integrated Model - SEM Analysis***

SEM stands for Structural Equation Model and is the last step in developing the integrated model of stressors, stresses, stress-coping behaviours and their impact on the performance of C-PMs. To conduct the SEM analysis, AMOS version 22.0 was used and

the fit indices of the structural equation model. According to Kline (1998) and Hair et al. (2005), at least, four fit indices have to be considered to quantify the degree of the fit model. This study used five indices to obtain an acceptable outcome, these were: i) Relative chi-square ($X^2$/DF); ii) Goodness-of-Fit Index (GFI); iii) Adjusted Goodness-of-Fit Index (AGFI); iv) Root-Mean-Square Error of Approximation (RMSEA); v) Comparative Fix Index (CFI).

The first model (Model 1) was based on the relationships found in the correlation analysis. Therefore, all the observed relationships were included in model 1. However, since the objective of the model is analysing the impact of stress (and all the other stress-related aspects) on the performance (of C-PMs), the relationships with all aspects of the stress-related factors and all types of performance were considered as predictors. That means that in the first model, the three types of performances were established as endogenous variables (predicted by the others). Once model 1 was analysed, the fit indices were checked and the outcome was:

| Model | DF | X2 | X2/DF | RMSEA | GFI | AGFI | CFI |
|---|---|---|---|---|---|---|---|
| 1 | 145 | 164.451 | 1.13 | .026 | .746 | .667 | .875 |
| 2 | 140 | 141.160 | 1.01 | .014 | .767 | .684 | .993 |
| 3 | 138 | 130.210 | 0.94 | .000 | .781 | .698 | 1.000 |

Hair *et al.* (2005) state that DF/$X^2$ ratios about 3:1 or lower are associated with the better fit. Likewise, lower values of RMSEA and higher of GFI, AGFI and CFI (values between 0 and 1) are related to a better fit. Therefore, as shown above, model 3 had the best fit (reaching 0 for RMSEA and 1 for CFI). Based on this result, the final integrated causal

model of stressors, stress, stress-coping behaviours and performance is presented in **Figure 2.**

**INSERT FIGURE 2 HERE**

**Discussion of the SEM analysis**

SEM analysis enhanced the relationships seen in the correlation analysis and set an integrated model that includes the stressors, stress-coping behaviours and types of stress that affect the different types of performances of the work of C-PMs in the UK.

The causal model in Figure 2 shows that all types of performance are predicted by several factors. Task performance is negatively affected by physiological stress and by 'lack of cleanness'. This source of stress especially affects those C-PMs who spend most of their time on site, where that condition is often not under control. Unlike previous studies that were undertaken in Hong Kong, this research shows that task performance is not affected by objective stress or burnout. On the contrary, task performance was observed to be affected by physiological stress.

Moreover, burnout and objective stress are predictors of interpersonal performance on C-PMs. Burnout seem to be detrimental to interpersonal performance whereas objective stress affects interpersonal performance positively. In addition, interpersonal performance is improved by 'workgroup cooperation' (having a good relationship with superiors and subordinates), as Djebarni (1996) observed, due to the linking role of C-PMs, who have to coordinate the work of different parties (client, suppliers, subcontractors, etc.) that often have different objectives.

On the other hand, organisational performance is positively affected by burnout but only in a moderate way. Moreover, there are many stressors affecting organisational

performance: unexpectedly, 'workgroup cooperation' is shown to have a moderately negative impact on organisational performance; perhaps, that implies a relaxed environment that does not foster C-PMs to offer their best at organisational level. The fact that, 'role conflict' and poor 'organisational structure' have a positive impact on C-PMs organisational performance, indicates that C-PMs might try to show their best under those delicate circumstances. Organisational performance is negatively affected by a 'career-developing environment' and by a 'poor work environment'. This study shows that a poor environment, with noise, interruptions, and dirt ('lack of cleanness' factor) decreases C-PMs' performances (task and organisational), which has a high potential to stress, as Gmelch (1982) and Selye (1980) also specified.

