CHALLENGING STANDARDISATION BY EMBRACING AMBIGUITIES OF SITE SAFETY: THE CASE OF MICRO CONSTRUCTION FIRMS

Emmanuel Aboagye-Nimo[1] and Ani Raidén[2]

[1] *School of Architecture, Design and the Built Environment, Nottingham Trent University, 50 Shakespeare Street, Nottingham NG1 4FQ, UK*

[2] *Nottingham Business School, Nottingham Trent University, 50 Shakespeare Street, Nottingham NG1 4FQ, UK*

Streamlining and standardising safety practices in the construction industry has always been the goal of many policymakers and large construction firms. This would understandably ensure that all practices on a wide range of projects adopt and implement similar procedures and regulations. In addition, this idea could possibly reduce the uncertainties and variations associated with interpretations of policies and regulations amongst project teams. Unfortunately, safety issues on construction projects and sites are widely acknowledged to differ from project to project and even activity to activity. For this reason, the implementation of a broad-brush approach has always proven difficult in the industry. Micro firms in the industry operate under the notion that projects and site conditions are always fluid and adapt their safety practices accordingly. The aim of this research is to the experiences and nuances in practices of workers of micro firms as they challenge standardisation by embracing ambiguities in project risks. Ethnographies were carried out on six construction sites in the South East and the East Midlands regions of the UK. Data collection tools adopted included observations, semi-structured interviews and conversations with tradesmen of selected micro firms. Findings from the ethnographic studies indicate that workers from small and micro firms from both regions acknowledge that the risks and hazards associated with various stages of projects change constantly. These changes are attributed to various reasons including site conditions, project changes, workers' state of mind and overall site culture. Furthermore, the workers believe that standardising approaches for all projects will be ineffective especially if the teams should encounter extenuating circumstances that they have not planned for. The workers thus embrace the uncertainties in safety and adopt an approach the considers the ambiguities associated with construction practices thereby being able to use a dynamic approach to avoid accidents and injuries that could prove costly or fatal.

Keywords: ethnography, micro firms, safety ambiguity, site safety

INTRODUCTION

The construction industry has always edged towards standardisation of practices for numerous reasons including productivity (Gibb, 2001; Pheng and Meng, 2018) and better work quality (Love *et al.,* 2000; Rumane, 2017). Although this is not a problem in the wider context, this can create problems when workers have to adapt to processes or situations that have not been captured in the standardised policies and

---

[1] emmanimo@hotmail.com

practices e.g. some project safety risks. The aim of this paper is to shed light on the experiences and nuances in practices of workers of micro firms (employing less than 10 workers) (European Commission, 2003) as they challenge standardisation by embracing ambiguities in project risks. The paper also delves into the taxonomy of team functions by exploring existing models and how overall safety can be improved using dynamic approaches. Subsequently, an explanation of the concepts of ambiguity and risks in construction projects is presented by considering how teams adapt to project complexities and inherent risks.

LITERATURE REVIEW

Construction projects are widely known for their complex nature from inception to completion. With these complexities arise numerous ambiguities particularly within communication and interpretation of risks (Floricel *et al.,* 2011). The literature review focuses on ambiguity and its role in construction safety practices.

Ambiguity and risk

The concepts of risk and ambiguity are connected in most construction works and require critical consideration for the success of projects (Walker *et al.,* 2017). Ambiguity is the '*perceived insufficiency of information regarding a particular stimulus or decision context*' (Acar and Göç, 2011: 842), in this case, risk and safety. Going by the Ellsberg Paradox; it is well established that people favour known probabilities in several instances including risk aversion (see Ellsberg, 1961). However, the complex realm of construction projects presents numerous situations that result in ambiguities and as such it is very difficult to identify every risk probability (Luo *et al.,* 2017). Risk by definition is the chance that individuals could be harmed by hazards (known and unknown) in conjunction with an understanding of how serious the harm could be (Health and Safety Executive (HSE), 2019). Small and micro construction firms are more tolerant of ambiguity and risk (Acar and Göç, 2011). This results from their relatively fewer formal practices and more importantly, their openness to the everchanging dynamics on site (ibid).

