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OCCUPATIONAL STRESS IN CONSTRUCTION: FOSTERING AN IGLC RESEARCH AGENDA

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ABSTRACT

Globally mental health is a serious concern, particularly in construction. According to the Health and Safety Executive (HSE, 2021), stress, anxiety, and depression are the second biggest cause of work-related ill health in the UK construction industry. Occupational stress and mental health issues should, therefore, be treated with the same level of significance as physical health and safety risks in construction. To the authors' knowledge, there are very few, if any, published empirical IGLC papers that have explicitly focused on this concern. This study was conducted using case-study interviews and a focus group with industry experts, to explore and promote the concept of 'occupational stress' in construction. The study provides novel contributions to knowledge, which include: identifying seven main sources of stress (i.e. stressor) in UK construction projects, revealing 'workflow interruptions' as a prevalent and severe source of stress in construction, shedding some empirical light on the inadequacies of the critical path method, and generating new questions and proposals to pave the way towards a future IGLC research agenda for tackling occupational stress and mental health issues in construction.

KEYWORDS

Lean construction, stress, mental health, flow, waste

INTRODUCTION

Occupational stress is increasingly becoming an issue of major concern all over the world. In the UK, for instance, it is estimated that stress-related illness costs the British industry £5 billion each year, with the Health and Safety Executive (HSE) calculating that stress, depression or anxiety account for 44% of all work-related ill health cases, and more than half of all sick days in an average year. The COVID-19 pandemic, the Russia-Ukraine war and the resulting global economic recession have further compounded these issues, by creating additional unprecedented social and economic pressures on the mental health and well-being of many people, particularly those working in construction.

In the US, the 2021 National Veteran Suicide Prevention Annual Report shows the [military] veteran suicide rate was 31.6 per 100,000 veterans in 2019. The adjusted suicide rate for the same year for all US adults is 16.8 per 100,000. The data shows the construction industry suicide rate is 53.2 per 100,000. Does that mean it is *"easier on a person's mental state to be asked to prepare for and propagate war than to work in construction?"* (Winningham 2022). It doesn't have to be this way.

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Stress in itself is not an illness, but it can make people ill. HSE (2021) defines work-related stress as "*the adverse reaction people have to excessive pressure or other types of demand placed on them*". Stress affects employees, their families and colleagues, by making their physical and psychological condition worse. This in turn affects employers who have to deal with increased sickness absence, lost productivity, human error leading to re-work, increased accidents, replacement of staff and poor performance within their organisations. Figure 1 illustrates how the level of stress can impact on the individual's performance at work.

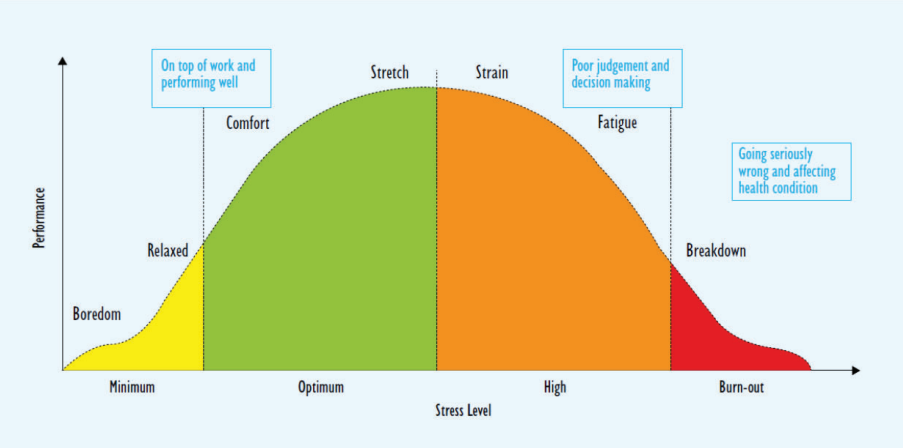

Figure 1: The Influence of Stress on the Individual's Work Performance
[Chart produced by Mates in Mind; cited in CIOB (2020)]