Within the three types of stress included in this research work, physiological stress has no direct relationship with any stressor, aside from its impact on task performance mentioned above. However, physiological stress is related to two problem-focused coping behaviours in the present study: it has a negative relationship with 'thinking action', meaning that a thoughtful attitude before tackling a problem has a negative physiological impact on C-PMs. In addition, the model shows that an 'alternative thinking' (brainstorming) attitude has a positive influence on C-PM's physiological stress.

On the contrary, objective stress is not affected by any coping behaviour but has a positive relationship with 'poor organisational structure' and a negative relationship with 'career-developing environment' in this research work. Objective stress would be increased by a 'poor organisational structure' and would decrease in a 'career-developing environment'.

Burnout is positively related with the 'avoiding action' factor (emotion-focused behaviour) that includes attitudes towards forgetting about problems and deferring

decision-making. This observation shows a relationship that was not found in the Haynes and Love (2004) research work in the Australian construction industry. Additionally, burnout is positively related to the stressors 'role conflict' and 'poor home environment', as displayed by Leung *et al.* (2009) in their study of C-PMs and in their research work on cost estimators as well (Leung *et al.*, 2005a, 2007 and 2008b). The existence of these three factors ('avoiding action attitude', 'role conflict' and a 'poor home environment') would lead to burnout of C-PMs.

Furthermore, the present research work outlines a positive relationship among 'emotional discharge' (emotion-focused behaviour), 'alternative thinking' and 'support seeking' (both problem-focused behaviours). And, although the stress-coping behaviours are the only stress-related factors that do not directly influence the performance of C-PMs, some of them are related to a few stressors: the existence of a 'poor home environment' of a C-PM is shown as positively related to his/her 'thinking action' and 'emotional discharge' behaviour. In addition, a 'poor organisational structure' has a negative relationship with 'thinking action' and a slightly positive one with 'avoiding action' as an attitude towards problems. Furthermore, a positive relationship between 'workgroup cooperation' and 'thinking action' is shown in the causal model developed in Figure 1.

The stressors take a big part in the developed model in the present study. Aside from the previously described relationships, there are other interrelationships displayed: 'career-developing environment' is negatively related to 'poor work environment' and to 'lack of cleanness', but positively with 'workgroup cooperation'. In addition, the stressor 'workgroup cooperation' has a negative relationship with the 'role conflict' of C-PMs, which is positively related to 'poor organisational structure'. The model developed here

shows, as well, that ‘’organisational structure’ and ‘work environment’ have a positive impact on C-PMs.

## Summary and conclusions

This research was conducted based on literature review and structured questionnaire, which was formulated and fully completed by 44 C-PMs across the UK. The aim was to develop a structural equation model (SEM) that shows the causal relationships between stressors, stress, stress coping behaviour and performance of the C-PMs. The statistical package SPSS and AMOS were utilised to analyse the data in order to obtain the best-fit model that is presented in **Figure 1.**

### *Summary of stress related factors*

Three types of stress related factors were identified and measured in this research, namely, objective stress, burnout and physiological stress. The level of objective stress (also called job stress) refers to the evaluation of a threat arising from cognitive factors and improves the C-PMs interpersonal performance. On a daily basis, those cognitive factors affecting C-PMs are project deadlines, the number of tasks (too many meetings, frequent phone calls, numerous site visits or too much paperwork) and the difficulty of the tasks (conflicts, complex decisions to make, lack of time. Objective stress was measured by the difference between expected and actual ability to perform a task and both abilities were rated from 1 to 7. The means of items related to objective stress were rather low (below 1.00 with standard deviations between 0.818 and 1.267).

The mean scores for burnout stress and physiological stress are somewhat higher than the objective stress but still rather low (just over 2.00 with standard deviations between 1.017 and 1.780 for burnout and between 1.129 and 1.646 for physiological stress).

