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ORIGINAL PAPER

Effects of low carbon waste practices on job satisfaction of site managers through job stress

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Abstract Low carbon construction has recently become an international issue as construction companies, governments, and communities have witnessed an increasing concern about the degradation of natural resources and pollution in the environment. Although literature abounds with studies investigating the positive impact of low carbon construction on decreasing the emission of carbon in the construction industry, following a low carbon practice might come into conflict with job satisfaction amongst construction site managers, which in turn can negatively affect companies' performances. This study examines the mediating effect of job stress to investigate the indirect effects of low carbon waste practices on job satisfaction. Data from a survey of 110 site managers of construction companies in Malaysia were examined through the application of the partial least squares technique. The results of the study advocates that unlike the reduce waste management practices, the two other low carbon waste practices, recycle and reuse management practices, positively and directly affected job stress. It was also revealed that only recycle waste management practices negatively and indirectly affected construction site managers'

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job satisfaction via job stress. The findings of the research presents an extent of caution for the managers of those construction companies which execute low carbon waste practices regarding the potential impact of low carbon practices on job stress and job satisfaction. From the job stress and job satisfaction points of view, the construction companies should give priority to waste reduction practices amongst low carbon waste practices.

Keywords Low carbon construction · Waste management · Job stress · Job satisfaction · Malaysia

Mathematics Subject Classifcation 62G08

1 Introduction

A great amount of carbon is emitted directly or indirectly into the atmosphere by construction sections (Yusof et al. 2016a; Esmaeilifar et al. 2015). The high amount of carbon dioxide (CO_2) in the atmosphere has been thought to raise an urgent problem. This has worsened environmental dangers (Zailani et al. 2014). One of main greenhouse emitters is the construction industry, which has been criticised for violating the rules of carbon emission management (Wang 2014; Yusof et al. 2016b). Concerning an increasing pressure on the dangers related to the climate change, construction companies should advocate cutting back on the carbon emission if they intend to achieve emission controls (Sharrard et al. 2007; Hajibabai et al. 2011; Wong et al. 2013). Implementing low carbon waste (LCW) practices is a vital solution for reducing waste caused by construction activities (Yusof et al. 2017; Begum et al. 2006). Therefore, implementing LCW practices is of such importance that there has been an increased attention towards it in research and practices recently carried out on construction (Ding et al. 2016; Vieira et al. 2016).

A large amount of research has been undertaken on sustainable construction in terms of the influence of the rapid growth of the infrastructure on the environment (Shen and Zhang 2002; Zhang et al. 2000), consideration of the flow of waste and construction site control (Tam et al. 2007; Shen et al. 2004), examination of the sustainable operation of construction sites, and contractor performances (Liyin et al. 2006; Shen and Tam 2002; Shen et al. 2005; Tam et al. 2006). These studies demonstrated the negative impacts of construction activities on the environment, sought proper practices to reduce site waste and emission generation, and showed the positive relationship between implementing LCW practices and the environmental performance of construction companies. However, the principle of LCW practices irrespective of the substantial advantages has still been controversial with regards to the well-being of humans (Shen et al. 2004).

Stress in the workplace or job stress (Bergerman et al. 2009) is described as the response people may have when ‘‘presented with work demands and pressures that are not matched to their knowledge and abilities, and which challenge their ability to cope’’ (Leka et al. 2003, p. 3). The volume of work required of an employee and the

perception that there is too much to do during a given period is listed as the most common sources of stress (Torres 2016). Research supports the direct effect of workload level on specific forms of workplace deviance, such as absenteeism (Bakker et al. 2000), as well as on the job dissatisfaction (Rössler 2012), and turnover (Torres 2016).

There is a potentially persistent discrepancy between LCW practices and job satisfaction from the workload and job demand perspectives. Besides completing their own tasks, site managers might need to work hard overtime to fulfill the demands of the LCW practices. Site managers' job stress is likely to rise due to such issues as process reconfiguration, infrastructure initiation, and redesigned jobs (Haynes and Love 2004; Liu and Low 2011; Gatti et al. 2010; Leung et al. 2009), which could result in job dissatisfaction (Bohle et al. 2011; Macklin et al. 2006; Lee 1995). As an important issue, particularly to the construction industry in Malaysia, job satisfaction could be mentioned due to the high rate of employee turnover (Ismail et al. 2012). Thus, job stress may be one of the major issues in implementing LCW practices. However, little, if any, research has been undertaken on the impacts of LCW management activities on site manager's job satisfaction and job stress. The current research intends to resolve this gap through the effect of LCW management activities on job satisfaction via job stress. The results are expected to be useful for site managers whose job appears to be one of the most stressful careers.