Despite the relatively low levels of 'reported' work-related stress in the construction sector, when compared to other industries, there is anecdotal evidence that occupational stress and mental health are increasingly becoming critical issues of concern within the sector (CIOB, 2006; HSE, 2007; CIOB, 2020). Several empirical studies have identified work-related stress as one of the root causes of unsafe behaviours in construction (for example, see Seo et al., 2015; Leung et al., 2016; Wu et al., 2018). Other major social problems such as high absenteeism, presenteeism, alcoholism, drug abuse and suicide have also become increasingly reported as consequent to occupational stress in construction. The CIOB's (2020) report described mental ill-health as a silent *crisis* within the construction industry, with males three times more likely to commit suicide than those in other sectors.

Why are People in Construction Particularly at Risk?

People working in construction are particularly vulnerable to suffering from mental health issues (Oswald et al., 2019). There are various systemic and inherited problems in construction (Sarhan *et al*., 2017), such as its risk-averse and blaming culture, cut-throat price competition, the traditional macho culture, long and fragmented supply chains, late payments, slim profit margins, tight deadlines and challenging working conditions, skills shortage and job insecurities, all of which contribute towards increasing stress and anxiety in construction.

Most of the workforce in construction are self-employed, and thus getting regular and reliable work can be very challenging for them. This job insecurity can contribute significantly to their poor mental health. In addition, these casual or self-employed workers may not have or be aware of any mechanism for reporting their work-related stress and mental health issues. Furthermore, the majority of workers in construction are employed by small and medium enterprises (SMEs), and it can be difficult for smaller companies, due to their limited budget and resource constraints, to put the right arrangements in place for supporting the mental health and wellbeing of their employees.

RESEARCH GAP AND OBJECTIVES

Many research studies have focused on investigating physical health problems and safety performance in construction. However, much less research has studied mental health issues affecting construction practitioners (Oswald et al., 2019). In addition, efforts in both academic and practitioner communities in construction focus mainly on managing occupational stress, as opposed to preventing or reducing its occurrence. Many studies on stress in construction have set out to identify its causes and effects at individual, task and organisational levels. Very few, if any studies, have sought to investigate the sources of stress (i.e. stressors) at a project or supply-chain level.

Lean Construction (LC) has shown to be effective in managing H&S risks in construction through integrating safety into production planning and control processes (Saurin et al., 2002; Sacks et al., 2005). Various LC tools and techniques have been used to improve safety performance in construction, including the use of the Last Planner® System, 5Ss program, BIM, visual management, and off-site construction. The idea is that an early focus on physical safety performance will also help in improving productivity, process transparency and minimising time and cost wastes resulting from accidents on construction projects. Guided by the two core lean principles of respect for people and continuous improvement, a limited but increasing number of IGLC studies have been used to promote the importance of considering psychological safety in construction.

Interestingly, there are only six conference papers within the IGLC repository (from 1996-2022) that explicitly focused on this critical topic of mental health in construction (see Table 1). This study, therefore, hopes to contribute to this topic by presenting the findings of a focus-group with UK industry experts. The ultimate aims of this study are to:

Identify the main sources of occupational stress in UK construction projects,

Propose strategies for preventing or reducing stress in construction projects

Promote an IGLC research agenda for addressing mental health issues in construction

Table 1: An identification of relevant IGLC papers on mental health issues

Author (Year)	Paper title	Method
Filho et al. (2018)	'Respect for people's well-being: meditation for construction workers'	Case-Study
Oswald et al. (2019)	'Mental Health in the Construction Industry: A Rapid Review'	Literature Review
Muñoz et al. (2019)	'Team Health: A Measured Approach to Collective Learning'	Action learning
Gomez et al. (2019)	'An Active Care Approach Through Psychological Safety in Construction Projects'	Mixed methods
Gomez et al. (2020)	'Lean, Psychological Safety, and Behavior-Based Quality: A Focus on People and Value Delivery'	Mixed methods
Padia et al. (2022)	'Employee's Mental Wellbeing with Reference to IEQ and Managerial Environment in Office Spaces'	Mixed methods