Burnout stress (occurs as a result of a complex interaction of individual characteristics and issues in the work environment) is the type of stress that has the highest impact on the performance of C-PMs, being detrimental to their interpersonal performance and positive for their organisational performance. The symptoms of burnout include changes in the social life of individuals (i.e., C-PMs could avoid communicating with people at home or in their private life), low attitude to work (i.e., low motivation, low commitment and low accomplishment complaints) and withdrawal behaviour (i.e., being late for work, absenteeism and even quitting). Whereas physiological stress refers to factors such as adverse work environment, imprecise and inconsistent job responsibilities, poor interpersonal relationships or excessive work overload affect stress experienced by C-PMs.

***Summary of stressors related factors***

Results of this research shows that 'workgroup cooperation' (personal stressor) has a mean over 5 (standard deviation between 1.227 and 1.336), 'career-developing environment' (organisational stressor) has means close to 5 (from 4.680 to 5.090) and standard deviation between 1.567 and 1.665), 'work overload' (task stressor) shows means over 4 (from 4.270 to 4.700 and standard deviations of 1.436 and 1.488 respectively. Further analysis of the respondent's questionnaire shows that 'work cooperation', 'career-developing environment' and 'work overload' are, positively or negatively, the most common sources of stressors for C-PMs. Workgroup cooperation has an impact on the interpersonal performance in a positive way but is detrimental to the organisational performance. In contrast to the observations described in the literature review, the work overload of C-PMs has no direct impact on any type of performance. This study also shows that both, problem-focused and emotion-focused stress coping behaviours, are related to stress and stressors but do not have a direct impact on the performance of C-PMs. Regarding the stress-coping

behaviour of the C-PMs who responded the questionnaire, it is worth noting that 37 out of 44 respondents stated that they follow a problem-focused stress-behaviour, representing an 84.1 % of the respondents.

The causal model has been developed, and takes account of the most common stressors in the construction industry, which are 'role conflict', 'career-developing environment', 'poor home environment', 'poor organisational structure', 'work cooperation', and 'work overload'. This study also added 'lack of cleanness' and 'poor work environment'.

Finally, in order to evaluate if the size of the company is related to the stress that C-PMs suffer from, Pearson correlation and regression analysis were applied to the three types of stress and the results were as follows:

- Objective stress: -0.075 (Pearson correlation) and 0.006 (R square)
- Physiological stress: 0.221 (Pearson correlation) and 0.049 (R square)
- Burnout: -0.002 (Pearson correlation) and 0.000 (R Square)

All the values were too close to zero to mean any relationship between the size of the companies and the level of stress that the C-PMs experience.

The study outcomes and the developed model have wider implications and ramifications to construction project managers, human resources departments of construction companies, and the construction industry generally. The different sources and typologies of stress and the impact they have on productivity provide an opportunity for organisations to "focus minds" on those issues that are likely to impact on the welfare and wellbeing of their staff. Similarly, it should provide targeted attention on those stress-related issues that impact on construction productivity. Talent managers, recruiters, and

HR professionals in construction may find the study outputs and model useful in informing. and putting together the most appropriate supportive and developmental programme for new and upcoming mangers entering the construction industry as part of a wider "health and welfare" programme. In the same way, the study outputs may inform educational materials on stress and wider mental issues in educational establishment that offer courses in construction related disciplines.

## Limitations and Recommendations

The construction work environment is continuously changing, especially with the advent of "digital construction". With the introduction of Building Information Modelling (BIM), Internet of Thins (IoT), and Big Data Analytics (BDA), the impact that these are likely to have on an increasingly "pacy" construction environment, especially with regards to these as potential sources of stress in certain circumstances is worthy of further consideration and research. This research considered Construction Project Managers (C-PMs) in the UK, and drew from forty-four (44) usable questionnaires. There is ample scope for comparative and international research that looks at different professionals in the construction industry in terms of the sources and impact of stress in the professions, in an increasingly changing global construction industry, together with the role of professional bodies, industry, organisations, policy makers and higher education institutions in playing vital roles in addressing this important area that impacts on health & welfare of individuals, as well as the productivity of organisations and nations. Again, with an increasing level of Mental Health issues in construction, as well as with students involved in Higher Education (especially students off Architecture), there is need to consider the transition of these students (future professionals and leaders of the

construction industry) from universities to industry, and how they are best placed to cope with stressful construction environments and other mental health issues.