This research does not seek to offer a discourse on the differences between ambiguity and risk but rather accepts that the two concepts are interrelated in the context of safety practices. Furthermore, it is acknowledged that while a given risk remains objective, the different interpretations of the situation and the approaches of resolving the situation is open to different methods (subjectively). Even formalized and explicit safety policies of large firms will interpret risks differently before recommending strategies to manage them. Thus, it is argued that every firm or team regardless of size, approaches risks and their associated ambiguities differently.

Team Adaptability and Safety Practices

Teamwork and adaptability are crucial to the safety of workers and their surroundings. Salas *et al.,* (2008) identify three types of team competencies required for success: knowledge (cognition), attitude (feelings), and skills (behaviours). The above traits will inform the empirical phase of this study in an attempt to further assess the effectiveness of the safety practices of the teams included in this study. In dynamic work environments such as construction sites, workers will have to possess the quality of adaptability for success in safety and a successful project overall.

Adaptability involves the redistribution of tasks and workload among team members to achieve balance during high-workload or time-pressured situations (Burke *et al.,*

2006). Working teams not able to work to such standards may struggle to be efficient and thus less successful. Successful adaptation requires anticipation and recognition (Malakis *et al.,* 2010). As implied previously, workers must be able to anticipate risks (embrace ambiguity) in a dynamic setting in order to appropriately manage them.

Stagl *et al.,* (2006) offer a comprehensive framework on how working teams adapt to unique situations and more importantly, they show the key traits and characteristics that ensure these teams are successful in their adaptability. Figure 1 shows that individuals, teams and job characteristics shape the emergent cognitive and affective states of the projects. This then results in the dynamic processes of situation assessment and decision-making for the plans to be executed. Furthermore, it is very important to note that team situation awareness and a shared common mental standpoint is imperative to shaping the overall team adaptive performance. Team adaptation as a process is iterative thereby feeding into each other and thus workers learning from each situation or encounter (see Figure 1).
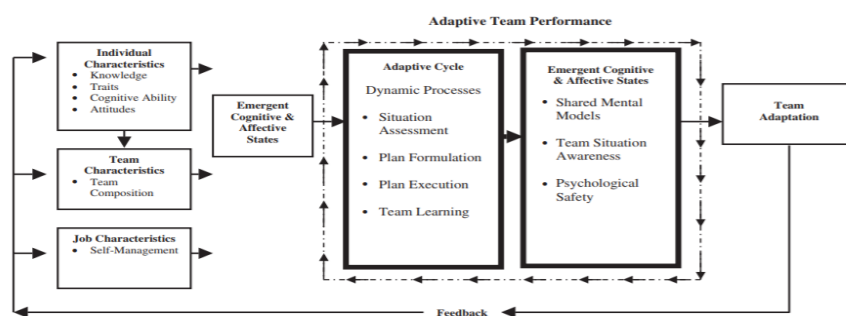

Figure 1: Heuristic Framework of Team Adaptation (Stagl et al., 2006)

A further analysis of Figure 1 indicates that some of the processes can be presented explicitly but other aspects may be more implicit. For example, situation assessments and plan formulation/execution can be included in the risk management process but other aspects such as individual attitudes may be more fluid within a given culture. After the critical consideration of the conceptual components of safety including ambiguity, risk and team adaptability; the next section presents literature on risk management practices amongst micro firms.