2 Literature review

2.1 Job stress

A large body of literature has discussed the outcome of stress in the work place. From an organisational point of view, job stress will lead to lower job satisfaction (Lambert and Paoline 2010), reduced organisational commitment (Dowden and Tellier 2004), negative safety outcomes (Finn 1998), an increase in turnover (Lambert et al. 2010), increased absenteeism (Dowden and Tellier 2004), and higher use of sick days (Finn 1998). Considering the increasing recognition and acceptance of the adverse impacts of job stress on individuals and organisations, the other stream of research has pointed to the multiple factors that have been implicated in stress. Organisational stressors, such as work overload, role conflict, under-promotion, and level of participation, interact with individual factors, such as personality and family problems, to create mental and physical ill health in employees (Finney et al. 2013). Job stress can also result from an imbalance between the demands placed on individuals and their ability to cope (Karasek 1979) or an imbalance between employees' efforts on the job and the subsequent rewards they receive (Siegrist 1996). Management is one the most stressful carriers (Cohen 1997; Noblet et al. 2001). The great deal of the stress experienced by managers has turned out to be the primary concern which has a fundamental role in the company (Noblet et al. 2001). In companies, managers express that stress related to work has a direct influence on health threats as well as the organisation's success (Haynes and Love 2004).

The sector of construction has been known as a stressful area, and many experts working in this area have experienced stress (Leung et al. 2011).

Compared to managers in other industries, projects managers of construction projects have been reported to significantly suffer from more stress (Sutherland and Davidson 1993; Khosh and Kerzner 1984; Sommerville and Langford 1994). It has also been reported that site managers are exposed to demanding and difficult situations; they are subject to an over abundant workload and long hours of working (Love et al. 2001; Farrell and Gale 2000). Studies have been undertaken to spot the possible drivers of stress, the negative impacts of stress on actions, as well as professionals' behaviour when dealing with stress on the construction site (Loosemore and Waters 2004; Janssen et al. 2001; Leung et al. 2005a, b). The management of the site is recognised to have a vital role in the projects of construction because of the overall effect that it has on the cost and quality of the projects (Farrell and Gale 2000; Haynes and Love 2004). Although, little research has been undertaken on the factors that affect the amount of stress put on site managers who play an important role in the success of the projects and suffer from extremely stressful situations (Leung et al. 2011). Therefore, in this study the impacts of LCW practices on site managers' stress were investigated.

2.2 Job satisfaction

According to Ilies and Judge (2004), job satisfaction is considered as an attitudinal construct that manifests an evaluation of the person towards his/her job. It is also described by Schneider and Snyder (1975, p. 318) as referring to a personal assessment of one's current job's condition, or the occurred consequences due to having a job. The studies of Iranmanesh et al. (2012) and Diaz et al. (2012) showed that high levels of work stress are associated with low levels of job satisfaction. Moreover, Cummins (1990) emphasised that job stressors are predictive of job dissatisfaction and a greater propensity to leave an organisation. This is to say that, job satisfaction is concerned with the perception and evaluation of a person of his/her job, which is shaped by the individual's specific conditions, such as his/her needs, expectations, and values. Since job satisfaction is likely to make large turnovers and, consequently, influence the overall performance of an institution in business, it is considered as one of the fundamental aspects which is required to be considered by a company (Ton and Huckman 2008). As maintained by Galbreath (2006), employees are regarded as one of the main stakeholders of a company.

Job satisfaction seems to be one of the controversial issues in companies. Experts argue that this could be ascribed to the fact that job satisfaction could have a significant effect on the conduct of the labour market, productivity and effort of job, workers absenteeism, and turnover. The job dissatisfaction could lead to the low performance of site managers which costs the construction industry a lot (Oduro-Owusu 2013). There is a positive link between a high degree of job satisfaction and desirable job outcomes, such as great rehabilitation, life satisfaction, and a good compliance with the goals and regulations of organisations (Lambert et al. 2005, 2007). Considering the importance of job satisfaction, the potential indirect effects of LCW practices on job satisfaction were investigated in this study.

2.3 Low carbon waste management practices

Over the last ten years, the issues of construction and demolition waste have come to the centre of attention amongst managers and researchers worldwide. A large amount of research has been conducted on different aspects of construction waste management (WM) in top-tier journals (e.g., Yuan 2013; Li et al. 2014). Serpell and Alarcon (1998) define waste in terms of construction activities that either directly or indirectly produce cost; these activities, however, do not produce value in the product or process. Davies (2008) comprehensively defines waste as a useless and unwanted substance coming from a variety of sources including industry, business, agriculture, and households, and it could be in different forms, such as liquid, gas, and solid, and depending on the concentration and location it could be dangerous or safe. 35% of the world' solid waste comes from construction debris and demolition activities (Hendriks and Pietersen 2000); the solid waste is usually dumped in uncontrolled sites or some other appropriate landfills and places. It seems that the waste coming from demolition and construction plays the role of a major pollutant in construction activities (Yuan 2013).