RESEARCH METHOD

This study forms part of a larger research study that was funded by a UK charitable trust to develop supply-chain management (SCM) strategies for improving stress management and productivity in construction. The study adopted a qualitative multi-methods research approach, comprising a qualitative systematic literature review, case study, and a focus group. Empirical

data were collected from a UK case-study through site observations and iterative semi-structured interviews. The case-study was selected because it was a live project which allowed the first author of this study to conduct multiple visits, observations and iterative conversations with the site team. It was also delivered by one of the most recognised main contractors in the UK, which was an essential criterion, to allow the study to capture examples of best practices in relation to H&S and SCM. The authors also had direct access to the client's project management team. The main features of the case-study project are as follows:

Higher Education building in the UK

Design and Build project procurement method using two-stage tendering

Contract value ~£30 Million, duration was 2 years

NEC 4 contract, BIM, and prefabrication techniques were used.

In total, 19 in-depth interviews were conducted as part of the case-study with a sample of construction workers at different levels (e.g. forepersons, supervisors, site workers, project managers, site managers) and representing the various parties of the project supply-chain (client, main contractor, and subcontractors). The data collected from the case study interviews and site observations were analysed using NVivo software, following Strauss and Corbin's (1998) formal procedures for data coding and analysis. A focus group was then used to evaluate the findings of the case-study (i.e. the themes and conclusions that emerged from the qualitative data analysis phase). This paper focusses on the findings of the focus-group.

FOCUS GROUP: METHODS AND TOOLS USED

This focus group was conducted to evaluate the findings of the case-study, collect feedback from wider industry stakeholders, and assess the extent to which its findings could be generalised. Focus group participants were selected to ensure that all participants had broad and significant experience in the construction industry (see Table 2).

Table 2: Focus Group Sample

No.	Job title of participants of the focus group	Years of Experience
P1	Consultant and Fellow Member of the Institute of Civil Engineers (FICE)	30+
P2	National Civil Engineering Director at the Civil Engineering Contractors Association	30+
P3	Professor of Sustainable Construction	30+
P4	Professor of Lean Project Management	30+
P5	Operational Change Manager at a Leading Consultancy Company	20-30
P6	Engineering Manager at a British County Council	20-30
P7	Business Development Manager at a Subcontractor	20-30
P8	Business Development Manager at a Charitable Trust	10-20
P9	Growth Development Manager at a Leading UK Charity Organisation	10-20
P10	Group Director of H&S at a Main Contractor	10-20
P11	Production and Performance Manager at a Global Consulting, Engineering and Construction Management Company	10-20
P12	Health & Safety Programme Manager at a Leading Global Construction Company	10-20

The focus group was conducted online and lasted for an hour and a half. Two of the authors of this study started by delivering a 20-minute presentation to summarise the findings of the case-study. They then introduced an interactive survey using a web-based response system named

Poll Everywhere. This application allows the participants to anonymously answer questions. The results are, however, displayed and updated live for all to see. The whole session was video recorded (following the agreement of all the participants) to capture feedback, interactions, and comments during the discussion of the results.

RESEARCH FINDINGS AND ANALYSIS

The following sections summarise the main findings of the study.

The Main Sources of Stress in Construction Projects

Based on the findings of the case study (listed in Figure 2 below), the focus group participants were asked to select the stressors that they believe are 'prevalent' in construction projects. 'Work demands' (i.e. work load, and unrealistic project budgets and demands) and 'workflow interruptions' were considered the most prevalent stressors by most of the participants, as shown in Figure 2.