Risk Management Practices of Micro Firms

Smaller construction teams are known for their fewer formal approaches in practice including safety (Acar and Göç, 2011; Allison and Kaminsky, 2017). Pinder *et al.,* (2016) explain that the bureaucratization of the safety policies puts smaller teams at a disadvantage as they are known to adopt informal methods regarding safety. Practical knowledge and judgement on site require complex interaction of both explicit and tacit knowledge gained through training, experience, guidance by leaders, experiential learning in new situations, and from experts and experienced workers who have preceded the workers (Gherardi and Nicolini 2002, 192). Smaller teams including micro firms do not dismiss explicit practices although they tend to work through such formal approaches due to necessity and also if their resources allow for it. For example, formal safety policies may not be written down even though the workers may be adopting practical measures to ensure safe working environments for all. The bureaucratization of safety policies has gained a negative image as it burdens workers unnecessarily and hinders overall productivity (see Lord Young of Graffham, 2010; Cook, 2015). Bureaucracy and red tape prevent experienced and knowledgeable workers from using their knowledge gathered from years of experience in enhancing

site safety (Vassie *et al.*, 2000). The taxonomy of team functions is discussed next with a critical view on key areas such as communication, coordination and measures for error checking.

Taxonomy of Team Functions

Successful safety practices are based on effective communication, teamwork, accountability and responsibility and finally, monitoring practices. These features can all be found in the HSE's guidance notes for acceptable safety policies and practices (HSE, 2019). According to McGlynn *et al.*, (1997) the [United States of America] military adopts similar functions amongst individuals and make provision for interchanging roles based on the assessment of immediate conditions and surroundings (see Table 1). It is worth noting that practices of micro construction firms are not necessarily comparable military practices. However, it is suggested that the principles identified by McGlynn *et al.*, (1997) regarding team functions bear similarities to the approach adopted by construction firms (micro or otherwise). One important difference for micro construction firms is the lack of formal documentation. The above shall be explored further in the empirical phase. Similar to the everchanging events on construction sites, soldiers in the field adapt their practices when the situations change or evolve. This thus ensures their readiness for ambiguity relating to emergent and unknown risks. Readiness for ambiguity helps address aspects of work that may not be captured in prior risk assessment e.g. suddenly exposed live wire on site. Site workers must rely on their extensive experience and sense of awareness to manage such risks when they arise (Whiteoak and Mohamed, 2016).

Table 1: Taxonomy of team functions (McGlynn et al., 1997)

Information exchange	Includes information regarding member resources and constraints, team tasks and goals or mission, environmental characteristics and constraints, or priority assignment among subtasks
Coordination	Includes coordinating responses with task timing requirements or with responses of other members, including activity pacing, response sequencing, and time and position coordination
Assigning roles and responsibilities	Includes the need for role interchange and is the matching of information, numbers, etc., to subtask requirements
Error checking	Includes the process of monitoring individual and team activity, identifying problems, and adjusting team and member activities in response to errors and omissions or the attainment or lack of attainment of standards of performance

McGlynn *et al.*, (1997) highlight the importance of team functions with respect to eliminating errors; in the case of this study a means of ensuring workers' safety. Bureaucratic measures in construction can often hinder the ability of workers to be able to adapt their practices during situations of ambiguity and emergent risks and this can thus create more safety concerns when such situations emerge. Pheng and Fang (2005) identity aspects that construction projects could be more successful if they learn from other sectors (particularly team functions) e.g. effective communication - one of the most important elements of safety (see Kines *et al.*, 2010). This is in line with McGlynn *et al*'s (1997) discussion on taxonomy of team functions.

RESEARCH METHOD

Rapid ethnographies were adopted for this study. In this approach, open-ended interviews and explorative observations are replaced with condensed equivalents which are more focused on specific propositions and/or issues of interest which are identified from existing theory and literature before the research begins (Baines and

Cunningham 2013). In this instance, data collection can be carried out in a span of a few days. The ethnographies were conducted on four sites in the East Midlands and two in the South East region of the UK with each one lasting up to two days. Some of the micro firms studied were working as the sole contractors on some projects while other micro firms were working as subcontractors on larger projects. This offered a variety of views and a better understanding of the different situations that some micro firms may find themselves in. The research design helped generate a better understanding of the participants' cultural formation and negotiations, generation of inequalities (if any), labelling of deviance and other significant sociological processes in the given contexts (see Riain, 2009).