In order to manage and minimise the influence of waste on the environment, three alternative methods, including recycling, reusing, and reducing were presented and were tried to lower the cost of disposing of waste (Li et al. 2014). Amongst the European Union members, there is a high demand for resources for construction activities and a high amount of material is wasted during these construction activities (European Environmental Agency 2007). For example, McGrath and Anderson (2000) found that around 10–15% of the material imported to a construction site is exported as waste. In another study, Yahya and Halim Boussabaine (2006) found that 25% of construction materials are wasted during construction operations.

In the construction projects, a great deal of power and fuel is used to operate equipment, thus producing a great amount of waste. The resulted waste negatively impacts the environment in different ways, such as the deterioration of land, energy use, generation of waste, emission of greenhouse gas and dust, the use of non-reusable natural resources, and noise pollution. This in turn brings out soma fatal consequences, such as air pollution, water pollution either on the surface or under water, health risks, and the demolition of natural resources. That is why a lot of criticism has been directed towards the construction sector as the main waste producer which has long degraded the environment worldwide.

Due to the negative environmental impact of the waste, numerous studies have been conducted to examine different aspects of low carbon activities in order to manage the waste produced by construction projects. As a result of the negative impact of waste during the construction stages to the environment, a plethora of research has been published investigating critical low carbon practices to effectively manage the waste which has been caused by construction. As long as there is intense competition, shortage of natural resources, and high standards for protecting the environment, there is a compelling demand to replace old methods with alternative ones which are in line with a low amount of waste production in construction activities. LCW management advocates recycling, reusing, and reducing waste in order to minimise the amount of waste. In general, in construction WM, reduce, reuse, and

recycle (3Rs) are proposed as principles and priorities to categorise the strategies of the waste management in terms of desirability.

3 Model conceptualisation and hypothesis development

3.1 Waste hierarchy

The "3Rs" principle, which is considered as the hierarchy of construction WM, has been used to guide the study and research on three "Rs" construction WM. The principle deals with the 3Rs of recycle, reuse, and reduce which places WM strategies in different categories based on their desirability (Peng et al. 1997; Faniran and Caban 1998). Indubitably, as stated by such researchers as Esin and Cosgun (2007) and Poon (2007), the most desirable way of waste management is Reduction as the top 'R' in the hierarchy. It can thus be argued that, since compared to other alternatives there are both direct economic as well as other advantages to source reduction; the rule can also be applied in construction waste. However, the high potentiality of construction materials being reused on-site and recycled off-site (Hettiaratchi et al. 2010), the other two 'Rs', namely Reuse and Recycling, has also become interesting.

Also, the 3Rs has a hierarchy order ascending from a low to high adverse impact on the environment. By considering the principles of handling materials on the construction site, the idea of reducing or even stopping producing waste could be developed; thus, the construction activities could be handled more efficiently (Skoyles and Skoyles 1987). The following lines shed more light on the concept of 3R.

3.1.1 Waste reduction

Waste reduction is concerned with the functional areas within the company (Manrodt et al. 2005). According to Lu and Yuan (2011), waste reduction is a procedural method to demolish and decrease waste at the source of production. In this study, waste reduction refers to the methods that construction companies have implemented to demolish and decrease the waste of construction projects. Construction waste reduction has been suggested as one of the most influential methods in decreasing and eliminating waste generation and disposal problems (Wang et al. 2015). There are two main advantages associated with waste reduction (Poon 2007; Esin and Cosgun 2007): (a) the prevention of construction waste production and (b) the reduction of the costly charges of recycling, transporting, and disposing of the waste.

Waste reduction is one the most versatile and effective ways to manage waste. Not only does it lower the waste production, it also decreases the expenditure of transporting, disposing of, and recycling waste (Esin and Cosgun 2007; Poon 2007). Being considered as the priority for waste management, waste reduction has come to the centre of attention amongst many researchers (e.g., Begum et al. 2007; Baldwin et al. 2007; Poon et al. 2004; Seydel et al. 2002; Hao et al. 2008). In order to save energy, avoid producing CO_2, and achieve environmentally friendly standards, it is vital to seek new ways to reduce the waste production during construction projects. Anderson-Connolly et al. (2002) found that seeking new ways for doing an activity and workplace change

considerably impacts the managers' both physical and psychological well-being. Having to complete a project on time, to a desired quality, within budget as well as satisfy a wide range of stakeholder objectives, which are often conflicting, can subject a project manager to job stress. This implies that site managers may experience a role conflict when the site managers need to practice waste reduction and at the same time complete the project on time within a scheduled budget. It means that conflicting demands are placed on the site manager. Previous studies revealed that role conflict is negatively associated with job stress (Elloy and Smith 2003). Consequently, it is probable that site managers experience stress when a construction company gets:

H1 Waste reduction practices positively affect the job stress of site managers.