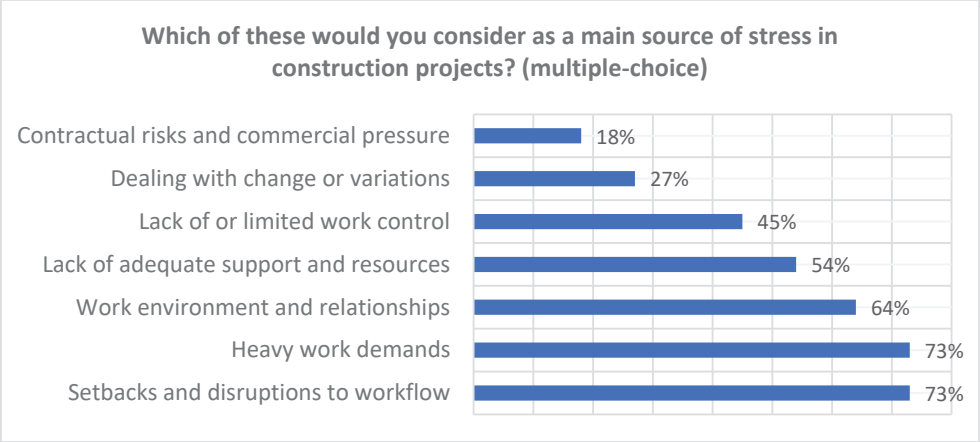

Figure 2: The Main Sources of Occupational Stress in Construction Projects

Following this, the participants were asked to assess the main causes of workflow interruptions as identified from the case-study. The participants were also provided with the opportunity to suggest any other factors and to provide any additional comments to support their answers.

Main Causes of Work-Flow Interruptions in Construction Projects

Two factors were agreed upon by more than half of the participants of the focus group as main causes of workflow interruptions in construction projects (see Figure 3). Some other suggestions and interesting comments were provided by the participants, as follows:

"It reflects the **culture** in construction not a particular site".

"Lack of building the **right team culture** to support the **collaboration** required"

"Over promising on **unclear expectations**. Pressure then cascades to the team"

"The **complexity** of the construction supply chain"

"The **uncertainty** created by weather and conditions that we didn't know about".

As shown in Figure 3, the findings suggest that the work-related stresses that construction workers may experience in construction projects mainly stem from the pre-construction stage. In particular, it appears that both the construction programme and design could have a significant impact on the performance, mental health and wellbeing of the people working on site. Thus, the following questions (see Figures 4-6) were introduced to identify and gain a better understanding of the limitations and potential sources of stress embedded in the way we traditionally design, plan and procure construction projects.

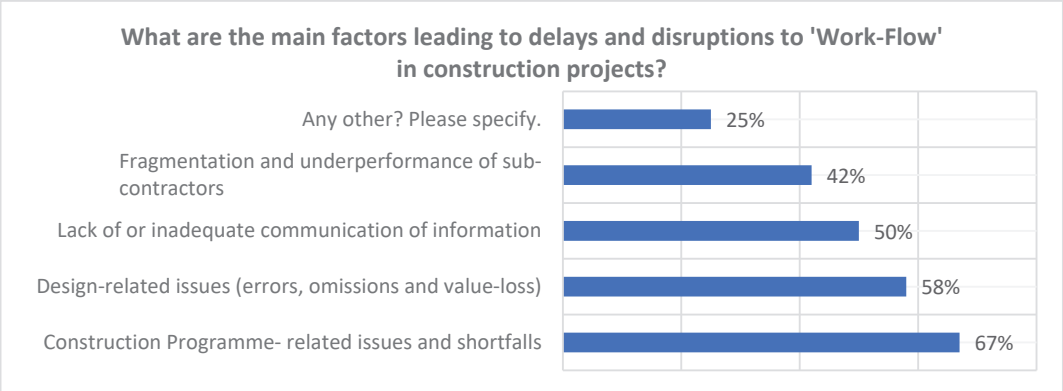

Figure 3: Main Factors Leading to Delays and Disruptions to Workflow in Construction Projects

CONSTRUCTION PROGRAMME-RELATED SHORTFALLS

The participants criticised traditional planning techniques used in construction, based on the critical path method (CPM). The main concern raised is that CPM leads to the development of static programmes that do not account for the high level of uncertainty that characterise many construction projects (Figure 4). CPM is used to manage work in projects by pushing trade crews to deliver work based on schedules prepared weeks, or even months, before the project even starts (Koskela et al., 2014; Mossman and Sarhan, 2021); this leads to unnecessary stresses and frustrations for people working on site. As stressed by one of the participants "in competitive bidding situations, the programme is often tightened by corporate management staff in order to win the project - even though the bidding teams may not be the ones eventually delivering the project". In addition, CPM does not take into consideration the coordination between the trades that is required to allow work to flow.

