SCAFFOLDING IN THE UK AND IRELAND: A FRAMEWORK TO IMPROVE HEALTH AND SAFETY NEGLECT ON SMALL AND MEDIUM-SIZED CONSTRUCTION PROJECTS

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The health, safety and well-being of construction operatives is a fundamental aspect of the construction industry, and safety standards have improved greatly with the introduction of safety training initiatives and welfare facilities on-site. However, one area that often tends to be neglected is scaffolding safety, particularly on smaller construction sites. Therefore, this study aims to analyse current scaffolding safety systems for Kwikstage scaffolding in the UK and Ireland, identify any differences between the two regions, investigate current scaffold safety neglect, if any, and finally, create a framework to encourage operatives to be more aware of the dangers of working with scaffolding on construction sites. A detailed literature review and pilot study provided foundations for the research to lead to both qualitative and quantitative approaches, using a combination of interviews and questionnaire surveys with industry professionals. Results were analysed consistently to ensure comparability, linking key phrases and topics from each method of research undertaken. Findings identified that scaffolding safety is neglected more-so by SME's based on smaller scaled construction sites, who tend not to sub-contract scaffolding temporary works. This research led to the creation of a new 'INSPECT' framework, designed to be displayed at scaffolding access and egress points, along with the development of a 'traffic light system' for the inspection of erected scaffolding. The INSPECT framework, developed using keywords from the research undertaken, is an acronym for Inspect, Neat, Secure, PPE, Entry, Caution and Trips. Overall, the key contribution is the development of a framework, using key information to display to construction operatives on-site, to improve their overall health, safety and well-being on-site when entering a scaffolding structure.

Keywords: health and safety, Ireland, Kwikstage, scaffolding

INTRODUCTION

The dangerous nature of the construction industry has been well documented, where health and safety (H&S) can have a significant impact. If a construction site is not properly managed, it can either make or break a contractor (Ganah and John 2015).

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According to Lingard (2007), it is only in recent times that the safety of workers has begun to be treated as a serious concern. Overall construction standards have risen substantially regarding H&S, with various training initiatives and programmes being implemented on-site. In Ireland, the Health and Safety Authority (HSA 2019a) note that all construction contractors must comply with site rules and a H&S plan, whilst ensuring that all employees are also compliant throughout the construction process. It is illegal in Ireland to work on-site without holding a SOLAS Safe Pass Card (SOLAS 2015), and while not a legislative requirement, most contractors in the UK require their workforce to hold a CSCS Card (CSCS 2020) before stepping onto a site. However, one area that often tends to be neglected is scaffolding safety, particularly on smaller construction sites. The major application of scaffolding is to support building works at heights, as well as areas with poor access (Błazik-Borowa and Szer 2015). Nadhim *et al. (*2016) argue that scaffolding is one of the riskiest construction activities that leads to falls from heights (FFH), and scaffolds can be very dangerous when they are improperly used or erected (Wong *et al.,* 2009). Thus, FFH are at the forefront of construction industry incidents compared with other industries (Hanapi *et al.,* 2013), and prolonged construction activities on poorly used or erected scaffolds contributes to higher rates of FFH (Rubio-Romero *et al.,* 2013).

On review, previous research fails to acknowledge and highlight the issue of scaffolding neglect and misuse within a UK and Irish context, while a lot of industry reports and surveys appear vague in comparison. Therefore, in the context of small and medium sized (SMEs) construction contractors, it its necessary to identify the reasons for scaffolding neglect and establish appropriate safety measures for operatives to adhere to on-site. In addressing these issues and answering a gap in knowledge, it is paramount to develop results based on actual events that emerge, when studying implicitly complex environments such as the UK and Irish construction industries. Focusing on a very important area of interest, this study aims to analyse current scaffolding safety systems for scaffolding in the UK and Ireland, identify any differences between the two regions, investigate current neglect of scaffold safety, if any, and finally, create a framework to encourage operatives to be more aware of the dangers of working with scaffolding on construction sites. This is achieved by incorporating a mixed methods research approach, encompassing a literature review and semi-structured interviews (qualitative), and a questionnaire survey (quantitative). Many different types of scaffolding exist; however, this study concentrates on the Kwikstage scaffolding system, as it is the most popular scaffolding system used in the UK and Ireland (ESL 2020; MJR 2020). SMEs are considered as they are very dominant in the sector, and furthermore, nearly a fifth of all SMEs covering all industry sectors in the UK and Ireland operate in construction (CSO 2014; Barton 2020). Thus, it is anticipated that in challenging this aim, this study will assist and aid construction contractors and operatives in identifying risks and issues regarding scaffolding neglect, and adopting strategies considering scaffolding safety, to improve H&S on construction sites in the UK and Ireland.