3.1.2 Waste reuse

Reusing waste refers to the process of using the same material for more than one time. This process includes the application and usage of the same material for the same function, for instance timber formwork in construction (Ling and Leo 2000). There is another form of reuse where the material is utilised as a raw material for a new purpose. An example of this type of reuse could be the re-utilisation of cut-corner steel bars to be reused for shelves or the reuse of bricks and concrete's fraction to be used as road base materials. This type of reuse is called new-life reuse by Duran et al. (2006). Nevertheless, the production of waste is unavoidable. This is, however, despite the fact that, as discussed by Peng et al. (1997) and Esin and Cosgun (2007), the most influential and efficient way of diminishing waste production and, accordingly, removing numerous environmental and waste disposal problems is considered to be waste reduction. Recycling and reusing procedures are considered as the optional methods in diminishing the amount of waste entering landfills. According to Peng et al. (1997), since reuse requires less usage of processing and energy, it is considered as the most favourable alternative after reduction.

Nevertheless, the site managers should devote extra time and effort for implementing waste reuse practices. For example, organising waste into such categories as demolition and packaging materials, concrete, wood, and plastic as a part of waste reuse methods needs special attention and effort from site managers (Shen et al. 2004). This time-based conflict may cause pressure on site managers and, consequently, lead to job stress (Green and Zenisek 1983). Considering the stressful nature of the site manager career and the high amount of workload, the extra work which is needed for implementing waste reuse practices may increase the work pressure. As such, the following hypothesis has been developed:

H2 Waste reuse practices positively affect the job stress of site managers.

3.1.3 Waste recycle

Waste recycling is the third practice to lower waste generation in the construction sector. The recycling strategy is taken into account in situations when it is not

possible to reuse the produced waste. Recycling turns the waste into new materials. There are a number of benefits identified by Kartam et al. (2004) and Tam (2008) for waste recycling. These advantages include: (1) the reduction of new resource demands; (2) the reduction of transportation and production costs and energy; (3) the application of waste which, if not used, would be lost to landfill sites; (4) the preservation of land for prospective improvements in the urban area; and (5) the improvement of the environmental condition in general. One of the main hurdles in promoting recycling practices in construction is the existing concerns about the additional costs that may occur by recycling. In addition, the quality of the recycled materials also acts as an additional barrier. However, the potential impact of waste recycling on the job stress of site managers can be another limitation for practicing waste recycling which has been investigated in the present study. The recycling practices, such as designing a specific area on the construction site for recycling processes or returning the material to the supplier for reprocessing, need special attention and effort from site managers which may lead to a higher job stress. Therefore, the following hypothesis has been developed:

H3 Waste recycle practices positively affect the job stress of site managers.

3.2 Job stress and job satisfaction

Several studies have tried to determine the link between stress and job satisfaction. Job satisfaction and job stress are the two hot focuses in human resource management researches (Bohle et al. 2011; Iranmanesh et al. 2012; Diaz et al. 2012). Grossi et al. (1996), Lambert (2004), and Lambert et al. (2007) also showed that high levels of job stress are associated with low levels of job satisfaction. Johnson et al. (2005) carried out a study in the UK and found that there were some occupations that were reporting worse than average scores on each of the associated factors, such as physical health, psychological well-being, and job satisfaction. The high job stress caused by LCW practices was expected to reduce site managers' satisfaction. Since being a site manager indicates a stressful profession in nature, this study examined the negative impact of stress on site managers' satisfaction. Accordingly, the following hypothesis was formed:

H4 Job stress negatively affects the job satisfaction of site managers.

3.3 Indirect effects of LCW practices

Generally speaking, LCW practices have been accompanied with numerous changes. As maintained by Diaz et al. (2012), the implementation of LCW practices results in the increase of job stress in site managers which is associated with substantial changes in reconfiguration, process methods, redesigning, and reengineering workers' jobs. These changes demand managers to exert wider skills (Loch 1998). According to Bohle et al. (2011), job dissatisfaction results as a consequence

of factors such as managers' lack of effectual and broad skills with a higher level of workload, as well as a high level of stress due to the lack of available time.

Thus, the high job stress caused by LCW practice implementation is expected to reduce site managers' satisfaction. Furthermore, Sutherland and Davidson (1993) investigated the stress audit amongst the managers of the sites and projects. They found that job stress mediates the relationship between ambiguity (i.e., task and role) and job satisfaction. Sutherland and Davidson (1993) report that job dissatisfaction is positively related with a stressful task and the roles amongst the construction managers. Considering that the implementation of LCW practices requires a high level of work integration, site managers face comprehensive responsibility and job stress which may lead to job dissatisfaction. Accordingly, the following hypotheses has been developed:

H5 Waste reduction practices have a negative indirect effect on job satisfaction through job stress.

H6 Waste reuse practices have a negative indirect effect on job satisfaction through job stress.