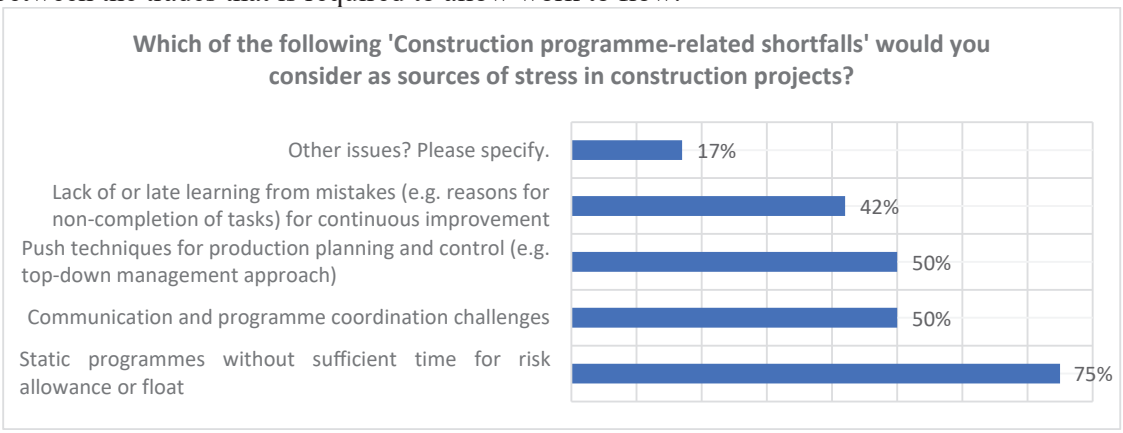

Figure 4: Construction-Programme Shortfalls as Sources Of Stress in Construction Projects

DESIGN RELATED ISSUES

Design changes were considered as a major source of stress and frustration in construction projects (Figure 5). Interestingly, design changes have been reported in many studies as a common problem in construction, due to its influence on project performance (see for example, Cox et al., 1999; Gharaibeh et al., 2021). However, there are hardly any studies that have considered their impact on the mental health and well-being of project participants.