Data collection was undertaken through audio recordings and field notes. All site access was negotiated through gatekeepers as micro firms are generally known to be closed off to outsiders. As part of the ethical considerations of the project, pseudonyms were adopted for all participants presented in this paper. Although narratives and observations presented in this paper do not cover all the participants observed and interviewed, it is important to note that all interactions, observations and encounters on site helped shape the data presented in this study. The unit of analysis adopted for this study is a group approach i.e. micro firms and teams were considered as collective units on the various sites. This further helped in the understanding of the workers' approach to safety matters on their projects. A thematic analysis was conducted after a verbatim data transcription. This was followed by a preliminary analysis of the field notes, and this informed the manner in which the findings are presented next.

FINDINGS AND ANALYSIS

The main themes identified were in relation to workers' views on standardised practices, acceptance of ambiguity, equal opinions, and their fear of a lack of inclusion of their views in safety policies particularly when drafted by large main contractors.

Questioning Standardised Practices

A critical look at the research findings reveals standards or standardised practices can be either formal or informal. Formal standardised practices are written out explicitly in the form of organisational practices and policies and are less likely to contain ambiguity in their interpretation. Lacking ambiguity however does not necessarily imply the documented policies are always accurate. When micro firms work as subcontractors, they are obliged to follow main contractors' explicit rules. These rules are often blanket rules as they ensure uniformity amongst workers' practices all around. In addition to ensuring uniform working practices, this is also a crucial method of ensuring an effective span of control without assigning individuals to micro manage teams. For example, the *5-point PPE* (personal protective equipment) rule is widely adopted on most major construction projects regardless of outcomes of specific risk assessment practices.

Subcontractors agree that they *have to* follow the rules without fail even though they disagree with some of these policies.

Regarding the use of the 5-point PPE, Pete shares his concern about *'blindly'* conforming to these standards and even admitted he had gone against the rule in the past due to safety concerns. In a conversation with his colleague, they both agree that gloves had created concerns for safety for them in the past. *"I've come across that myself. It's annoying. You're doing something, and you have to take 'em off"* - Mick

It is worth noting that Pete's description of the situation as annoying can easily be misinterpreted as mere displeasure, but the wider context of the conversation reveals that he is referring to gloves creating unsafe situations - a situation that is agreed by his colleagues. Pete further explains that the standards are ideally developed to help workers but when they are not designed for specific tasks, it essentially invalidates the project's good safety practices. Although the removal of the gloves during any activity goes against the main contractor's policy, it is not 'wrong' according to the HSE guidance notes: "…*about identifying sensible measures to control the risks in your workplace*". Thus, an interim assessment of impending or newly developed risks inform Pete that the gloves would rather create a hazardous situation not prevent one. Other workers from different sites believed that standardised safety policies offered no flexibility or allowance. It was also widely acknowledged that many site managers disagree with blanket rules on health and safety issues, but they are pressured by the *"[writers] of these policies who are not in the best positions to understand the actual works" (John)* carried out by skilled tradesmen.

One key requirement of every effective safety policy according to the HSE (2019) is the creation of a safe space for workers to openly express and communicate any safety concerns. From the above interactions, Pete and his colleagues did not believe they were working in an environment that encouraged open communication amongst workers especially from subcontractors to main contractors. Furthermore, it is widely documented that challenging standards and policies of main contractors (including matters relating to safety) have in the past resulted in some subcontractors being placed on blacklists or quite ironically being excluded from main contractors' approved list of subcontractors (see BBC, 2016).

Embracing Ambiguity

Many workers on sites visited believed the construction practice in general was inherently dangerous and there were different ways of approaching the risks. Experienced workers and leaders showed genuine openness to listening to other workers about approaches to eliminating and/or minimizing risk on site. They believed that no matter your experience, you could be faced with a situation that you may not be equipped with the most efficient solution to manage it.

> There's always more than one way of doing something as well as several safe and unsafe ways as well. I think it's always good to discuss as well as just have your own opinion. Tony

Tony who had many years of experience and was the owner of his micro firm indicated he was willing to listen to the workers (both experienced and less experienced) because it was a good learning opportunity that could offer a new way of carrying out activities safer. Thus, he is in continuous search of improvement in their team's safety approaches. New risks and hazards could always lead to an opportunity to improve. Furthermore, new workers or new team members could mean an opportunity to gain a fresh perspective on the risk management. Therefore, the ambiguity they embrace is not always focused on the risk that arises but also the potential for a team member to offer a better solution to the impending issues.