H7 Waste recycle practices have a negative indirect effect on job satisfaction through job stress.

4 Methodology

4.1 Data collection and the sample

The sample used in the study involved G7 construction firms which were operating in Malaysia's construction industry. This study, in fact, took advantage of the G7 contractors due to a high range of partnerships on construction projects. In addition, they had the highest experience in green building projects in Malaysia. In 2009, 4326 G7 construction companies had been registered in Malaysia (CIDB 2009). In the present study, the population sample consisted of site managers working in construction companies in Malaysia. The reason for selecting these respondents was based on their direct engagement with the waste action process which had made them highly experienced and knowledgeable in dealing with low carbon waste actions in their respective firms. The questionnaires were directly distributed amongst the construction managers in each given company. Nearly 300 questionnaires were distributed in a period of three months from September to December 2015. A total of 122 questionnaires were returned. Of the collected surveys, 12 questionnaires were discarded since they were uncompleted; whereas, 110 questionnaires were completely filled out. In total, out of the 300 questionnaires, 110 acceptable questionnaires, with an acceptable response rate of 36.6%, were returned.

The majority of the participants were male (63.6%) and the rest were female (36.4%). Considering the respondents' academic qualifications, there is a descending order ranging from bachelor's degree (57.3%), certificate or diploma (22.7%),

master's degree (15.5%), and the rest of the respondents had other types of degrees. The most of the companies were based in Selangor (36.4%), 32.7% were based in Kuala Lumpur, 14.5% in Pulau Penang, and the remaining companies (16.30%) were based in other areas such as Putrajaya, Johor, and Kedah. As for the companies' size, in descending sequence, the largest companies had 100 workers (62.6%), followed by companies with 50–99 workers (22.7%), and finally small companies had 1–49 workers (13.6%).

4.2 Measure of constructs

A structured questionnaire was developed as the tool of the quantitative survey. Six parts were developed in the questionnaire: the demographic data of the participants, LCW practices (reduction, reuse, and recycling practices), job stress as well as job satisfaction. In addition to the basic information about the respondents and the companies, 5-point Likert scales were employed in the evaluation of the questions. The Likert scales ere ranged from "strongly disagree" to "strongly agree". The content validity of the items was supported since they were adapted from other relevant studies in this domain. The scales assessing the LCW practices were adapted from Poon et al. (2001), Peng et al. (1997), Treloar et al. (2003), Dainty and Brooke (2004), Shen et al. (2004), and Griffiths (2011). The scales for job stress were adapted from Higgins et al. (2010), and the job satisfaction items were adapted from Thatcher et al. (2002) and Fredman and Doughney (2012).

4.3 Data analysis

Structural Equation Modelling (SEM) has been widely applied by numerous researchers (Babin et al. 2008; Mosteller et al. 2014). The reason for the application of SEM is its capability in performing a wide range of theories and concepts (Rigdon 1998). There are two techniques that are likely to be applied in SEM: either covariance-based techniques (CB–SEM) or variance-based partial least squares (PLS–SEM). This study took advantage of the PLS-SEM method of structural equation modelling employing the SmartPLS Version 3.0 to assess the structural model. PLS-SEM generally makes no assumptions about the data distributions and PLS is a nonparametric technique (Hair et al. 2014). The exploratory nature of the present study was the main reason for selecting this method (Hair et al. 2011). As is suggested by Hair et al. (2014), for the purpose of data analysis, a two-step framework was applied in the current attempt. Whilst the first step involved the measurement model analysis, the second one involved the investigation of the structural correlation that could have existed amongst the latent variables (see Zailani et al. 2016; Soltanian et al. 2016; Nikbin et al. 2016). Based on this approach, the measures of reliability and validity were determined before assessing the structural relationship model.

5 Results

5.1 Common method variance

As Podsakoff and Organ (1986) put, common method bias brings out some problems as one single latent construct is responsible for most of the variance. Several methods were employed to test the common method variance, including Harman's one-factor test. We also performed an un-rotated principal component analysis on all of the measurement items, finding that the first factor accounted for only 29.54% of the total 62.41% variance, thus implying that common method bias might not be as problematic as it was expected. The construct correlation matrix (Table 2) shows that each of the inter-construct correlations was less than 0.75; however, the common method variance is usually evidenced by correlations greater than 0.90 (Bagozzi et al. 1991). We also measured for the full collinearity variance inflation factors for each of the constructs, which refers to the vertical and lateral collinearity amongst the constructs (Kock and Lynn 2012). These variance inflation factors can be used to assess the common method variance, providing for a more conservative test than the traditional exploratory factor analysis (Kock 2013). To rule out the common method bias, the variance inflation factors should be lower than 3.3 (Kock and Lynn 2012). The full collinearity variance inflation factor of all of the constructs in the model was less than 3.3. Therefore, having tested for the common method variance using three different approaches, we can reasonably conclude that the common method bias was not a serious threat in the present study (Fig. 1).