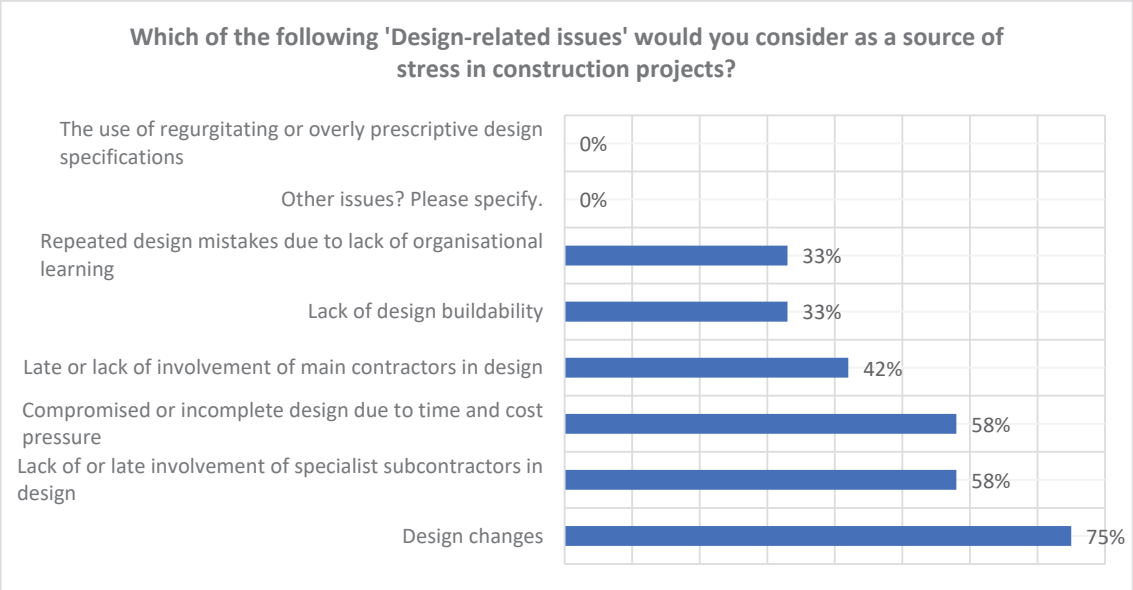

Figure 5: Inefficiencies in Design as a Source of Stress in Construction Projects

Design changes in construction usually occur due to: (1) changes in client requirements and value engineering purposes (2) design errors and omissions. From a lean perspective, there should not be a major concern with client changes during the project, as creating customer-value is part of the job. It is the responsibility of the delivery team to explain the change to the workers once they have ensured that the client understands the cost and time implications of the change and agrees them. However, as one participant reported, stress in construction projects usually occurs due to *"unrealistic changes made by the client organisations without fully understanding the impact that the change will have on the delivery team".* Obviously, changes due to design errors or emissions lead to rework – that is waste. However, these design-related changes may not always be frustrating for everyone, as it could be argued that more work to do can be beneficial for the contractors and tradesmen involved, if they are compensated and feel valued.

Two other important design related issues were selected by the majority of the respondents as potential sources of stress. One is concerned with the need for engaging specialist subcontractors in design. This was also described by a participant as follows: "*main contractors have a very skeleton staff - the bulk of the work is done by specialists and these people can be missed out of the loop - especially M&E*".

The other issue relates to the contractual and commercial pressures that seem to influence the quality of design (for example, late or low payments). Interestingly, it was suggested in the focus group that "*designers need to be made more aware of occupational health issues within construction and not leave the contractors to sort it out*". Thus, it seems that design can play a major role in preventing or reducing stress in construction.

Both of these reasons point to the value of procuring construction with IPD or Alliance relational contracts that bring the whole delivery team together at the earliest stages of a project.

Contractual and Commercial Pressures

Most of the participants agreed that 'single-stage competitive tendering based on cheapest price and shortest programme' is a prevalent yet stressful practice (see Figure 6). Other factors were highlighted including 'contractual and commercial pressures; this has been described by a participant as follows:

> *"Commercial assumptions in the bidding phase can be over optimistic. I believe there has also been a trend for clients to push risk further downstream into consultants and contractors without necessarily allowing the budget to deal with those risks adequately in advance".*

There was also an emphasis from the participants on the importance of 'early involvement' of key members of the supply chain to support collaborative costing and design (Zimina et al., 2014; Namadi et al., 2017). For example, it was stated that "*the whole team of client, contractor, designer and the supply chain need to be engaged as early as possible - even at concept stage - so that there is full understanding of what is to be delivered and for how much!"*

Figure 6: Contractual and Commercial Issues Influencing Stress in Construction Projects

This section has discussed the main sources of stress in construction projects revealed by this study, and it focused particularly on workflow interruptions and their causes. The next section looks at the findings in relation to stress prevention and reduction.

Strategies For Preventing or Minimising Stress in Construction

Common organisational practices for managing occupational stress used in construction tend to be 'reactive' rather than 'proactive'. Reactive practices include, for example, the use of fair and inclusive HR policies, offering counselling services, employee assistance programmes, and mental health awareness, training and first aiding — knee pads if you like. There are very few, if any studies, that have focussed on identifying or investigating strategies used at a project level. The following question, therefore, included a list of 'preventive measures' at a 'project supply-chain level' as identified in this study.