In other instances when firms were working with main contractors, they had to be cautious of the supposed explicit and efficient safety measures. Even having been told about the formal risk assessment and risk control measures (which are supposedly not

open to negotiation thereby not ambiguity), workers still use their personal judgement to quickly assess situations to ensure their personal safety i.e. the workers still anticipate ambiguity and hence are prepared. The notion of embracing ambiguity enables them to dynamically and appropriately adapt their practices without the encountered situation significantly impacting the work flow or productivity. For example, Sam had his concerns about accepting all formal documentation on face value. *"I've been told before in the past like oh there's nothing live in there you can dig away and they added they had scanned the area as well (up north). Yeah you can dig away, but we start digging away and next minute there's a cable." Sam*

The key observation about when this story was told was that Sam was not surprised. His expectation of the unexpected meant he was prepared. According to McGlynn *et al.,* (1997) this function is referred to as 'error checking' in the military. A practice that Sam had not been formally taught but his years of experience has informed him that human errors do occur, and they fall under the category of risks and ambiguities.

Egalitarian Approach to Risk Management

Although there are both formal and informal hierarchies amongst micro firm workers, their approach to safety discussions did not reveal any power distances. Huang and Hinze (2006) highlight the role of the owner of the small team in shaping the safety culture. This current research does not dispute the above and it is further advocated that there is an egalitarian approach to safety negotiations among workers of micro firms. Owners tend to appreciate and incorporate the views of their workers/employees when arriving at decisions affecting safety.

An open conversation is the start of these negotiations. In a typical scenario where workers were trying to negotiate an approach to an emergent situation; workers were observed discussing whether an area could be classified as a confined space. The workers acknowledged the area in question was not the *'textbook definition'* of a confined space and as such were willing to discuss how they would define the situation and, how they would safely carry out their work there. The discussion involved both experienced and new workers. The experienced workers listened to the less experienced workers' views before proceeding to explain how the current situation posed more of a risk than they had envisaged. In the absence of this discussion, the less experienced workers would have attempted to carry out their task without the necessary emergent risk assessment and this could have led to an accident or injury. The point here is not the definition of the confined space but the opportunity the less experienced workers were given to share their views. This discussion was not formally documented. The workers have however demonstrated one vital point in a safety policy - effective and open communication which is a fundamental principle recommended by the HSE.

Another important observation was made when a team would always have tea and coffee in the morning in place of standard toolbox talks. They used this time create better communication amongst the workers and encourage a good relationship between experienced and less experienced workers. When asked about this practice, it was explained that it helps prevent rifts and power distances amongst workers. Furthermore, this was also known to help the less experienced workers develop as well as giving the older generations an opportunity to learn new approaches. Adam, the team leader with many years of experience stated the following:

> But you have got to communicate, you have to discuss opinions. What works better for me might not work better for them, so you've got to be prepared to discuss it and come to an accord some way that works better for you both. Adam

The above is in line with on-the-job learning processes of construction workers as they are allowed to learn through making mistakes with a clear explanation of why one view may be more effective (Gherardi and Nicolini, 2002) i.e. learning from mistakes.

Lack of Inclusive Policies on Projects

Most project safety policies are designed by the principal contractors as they are not done with the input of the workers of the micro firms who are usually subcontractors. The micro firms believe the policies and bureaucratic measures are only developed to prevent law suits and the worsening of the compensation culture.

When discussing the views of workers on various projects they had been part of, there were mixed views of how main contractors treat the subcontractors especially the micro firms.