5.2 Measurement model results

The reliability as well as the validity of the reflective constructs were determined. Composite reliability (CR), similar to Cronbach's alpha, was determined with regards to internal reliability. As it can be seen in Table 1, the number of more that

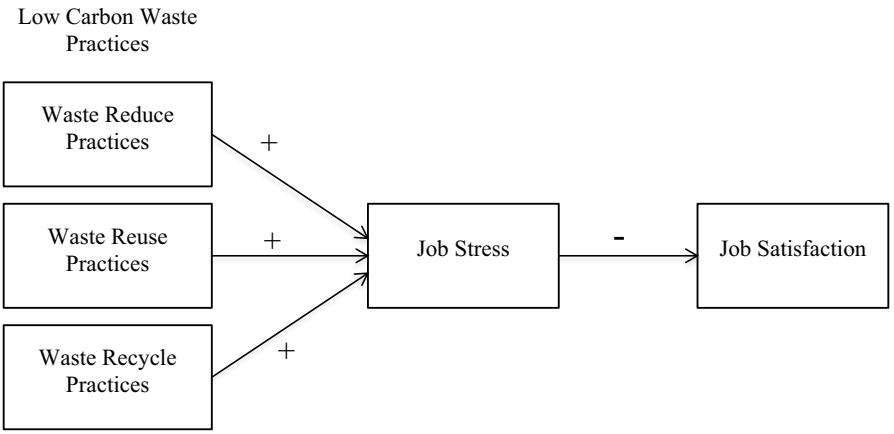

Fig. 1 Proposed theoretical model

Table 1 Measurement model evaluation

Constructs	Items	Factor loading	CR	AVE
Waste reduce (WRE)	Adopting a just-in-time delivery strategy to eliminated long-term site storage that is cause of damage and waste	0.783	0.902	0.649
	Makes contractual clauses to penalise poor waste performance	0.827		
	Increases the use of off-site prefabrication to control the waste and damages	0.785		
	Uses waste auditing to monitor and record the environmental performance on-site	0.814		
	Where construction materials cannot be reused on site then sell materials to salvage	0.817		
Waste reuse (WRU)	Reuses the industrial materials such as concrete in construction projects	0.856	0.851	0.656
	Reducing waste by the reuse of second-hand materials	0.839		
	Dedicates specialist sub-contract package for on-site waste management	0.730		
Waste recycle (WRC)	Recycles the construction site materials and demolition debris	0.752	0.916	0.688
	Reducing waste by the use of materials with recycled content	0.836		
	Recycle the material for other uses or return to the supplier for reprocessing	0.803		
	Designs a specific area on the construction site for recycling process	0.883		
	Provides the waste skips for the specific construction materials	0.864		
Job stress (JST)	Been upset because something happened unexpectedly	0.776	0.896	0.642
	Felt unable to control important things in your life	0.827		
	Felt nervous or stressed	0.815		
	Found could not cope	0.770		
	Been angered because of things outside of your control	0.833		
	Felt difficulties so high could not overcome them	0.712		
Job satisfaction (JS)	Overall, I am satisfied with my job	0.925	0.952	0.800
	I am satisfied with the way I work at the moment	0.871		
	I am satisfied with the important aspects of my job	0.912		
	I would like to stay at this institution even if I were offered a decent job elsewhere	0.862		
	I have a higher degree of work satisfaction now	0.900		

CR composite reliability, *AVE* average variance extracted

0.7 was obtained for all variables' CRs which met the criteria proposed by Hair et al. (2013). Based on Hair et al. (2010), the minimum loading of 0.6 supports the acceptance of an item. Due to the loading of above 0.6 for all scales, each item's reliability was fairly investigated. Convergent validity was examined based on average variance

Table 2 Discriminant validity coefficients

	Mean	SD	WRD	WRU	WRC	JST	JS
RWD	3.594	0.881	**0.805**				
WRU	3.487	0.931	0.731	**0.810**			
WRC	3.581	0.893	0.742	0.728	**0.829**		
JST	3.476	0.783	0.456	0.462	0.491	**0.810**	
JS	3.583	0.721	0.284	0.234	0.315	− 0.302	**0.894**

Bold values represent the square root of average variance extracted (AVE)

WRD waste reduce, *WRU* waste reuse, *WRC* waste recycle, *JST* job stress, *JS* job satisfaction

extracted (AVE). The constructs' AVEs were greater than 0.5, implying an acceptable level of convergent validity (Fornell and Larcker 1981).