Despite construction environments becoming dramatically safer over the past several decades (Shin *et al.,* 2014), the industry remains 'high risk' (HSE 2013). Man *et al. (*2017) support that the construction industry has the highest number of fatalities and accidents among all sectors. Furthermore, the Centre for Construction Research and Training (CPWR 2013) validate that 56.3% of construction deaths occurred in companies with fewer than twenty employees. Chi *et al. (*2014) argue that FFH are the leading cause of fatalities in the industry, and Saurin and de Macedo Guimarães

(2006) concur that work on scaffolds, whatever the type, is usually associated with fall hazards. Hoła *et al. (*2017) identify that the causes of falls from scaffolds are of a technical, organisational and human nature, such as the lack of or inadequate equipment, inadequate professional preparation and a tolerance by management to deviate from H&S regulations. Liy *et al. (*2016) corroborate that a lack of guard rails on scaffolds is the main cause of falls, and Dodge (2012) furthers the argument that partially dismantled scaffolds leads to FFH. Considering regulations, Ismail and Ab Ghani (2012) state that the main factor contributing to accidents involving scaffolding is the lack of compliance. Moreover, findings from a Health and Safety Executive (HSE) report in the UK substantiate that complacency exists surrounding legislation, as 20% of scaffolds on construction sites failed to address working at height regulations (Hughes and Ferrett 2011).

Research in the areas of scaffold safety and neglect in the UK and Ireland is scant, however, studies have been undertaken elsewhere. When evaluating scaffold safety on construction sites in the USA, Halperin and McCann (2004) establish that on small sites with fewer than ten workers, only 48% of the scaffolds received an acceptable scaffold rating. Rubio-Romero *et al. (*2013) argue that the safety of scaffold supports on construction sites in Spain is a concern due to ignorance on the part of building contractors. In Malaysia, Hamdan and Awang (2015) observe that unskilled workers contribute to scaffolding accidents, and Pieńko *et al. (*2018) strengthen that in Poland, scaffolds used for small investments are in the worst technical condition, because they are most often assembled by contractor's employees rather than by professional companies. In the UK, Whitaker *et al. (*2003) outline the development of a prototype decision aid to promote access scaffold safety. Concentrating on contributing factors in UK construction accidents, Haslam *et al. (*2005) argue the ergonomics of traditional scaffolding has not been examined, and there is opportunity for modest innovation.

Kwikstage scaffolding is contrived from hardwearing galvanised steel and it is admired for its easy installation (Adhikari *et al.,* 2019). Compared to traditional tube and fitting scaffolding systems, Hou *et al. (*2017) affirm that the Kwikstage system is easy to handle on-site, sparing workforce, resource and effort. Furthermore, it is popular in the UK and Ireland as it is cost effective, which is attractive to smaller construction contractors. Regardless of which scaffolding system is used, both the UK and Ireland are bound by stringent regulations and legislation. Howarth and Watson (2009) note that safety requirements for UK construction sites are controlled by a hierarchy of legislative elements, and some scaffolding regulatory bodies include the National Access and Scaffolding Confederation (NASC) and the Construction Industry Scaffolders Record Scheme (CISRS) (Scaffolding Costs 2019). In Ireland, the HSA (2019b) have published a Code of Practice for Access and Working Scaffolds, and they comply with normal European Union (EU) legislation EN12810 and EN12811, which provide some recommendations on the manufacturing and assembly of scaffolding (Rubio-Romero *et al.,* 2013). However, even with such legal requirements, issues with scaffolding continues to occur. Błazik-Borowa and Szer (2015) argue that because of the temporary nature of scaffolds on a building site, their construction is regarded with little significance, and minor importance is attached to their proper assembly and exploitation. Kumar *et al. (*2013) support that the scaffolding process is less significant against the overall construction project, even though it involves a considerable amount of resource input and effort. The construction industry is classed as 'fragile' with low profit margins and high risks (Hawker 2019), thus attributing to smaller construction contractors not complying

with legislation and implementing cost-cutting measures. Therefore, Kim and Teizer (2013) postulate that scaffolding systems deserve more attention due to the impact they have on costs, schedules, and the H&S of the overall construction site.