As can be seen in Figure 7, 'inclusive and collaborative planning' was the most recommended strategy for stress reduction in construction projects. This is an interesting finding, especially since the majority of the focus group have never heard of or used the Last Planner® System (LPS) for production planning and management – also known in the UK as 'collaborative planning'. This, therefore, suggests that the lean construction community can play a major role in promoting and improving mental health in construction through using and testing relevant LC theories and practices, such as the LPS, 5S, Target Value Design (TVD), and visual management techniques.

The effects of the implementation of the LPS on projects in Denmark (Thomassen 2003) appear to confirm the idea that predictable flow creates much less stress on projects. In the Danish projects that used LPS, sickness absence fell by 65%. It is generally accepted that sickness absence is associated with work stress.

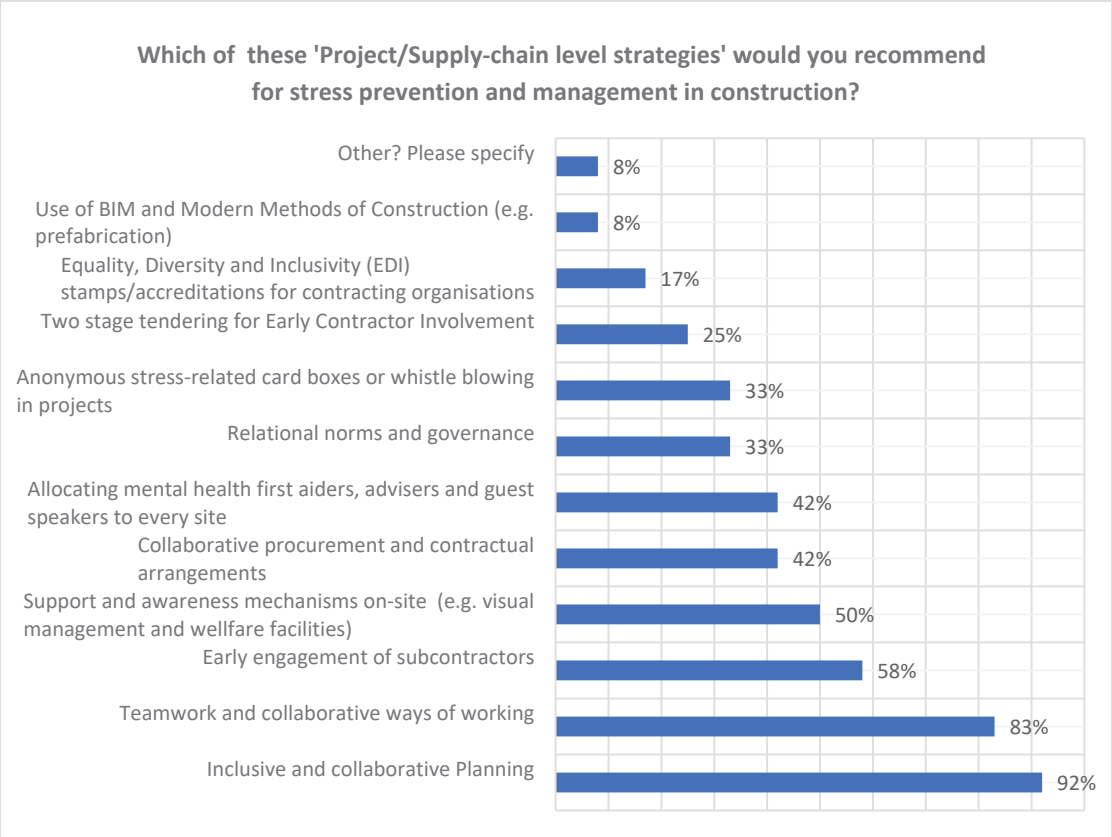

Figure 7: SCM Strategies for Reducing Occupational Stress in Construction Projects

TOWARDS A RESEARCH AGENDA

The empirical findings of this study have indicated that 'workflow interruptions' are a common and severe stressor in construction that can seriously affect the construction employee's job performance and well-being. This raises the following fundamental question (RQ):

RQ: 'How can work-related stress and mental health considerations be incorporated into production planning and control processes in construction?'