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| Structural equation modelling of occupational stress in the construction industry | ZA | 2014 | Bowen, P., Govender, R., Edwards, P. | JCEM |
| Occupational stress and job demand, control and support factors among construction project consultants | ZA | 2014 | Bowen, P., Edwards, P., Lingard, H., Cattell, K. | IJPM |
| Impact of job stressors and stress on the safety behavior and accidents of construction workers | HK | 2015 | Leung, M.Y., Liang, Q., Olomolaiye, P. | JME |
| Exploring and validating the internal dimensions of occupational stress: evidence from construction cost estimators in China | CN | 2015 | Xiong, B., Skitmore, M., Xia, B. | CME |
| Development of a mindfulness–stress–performance model for construction workers | HK | 2016 | Leung, M.Y., Liang, Q., Yu, J. | CME |
| Stress among South African construction professionals: a job demand-control-support survey | ZA | 2016 | Cattell, K., Bowen, P., Edwards, P. | CME |
| Managing the work-family interface: experience of construction project managers | AU | 2016 | Turner, M. and Mariani, A. | IJMPB |

AJCEB *Australasian Journal of Construction Economics and Building*
BRI *Building Research and Information*
CME *Construction Management and Economics*
ECAM *Engineering, Construction and Architectural Management*
ER *Employee Relations*
IJMPB *International Journal of Managing Projects in Business*
IJPM *International Journal of Project Management*
JCEM *Journal of Construction Engineering and Management*
JME *Journal of Management in Engineering*
SM *Stress Medicine*
WS *Work and Stress*

Table 1 – Historical trend of published papers related to stress by year, country, authors and journals