RESEARCH METHOD

This study is part of an initial exploratory investigation which aims to contribute to both industry and academia. Considering the theoretical stance and reasoning this research is founded on, a critical realism approach is adopted. Also, the ontological approach is that of a subjectivist, as the nature of the study mainly concerns the opinions of human participants. An abductive logic is selected as it breaks down our understanding of something and is oriented towards making the indeterminate more determinate to facilitate action (Alvesson and Karreman 2011). A mixed methods research approach is utilised, encompassing both qualitative and quantitative techniques including a pilot study, informative literature review, five exploratory individual interviews and a questionnaire survey. Leon *et al. (*2011) suggest that pilot studies play a key role in the creation or implementation of new approaches, assessments and other methods of research. The pilot study consisted of a short questionnaire on general H&S practices and distributed to six construction industry professionals. These participants, along with the five individual interviewees, were selected based on criterion and convenience sampling strategies; firstly, by identifying their credentials and experiences with scaffolding systems in the UK and Ireland, and secondly, by arranging interviews depending on the participants availability at a suitable time. For the individual interviews, a semi-structured interview format is chosen, as it determines people's subjective reactions to situations, thus, extending the researcher's knowledge on the topic (McIntosh and Morse 2015).

From an ethical perspective, the participants are informed of the nature of the research, its purpose and what the resultant data will be used for, prior to commencement of interviews. Also, the identities of those involved remain anonymous and confidential information is not disclosed. All five interviewees are currently based in Ireland; however, they all have industry experience in the UK. Interviewee 1 is a Site Engineer working in the greater Dublin area; Interviewee 2 is a H&S Officer working across the Leinster region; Interviewee 3 is a H&S Consultant working nationwide; Interviewee 4 is a Director of a Scaffolding Company working nationwide; and Interviewee 5 is a Project Manager working in the greater Dublin area. Following the interviews, a questionnaire survey was distributed to various construction professionals ranging from Site Operatives, Contractors, Project Manger's and H&S Officers, to further consolidate the findings. Questionnaires are a widely used means of collecting data, and it is an easy way to get responses from many people (Rowley 2014). One hundred and fifty questionnaires were distributed, and forty-one people responded, resulting in a 27% response rate.

RESULTS

The interviews began by gaining general background information from each

participant, followed by a discussion on scaffolding systems, safety and neglect in the UK and Ireland. Findings from both the interviews and literature review were then combined to generate the questionnaire survey, and this was circulated out to industry. All the resultant data from each research method was amalgamated and thematically analysed, identifying key words, topics and themes for discussion. A summary of the key findings is illustrated in Figure 1. Links are established between all the key points

and phrases, which forms the basis for creation of the framework, as a result of the research undertaken. It is worth documenting that the findings from the individual interviews and questionnaire surveys are specific to this research; thus, not a generalised view. Nevertheless, this study provides a foundation to advance and expand further, supporting continuous research into scaffolding systems on construction sites in the UK and Ireland.