This question is introduced to encourage further empirical research and foster an IGLC research agenda for addressing mental health issues in construction. One suggestion is to incorporate the HSE's Management Standards (see HSE, 2019) into the Look Ahead Planning phase of the LPS when tasks in the Look Ahead period are *made ready* (i.e., constraint free) for the construction crew to deliver them when they want to (Mossman and Sarhan, 2021).

The UK's HSE Management Standards are designed as a guideline for effective stress management. They address six key areas of *work design* that, if not properly managed, can lead to poor health and wellbeing, lower productivity and increased sickness absence (HSE, 2019). The Look Ahead window is when *work* is Made Ready. We also need a process for making *workers* ready. The six item HSE "checklist" is: (1) Demand – *e.g. can you cope with the demands of your job?*; (2) Control – *do you have a say in how your work is planned?*; (3) Support – *do you feel supported in your work?;* (4) Role – *are you clear about your role and responsibilities on the project?;* (5) Relationships – *can you have an open and honest conversation with people at any level in any organisation on the project?;* (6) Change – *is change well managed on the project?*. (For more detail on the checklist see HSE 2019)

The findings of this study, augmented by further empirical studies on the links between the concepts of *workflow* and *work-related stress* in construction, have potential to influence policy by incorporating 'flow' into the HSE's Management standards for stress prevention and management.

It has been previously argued that the IGLC community should rethink the prevailing conceptualisation of 'waste', so that it can account for both 'environmental wastes' (e.g. carbon emissions and energy consumptions) and 'social wastes' (e.g. unhealthy and unsafe practices) rather than focussing merely on process and physical wastes (Arroyo and Gonzalez, 2016; Sarhan et al., 2018). This study echoes and contributes to these arguments, by suggesting that the sources of stress (i.e. stressors) in construction projects be classified as 'social wastes'. The stressors identified here could also be classified as sources of process waste in construction.

CONCLUSION

This study was conducted to explore the concept of 'occupational stress' in construction and has led to novel contributions to knowledge. ***First***, the study identified seven main sources of stress in UK construction projects (Figure 2). ***Second***, the findings of this study revealed that 'workflow interruptions' are the most significant source of stress in the construction project studied. It is, therefore, suggested that strategies for stress-reduction in construction should focus on finding innovative ways for enhancing workflow in construction. ***Third,*** it is suggested that policymakers should consider the potential for incorporating 'flow' into the HSE's Management Standards. This study also identified two main causes of workflow interruptions in UK construction projects: (1) Construction Programme-related shortfalls; and (2) Design-related issues. Accordingly, the importance of engaging specialist sub-contractors in both design and construction programme development has been highlighted. ***Fourth***, it is suggested in this study that 'stress' and 'risks' are closely related in construction, as both tend to be pushed and transferred down the supply-chain. In particular, 'single stage competitive tendering based on cheapest price and shortest programme' has been identified in this study as a deeply rooted source of stress and value-loss in construction projects. ***Fifth***, 'inclusive and collaborative planning' is identified by the participants of this study as the most recommended strategy for stress prevention and/or reduction in construction projects. Accordingly, this study suggested incorporating the HSE's Management Standards into the Look Ahead Planning phase of the LPS. ***Finally***, the study formulated new research questions and ideas, to contribute towards fostering an IGLC research agenda for tackling mental health issues in construction.

OPPORTUNITIES FOR FURTHER RESEARCH

This study focused on a single project. There are opportunities to do similar research on other projects in the UK and elsewhere in the world. There are also opportunities to use radically different research methods to see if they come up with similar or different results. It is suggested that further studies could also focus on investigating the sources and impacts of occupational stress on the productivity of different levels of workers within the construction project context.

Future studies are encouraged to investigate how lean design (e.g. TVD) and contractual arrangements (e.g. relational contracts) influence the mental health conditions of the project teams and workers involved. Furthermore, there is also scope for investigating the roles that emerging technologies and visual management techniques could play in supporting both 'workflow' and 'stress reduction' in construction projects.

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