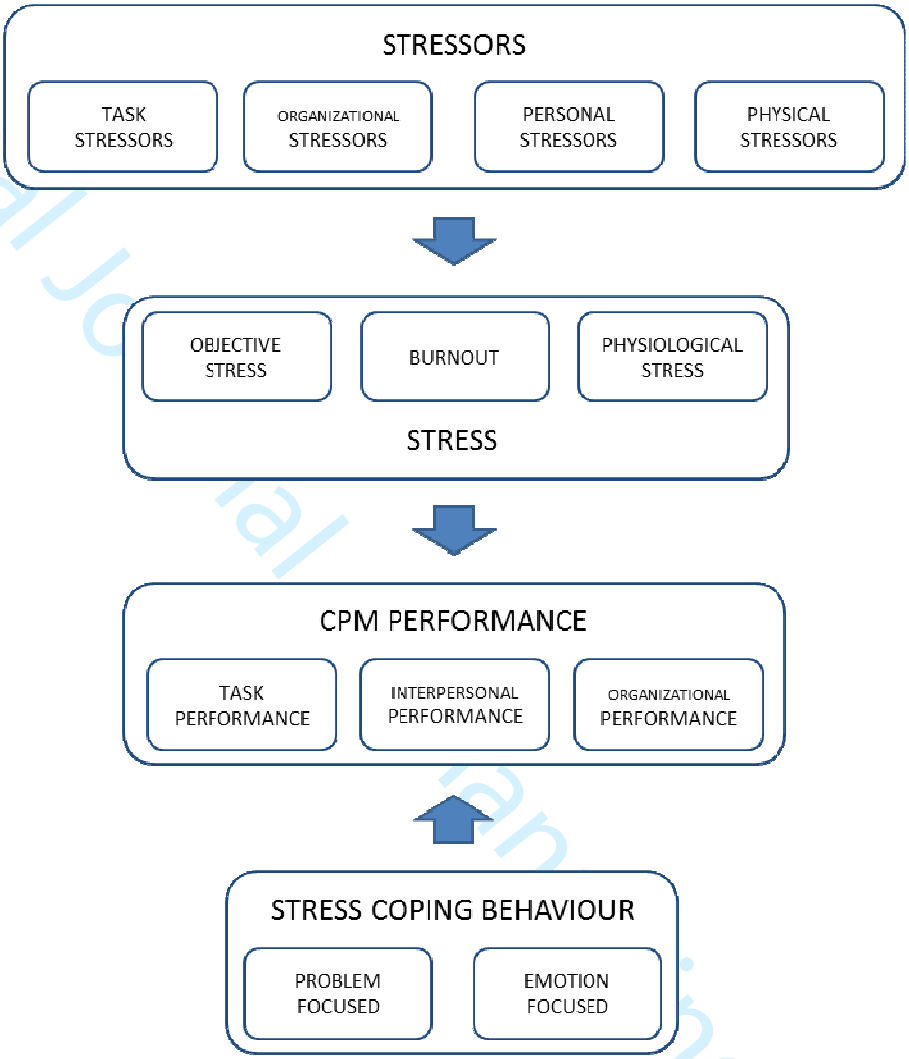
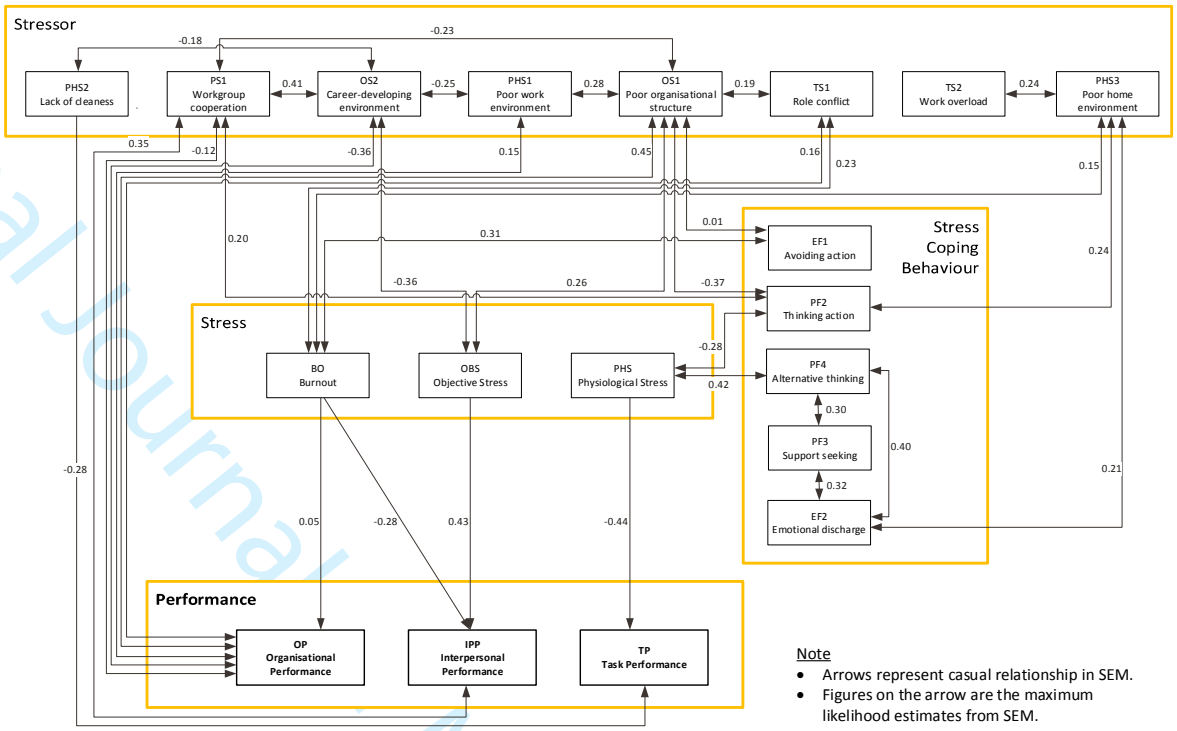



**Figure 1. The research framework**




Note

- Arrows represent casual relationship in SEM.
- Figures on the arrow are the maximum likelihood estimates from SEM.