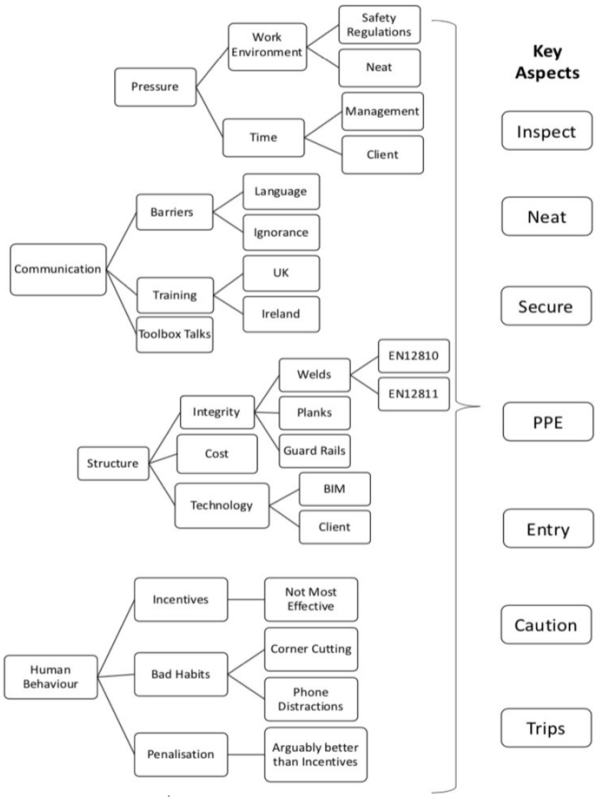

Figure 1: Summary of Key Findings

DISCUSSION

Theme 1 - H&S Compliance and Human Behaviour

Four out of five interviewees agreed that current scaffolding safety compliance is of an acceptable standard, supporting Zin and Ismail (2012) who view that good safety behaviour results in the achievement of good safety compliance. However, the H&S Officer argued that 'corner cutting' is still a huge factor, particularly on smaller sites. There is a direct correlation with contractor size and scaffolding safety, where SME's tend to erect their own scaffolding without trained personnel, and not sub-contract out to a professional company, substantiating with the findings of Pieńko *et al. (*2018). Human behaviour is also a huge factor, and the Director of the Scaffolding Company discussed how bad habits are rife among operatives on-site. Li *et al. (*2018) agrees that construction workers are renowned for getting into bad habits and taking the easy way out without respect for safety. Phone usage on-site, particularly among younger site workers was also highlighted by the H&S consultant, corroborating with Westaby and Lowe (2005) who argue that young people are more likely to partake in risk-taking behaviour on-site. Liang *et al. (*2018) confirm the findings and encourage further elimination of unsafe behaviours of construction workers.

Theme 2 - Incentives

80% of interviewees and 60% of questionnaire respondents verify that incentives are beneficial, confirming Kim's (2018) view that accident prevention on construction sites is improved when an incentive system is introduced. However, all five of the interviewees spoke about a penalty system instead. The Site Engineer summarised that the penalisation system rates each worker, and the more points against that worker, the greater severity of consequence. For example, for not using safety goggles, they are penalised one point, and if they were caught altering scaffolding without the relevant training, they are penalised ten points, and the culmination of points may result in a wage reduction. Other non-monetary incentives might include free company merchandise. Zulkefli *et al. (*2014) conclude that offering rewards, either monetary or non-monetary, is an important part of improving overall safety on construction sites.

Theme 3 - Technology

All interview participants noted the importance of technology and particularly Building Information Modelling (BIM). The general belief is that BIM can very much improve scaffolding safety, with the Project Manager stating that 'BIM is the future'. Zhang *et al. (*2013) argue that the use of virtual reality-based tools such as BIM can improve safety standards in construction, and Collins *et al. (*2014) support that safety risk factors for scaffolding construction can be integrated in BIM. However, 80% of the questionnaire respondents believe that BIM will not be implemented in SME's in this way due to the high costs involved. The interviewees also discussed the potential use of a 'Traffic Light System', where instead of signing off scaffold tags after each inspection, card tapping could be introduced, which would display a green light enabling access to the scaffold. However, on smaller sites, the interviewees agreed that cost would again be the main issue, and it would be hard to implement.

Theme 4 - Communication

Four of the interviewees agreed that toolbox talks are an effective way of communicating with site operatives. However, the Site Engineer remarked that toolbox talks concerning scaffolding safety or working at height are not given regularly unless it is relevant to the activity on-site at that time. Ganah and John (2015) encourage the use of BIM in toolbox talks, as the personnel can visually understand H&S issues as work progresses. Due to the diversity of the site operatives, language barriers are also prevalent. The Project Manager felt that toolbox talks, and daily meetings should contain more detailed information regarding scaffolding safety, supporting Eggerth *et al. (*2018) who claim that a narrative and informed discussions increase toolbox talk effectiveness. 40% of the questionnaire responses identified daily meetings to be more effective than toolbox talks, validating Kines *et al. (*2010) who state that coaching construction site foremen to include safety in their daily verbal exchanges with workers has a positive effect on the overall level of safety.