> It's just basically the people you meet, some are a bit even and some are not, some you can communicate with and some just wanna do their job and don't wanna help you do your job. You're getting paid for it, so you do it. You know but you get some and you can talk to 'em and they might be able to advice you. George

George clearly believed many of the large firm workers were not happy to interact with his team let alone help them with tasks. This practice that George believes his team has been subjected to is unacceptable according to HSE regulations. Furthermore, not getting the necessary help one needs can lead to improper execution of activities which could then lead to accidents and injuries or poor work output. In addition, none of the workers included in the study had been involved in the development of the projects Construction Design and Management (CDM) documentation. By law, all parties must contribute to development of this document as it ensures every worker or site visitor's safety. The CDM regulations (2015) guidelines instruct that every project group or subgroup should have a considerable amount of input especially on matters affecting the tasks and activities they will be carrying out (Summerhayes, 2016).

CONCLUSIONS

This paper has explored an approach adopted by workers of micro construction firm workers when managing safety on projects. A rapid ethnographic approach was adopted to study the workers of these micro firms from within their operational setting. This approach enabled their everyday practices and interactions to be captured and analysed to sufficiently address the research aim i.e. highlighting the experiences and nuances in practices of workers of micro firms as they challenge standardisation by embracing ambiguities in project risks. Learning from established effective methods (see McGlynn *et al.,* 1997), the uncertainties and ambiguities associated with construction projects can be managed more efficiently if dynamic approaches are encouraged within the sector. Thus, the industry needs to acknowledge the existence of ambiguities and uncertainties in all projects and subsequently embrace a culture that readily adapts to address emerging risks. Role of workers in teams can interchange based on the developing events so as to enable a constant risk assessment and effective communication as projects are underway, thus workers can advise each other in relation looming risks and ambiguities in activities

and site conditions as they arise. This practice of adaptability will also ensure team members constantly monitor the safety of practices both individually and collectively.

This work is limited by the use of rapid ethnographies and it would be beneficial to policymakers, practitioners and academics if extensive ethnographies can be carried out on projects from inception to completion. This paper however sheds vital light on the importance of the industry's need to embrace practices that do not limit workers to standardised measurers but also encourage adaptability due to the nature of the industry.

REFERENCES

Acar, E and Göç, Y (2011) Prediction of risk perception by owners' psychological traits in small building contractors, *Construction Management and Economics*, 29(**8**), 841-852.

Allison, L and Kaminsky, J (2017) Safety communication networks: Females in small work crews, *Journal of Construction Engineering and Management*, 143(**08**), 1-8.

BBC (2016) *Construction Workers Win Pay-outs for 'Blacklisting'*, 9/05/2016. Available from https://www.bbc.co.uk/news/business-36242312 [Accessed 01/04/2019].

Burke, C S, Stagl, K C, Salas, E, Pierce, L and Kendall, D (2006) Understanding team adaptation: A conceptual analysis and model, *Journal of Applied Psychology*, 91(**6**), 1189-1207.

Cook, M (2015) From red tape to risk management, *Construction Journal*, 11-12.

Ellsberg, D (1961) Risk, ambiguity and the savage axioms, *Quarterly Journal of Economics*, 75, 643-669.

European Commission (2003) *Commission Recommendation of 6 May 2003 Concerning the Definition of Micro, Small and Medium-Sized Enterprises* (Text with EEA relevance) (notified under document number C (2003) 1422).

Floricel, S, Piperca, S, Banik, M (2011) *Increasing Project Flexibility: The Response Capacity of Complex Projects*. Newtown Square, PA: Project Management Institute.

Gherardi, S and Nicolini, D (2002) Learning the trade: A culture of safety in practice, *Organization*, 9(**2**), 191-223.

Gibb, A G F (2001) Standardization and pre-assembly- distinguishing myth from reality using case study research, *Construction Management and Economics*, 19(**03**), 307-15.

HSE (2019) Example risk assessments. Available from http://www.hse.gov.uk/risk/casestudies/index.htm [Accessed: 01/04/2019].

HSE (2019) Risk- Controlling the risks in the workplace. Available from http://www.hse.gov.uk/risk/controlling-risks.htm [Accessed: 01/04/2019].

Huang, X and Hinze, J (2006) Owner's role in construction safety, *Journal of Construction Engineering and Management*, 132(**2**), 164-173.