The constructs' discriminant validity was examined based on two approaches (see Nikbin et al. 2014; Zainuddin et al. 2017, Iranmanesh et al. 2017). First, the indicators' cross loadings were assessed; this did not indicate any indicator loads above any opposing construct (Hair et al. 2012). Second, based on the Fornell and Larcker (1981) benchmark, for each construct, AVE's square root ought to be above the variables' intercorrelations with other constructs in the model (Table 2). The discriminant validity was supported by the findings obtained from both analyses for all of the constructs. As Table 2 shows, reuse management (RUM) (mean 3.487), recycle management (RCM) (mean 3.581), and reduce management (RDM) (mean 3.594) meet an acceptable degrees among the Malaysian construction companies. That is, considering the manager's perceptions, JS (mean 3.583) and WS (mean 3.476), which were quite high, were noteworthy outcomes in the study.

5.3 Assessment of the structural model

Acceptable results were offered by the measurement model. Subsequently, the researcher examined the structural model (see Yusof et al. 2017; Gilani et al. 2017). The explained variance portion was also exploited to investigate the accuracy of the predictive model. According to the results, the model could fairly explain 9.38% in job satisfaction and 25.57% of the variance in job stress. As an additional model fit index, the predictive relevance set forth by Stone (1974) and later by Geisser (1975) were employed. This was carried out in addition to the calculation of R^2 degree. This measure is an indicator of the model's predictive relevance. More specifically, when the PLS-SEM exhibits predictive relevance, it accurately predicts the data points of the indicators in the reflective measurement models of endogenous constructs (Hair et al. 2013). The utilized model fit index indicates the model's capacity in projecting the noticeable indicators of the latent variables. In order to evaluate the predictive relevance via a blindfolding process, the study calculated the Stone–Geisser Q^2 (see Kurniawan et al. 2017; Weng et al. 2017). Blindfolding is a sample reuse technique that omits every d^{th} data point in the endogenous construct's indicators,

Table 3 Path coefficient and hypothesis testing

Hypothesis	Relationship	Path coefficient	T-value	Decision
Direct effect				
H1	WRD → JST	0.1273	0.6306	Not supported
H2	WRU → JST	0.1645	1.652*	Supported
H3	WRC → JST	0.2476	1.746*	Supported
H4	JST → JS	− 0.3025	2.852**	Supported
Indirect effect				
H5	WRD → JST → JS	− 0.0385	0.581	Not supported
H6	WRU → JST → JS	− 0.0498	1.459	Not supported
H7	WRC → JST → JS	− 0.0749	1.653*	Supported

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$ (one tail)

and estimates the parameters with the remaining data points (Henseler et al. 2009). The omitted data points are considered missing values and treated accordingly when running the PLS-SEM algorithm. The resulting estimates are then used to predict the omitted data points. The difference between the true (i.e., omitted) data points and the predicted ones is then used as input for the Q^2 measure (Hair et al. 2013). As maintained by Chin (2010), the predictability capacity of the model is supported when the value of Q^2 is above zero. The current study gained 0.079 for average cross-validated redundancy (for all endogenous variables) that was above zero. Hence, the model showed satisfactory fit and high predictability capacity.

To test the structural model, nonparametric bootstrapping (see Iranmanesh et al. 2016; Foroughi et al. 2016) was used with 5000 replications. Table 3 exhibits the structural model coming from the analysis of CB-PLS. The results indicate that the effect of waste reuse practices and waste recycle practices on job stress were significant and positive. In addition, the impact of job stress on job satisfaction was significant and negative. In contrast, waste reduction practices had no significant effect on job stress. As such, H2, H3, and H4 were supported whilst H1 was rejected. The bootstrapping procedure proposed by Hayes (2009) was performed in examining the indirect effects. The indirect effect's t value was gained through dividing the indirect effect (ab) by the indirect effect's standard error (SE). SE refers to the standard deviation of the repeated bootstrap estimates of the indirect effect. As it is shown in Table 3, the only significant value was the indirect influence of recycling waste on job satisfaction through the stress in the job. Therefore, H7 was supported; whereas, H5 and H6 were not supported.

6 Discussion and conclusion

The construction industry has been reported to be one of the most stressful areas, and a great number of people working there are under tremendous stressful pressure (Leung et al. 2008). Site managers have often highly stressful tasks because of the limited time frame, the uncertainties, and the dynamicity of the social

structure in implementing construction projects (where many individuals enter and exit the projects during the year) (Leung et al. 2008). They also pointed out the effect of intense work and stress on the quality of the managers' performance. However, there has been little research on the effect of stress on site managers and construction project managers, who are supposed to play a fundamental role in the project's success and to deal with stressful tasks. The main purpose of the present study was to examine the impacts of LCW practices on the industrial construction manager's job satisfaction through job stress in Malaysia's construction companies. The finding showed that recycle and reuse managements have a positive effect on job stress; whereas, reduce management has no effect. Regarding the indirect effect, recycle management is the only factor that has a negative effect on job satisfaction through job stress.