Theme 5 - Training

The H&S Officer and Consultant have a wealth of experience in both jurisdictions, and in their respective interviews, they both strongly argued that the standard of scaffolding safety training in Ireland is unacceptable and insufficient, compared to the UK. The UK has a well-structured scaffolding training procedure, with different tiers for different roles (HSE 2019). All the interviewees believed that all site operatives should have basic scaffolding training, particularly in housekeeping and general maintenance. However, the Project Manager suggested that there is a lack of interest due to the temporary nature of scaffolding on site, which supports the findings of

Błazik-Borowa and Szer (2015). The H&S Officer further acknowledged that construction SME's are taking advantage of the Irish system, where only one person is required to complete the relevant scaffolding safety training. Thus, they can then sign off inspections on all company sites, sometimes without even being present on-site. Moreover, only two of the interviewees claimed that the new scaffolding Code of Practice in Ireland (HSA 2019b) was effective, and not strict enough regarding safety.

Theme 6 - INSPECT Framework

The initial ideas for a scaffolding safety framework were discussed with the interviewees, and it received an overwhelmingly positive response. The design was finalised following data analysis of both the interviews and questionnaire responses, leading to the creation of the INSPECT Framework. It was developed using keywords from the research undertaken and is an acronym for Inspect (Has the scaffold been inspected in the last seven days?); Neat (Ensure housekeeping is in place); Secure (Is the structure secure - guardrails, bracings etc.); PPE (Have you got the correct Personal Protective Equipment before entry?); Entry (Access and egress - are ladders intact and tagged?); Caution (Take caution - risk of falling from height); and Trips (Be aware of slips, trips and falls). The framework has been designed to be displayed at scaffolding access and egress points on-site, with the anticipation of creating awareness and encouraging safe practices when using scaffolds on construction sites.

CONCLUSION

Essentially, this study focuses on scaffolding safety on small and medium sized construction sites in the UK and Ireland. The construction industry is one of the most dangerous industries in the world in terms of H&S, and scaffolding is one of the riskiest construction activities that leads to FFH. Therefore, construction site managers and contractors are tasked with ensuring that all workers on-site are sufficiently trained in the operation and maintenance of scaffolds, the equipment and tools used are adequate, and that all processes are compliant with the appropriate legislation and regulations. Considering the results captured from the individual interviews and questionnaire survey, key themes emerged including H&S Compliance and Human Behaviour, Incentives, Technology, Communication and Training. These themes culminated into the creation of the INSPECT Framework, designed to be displayed at scaffolding access and egress points on-site to encourage scaffolding safety. The framework was developed using keywords from the research undertaken and is an acronym for Inspect, Neat, Secure, PPE, Entry, Caution and Trips.

However, the findings established from the interviews and questionnaire surveys are specific to this research, and only a concise, subjective view of the topic is produced; not a generalised one. Nevertheless, this study provides a foundation to advance and expand further, supporting continuous research into scaffolding systems on construction sites in the UK and Ireland. There is potential to further develop the findings in this paper, and it is anticipated that a broader analytical context will be addressed in a future publication, where additional theoretical points of departure, coupled with the initial findings of this research, can be articulated. It is recommended that further individual interviews and focus group seminars for qualitative analysis are introduced, using sequential selection strategies incorporating quota and random sampling methods. To gain a richer understanding of scaffolding use in these environments, alternative research methods can be implemented such as action research and ethnographic studies. There is also an opportunity to further develop the 'Traffic Light System' concept that was previously discussed.

Nonetheless, this study provides a foundation for informing and confirming the validity and necessity of the research and ensuing investigation going forward. Going forward, large custom-made signs of the INSPECT Framework have been produced and are being deployed and piloted on a number of SMEs located in the Leinster region of Ireland. These will be displayed at scaffolding access and egress points on-site to promote safe scaffolding use, and any feedback and recommendations received will be utilised to support further research. Overall, the key contribution of this study illustrates the development of the INSPECT Framework to construction contractors and site management, using key information to display on-site, to improve the overall H&S of operatives when entering a scaffolding structure.

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