Kines, P, Andersen, L P, Spangenberg, S, Mikkelsen, K L, Dyreborg, J and Zohar, D (2010) Improving construction site safety through leader-based verbal safety communication, *Journal of Safety Research*, 41(**5**), 399-406.

Loosemore, M, Powell, A, Blaxland, M, Galea, N, Dainty, A and Chappell, L (2015) Rapid ethnography in construction gender research *In:* Raidén, A B and Aboagye-Nimo, E (Eds) *Proceedings of the 31st Annual ARCOM Conference*, 7-9 September 2015, Lincoln, UK, Association of Researchers in Construction Management, 1271-1280.

Lord Young of Graffham (2010) *Common Sense Common Safety*, London: Cabinet Office.

Love, P E D, Smith, J, Treloar, G J and Li, H (2000) Some empirical observations of service quality in construction, *ECAM*, 7(**2**), 191-201.

Luo, L, He, Q, Jaselskis, E J and Xie, J (2017) Construction project complexity: Research trends and implications, *Journal of Construction Engineering and Management*, 143(**7**), 04017019-10.

Malakis, S, Kontogiannis, T and Kirwan, B (2010) Managing emergencies and abnormal situations in air traffic control (part 1), *Applied Ergonomics*, 41(**4**), 620-627.

McGlynn, R P, Sutton, J L, Sprague, B L, Demski, R M and Pierce, L G (1997) *Development of a Team Performance Task Battery to Evaluate Performance of the Command and Control Vehicle (C2V) Crew*. Aberdeen Proving Ground, MD: US Army Research Laboratory (Contract No DAAL01-96-P-0875).

Pheng, L S and Fang, T H (2005) Modern-day lean construction principles: Some questions on their origin and similarities with Sun Tzu's Art of War, *Management Decision*, 43(**4**), 523-541.

Pheng, L S and Meng, C Y (2018) *Managing Productivity in Construction: JIT Operations and Measurements*. London: Routledge.

Pinder, J, Gibb, A, Dainty, A, Jones, W, Fray, M, Hartley, R, Cheyne, A, Finneran, A, Glover, J, Haslam, R and Morgan, J (2016) Occupational safety and health and smaller organisations: Research challenges and opportunities, *Policy and Practice in Health and Safety*, 14(**1**), 34-49.

Riain, S Ó (2009) Extending the Ethnographic. *In*: The SAGE Handbook of Case-Based Methods. London: Sage Publications, 289.

Rumane, A R (2017) *Quality Management in Construction Projects*. New York: CRC Press.

Salas, E, Cooke, N J and Rosen, M A (2008) On teams, teamwork and team performance: Discoveries and developments, *Human Factors*, 50(**3**), 540-547.

Stagl, K C, Burke, S, Salas, E and Pierce, L (2006) Team adaptation: Realizing team synergy, *In*: *Understanding Adaptability: A Prerequisite for Effective Performance Within Complex Environments*, London: Emerald, 117-141.

Summerhayes, S D (2016) *CDM Regulations 2015 Procedures Manual*. Chichester: John Wiley and Sons.

Sutton, J L, Pierce, L G, Burke, C S, Salas, E (2006), Cultural adaptability In: C S Burke, L G Pierce, E Salas (Eds.) *Understanding Adaptability: A Prerequisite for Effective Performance Within Complex Environments (Advances in Human Performance and Cognitive Engineering Research, Volume 6)*, London: Emerald Group Publishing Limited, 143-173.

Vassie, L, Tomas, J and Oliver A (2000) Health and safety management in UK and Spanish SMEs: A comparative study, *Journal of Safety Research*, 31(**1**), 35-43.

Walker, D H, Davis, P R and Stevenson, A (2017) Coping with uncertainty and ambiguity through team collaboration in infrastructure projects, *International Journal of Project Management*, 35(**2**), 180-190.

Whiteoak, J.W and Mohamed, S (2016) Employee engagement, boredom and frontline construction workers feeling safe in their workplace, *Accident Analysis and Prevention*, 93, 291-298.