The significant effect of waste reuse and recycle practices on job stress seems to be in line with the findings of Hagen and Bogaerts (2014) and Wiezer et al. (2005) who confirmed that waste action is highly correlated with intense work. The results show that an insignificant relationship exists between waste reduce practices and job stress. The potential reason for the insignificant effect of reduce practices is that these practices cause less extra work for site managers compared to waste reuse and recycle practices (Shen et al. 2004). Therefore, the site managers should devote less extra time and effort implementing waste reduce practices and, consequently, receive less stress. It is obvious that just by decreasing the transporting (e.g., better truck utilisation) and disposing processes (as the result of lower waste), the pressure and stress on managers will be less compared to the waste reuse and waste recycle practices. In addition, part of waste reduction happens off site and at the source of production. As such, reduce practices have insignificant effect on job stress as it needs lower extra effort of the site managers compared to reusing and recycling practices.

The results indicate that job stress has a negative effect on the job satisfaction of the site managers which is consistent with the findings of Lopes et al. (2014) and Hagen and Bogaerts (2014). Further, Gemmill and Heisler (1972) reported that for the managers, the higher the job strain is, the lower the job satisfaction is. In other words, lower job pressure causes higher job satisfaction. Therefore, it is necessary to give special notice to the job stress of the site managers. Understanding the negative effect of job stress on the job satisfaction of site managers is quite important in the context of Malaysia, where the job turnover rate is high. Since Malaysia does not have skilled and experienced manpower (National Economic Advisory Council 2010), workers' turnover and dissatisfaction could significantly impact the companies' actions. Thus, companies' managers should give more attention to JS practices.

According to the finding of this research, waste recycle practices are the only LCW practices that have a negative impact on the job satisfaction of site managers through job stress. The findings of the literature also confirmed that waste practices could have a strong effect on job stress which in turn could significantly affect job satisfaction (Applebaum et al. 2010; Sutherland and Davidson 1993). The potential reason that waste recycle practices have a negative effect on job satisfaction whilst waste reduce and waste reuse practices have no significant effect on job satisfaction

through job stress can be that recycle practices create higher pressure and need higher skills compared to reduce and reuse practices. For example, site managers should design a specific area on the construction site for the recycling process, which needs more work, such as sorting wastes into specific categories, compared to reuse practices, such as reusing second-hand materials. Therefore, recycle practices cause higher pressure on site manager which will lead to job stress and dissatisfaction. As such, waste reuse practices are the desirable option, as they have no significant effect on site managers' job satisfaction. In addition, Wang et al. (2015) also suggested the waste reduction of construction materials as one of the best methods for minimising the generation of waste. However, as waste is unavoidable, from the site managers' satisfaction point of view, reusing is the most desirable option after reducing practices.

Like any other study, this paper comes with some limitations that must be pointed out. Firstly, the data were collected at a single point in time; hence, considering the cross-sectional nature of the study, the findings only reflect the situation at a particular point regarding the relationship between LCW practices and job stress. For that reason, a longitudinal study should be attempted to examine LCW practices in a construction project for an extended period of time. Secondly, sampling could be considered as one of the limitations because participants were working only in construction companies in Malaysia. Further studies can replicate the present study in other industries and in other countries. Thirdly, the impacts of the LCW practices on job stress may be moderated by other factors, including social support and job control (Smoktunowicz et al. 2015). Future studies should seek for potential moderators. Future studies can also examine the impact of LCW practices on the performances of the companies in a more exhaustive model considering the mediating roles of JS and practice cost in performance.

Regardless of its limitations, the present study provides both theoretical and managerial contributions. In terms of the theoretical contribution, this study is the first to empirically investigate the effects of LCW practices on job satisfaction through job stress. The results of this study demonstrate that waste reuse and recycle practices have a positive effect on job stress; whereas, waste reduce practices have no effect. On the other hand, the present findings have a significant contribution to the present literature through assessing the mediation effect of managers' job stress on the relationship amongst low carbon waste actions and job satisfaction. From the managerial point of view, the findings introduce a degree of caution to those construction companies that implement LCW practices. According to Judge et al. (2010), job dissatisfaction might influence the overall construction performance. Therefore, construction companies should consider the consequences of LCW practices on job stress and satisfaction if they aim at pursuing job satisfaction. As, waste reduce practices have no significant effect on the site managers' job stress and job satisfaction, the companies should give the priority to waste reduction practices. Furthermore, Smoktunowicz et al. (2015) found that job demand was associated with higher job burnout when social support and job control were low. Social support refers to information that leads a person to believe that he or she is cared for, esteemed, and valued, and belongs to a network of communication and mutual obligation (Kirmeyer and Dougherty 1988). According to Demerouti et al. (2015), job burnout may

represent a highly stressful experience by high job demands. As such, the social support and job control are crucial in the construction companies that implement recycling and reusing practices in order to reduce the work stress amongst project managers.

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