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EXPANDING PREVENTION THROUGH DESIGN (PtD) IN PRACTICE: INNOVATION, CHANGE, AND A PATH FORWARD

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ABSTRACT

Prevention through Design (PtD) is an attractive occupational safety and health intervention because it complements the motivation to eliminate hazards on job sites before work commences. Implementation of PtD with respect to construction safety and health, however, is not present or widespread in some countries, and efforts continue to increase its dissemination. This paper presents findings of a research study aimed at determining the impacts of PtD on project team roles and professional practice, with the objective of identifying a path forward for further diffusion of PtD in the United States (US) construction industry. The researchers conducted fourteen structured focus group interviews of six different professional communities in the United Kingdom (UK), where PtD is integrated in practice through regulation. Widespread and sustained implementation of PtD in practice reveals changes in attitudes towards worker safety, especially with regard to who can have a positive impact and should play a role, as well as improved communication, team integration, knowledge transfer, and design innovation. The findings point to a path forward for expanding PtD in the construction community that includes four essential attributes: knowledge, desire (motivation), ability, and execution. Each attribute addresses a fundamental need for effecting positive change and enabling successful PtD diffusion to take place.

Keywords: safety, prevention, design, construction, architecture

1. INTRODUCTION

Implementation of the Prevention through Design (PtD) concept with respect to construction worker occupational safety and health (OSH) is currently limited in some countries, including the United States (US) (Tymvios et al., 2012). While potential benefits

of PtD to construction worker OSH have been identified (Lam et al., 2006; Gambatese et al., 2005; Christensen, 2011) and examples of successful and continued PtD implementation exist in practice (Weinstein et al., 2005; Zou et al., 2008), further diffusion of PtD throughout the construction industry is needed. This paper reports on a study designed to explore changes that have occurred as a result of implementing PtD, in an attempt to understand how the PtD concept can be further diffused throughout the construction industry in the US and other countries. Formal application of the PtD concept, while not extensive in the US, is common practice in some other countries and regions around the world (Aires et al., 2010; Toole et al., 2012). In the United Kingdom (UK), the Construction (Design and Management) Regulations were put in place in 1994 to fulfil the Temporary or Mobile Construction Sites Directive of the European Union (EU) (Directive 92/57/EEC) (CDM, 1994). The CDM Regulations place a duty on design professionals and others involved in projects to ensure that foreseeable hazards and risks to construction workers are mitigated (MacKenzie et al., 2000).

The many years of PtD experience among UK architects, engineers, owners, constructors, and health and safety professionals presents a valuable opportunity to learn how an industry adapts to PtD regulations and sustained implementation. While full understanding and implementation of PtD in the UK may still be forthcoming, and educational institutions have yet to fully integrate PtD into design curricula, practical experience gained so far can provide useful insights for those countries that have yet to experience a high rate of implementation. The current research study captures salient perspectives and knowledge from UK companies in the construction sector regarding changes in design and construction practice and project team member roles and attitudes since adoption of the CDM Regulations. For newly adopted interventions, such as PtD, anticipating the potential changes can influence implementation success. Realising and planning for direct and ancillary impacts beforehand can facilitate and accelerate dissemination of the intervention.

2. CURRENT KNOWLEDGE AND PRACTICE

Whenever the PtD concept has been implemented, the construction industry has had beneficial impacts. In their investigation of a PtD process implemented on a project, Weinstein et al. (2005) found that in 14 (54%) of the 26 changes made to the design of a facility that were studied, trade contractors specifically mentioned that the changes improved safety. Levitt and Samelson (1993) and Hinze (2006) contend that improved OSH also positively influences productivity, quality, time, and activity costs. Öney-Yazıcı and Dulaimi (2015) found that designers in the United Arab Emirates believe that PtD does not limit their creativity. Implementation of PtD has been found to positively impact project aesthetics and ease of structure maintenance (Behm and Poh, 2012), and to lead to a reduction in construction duration (Behm and Culvenor, 2011). A reduction in the time needed from project conception to completion is expected because there is less retrofit required (Christensen, 2011). PtD also increases the constructability of a project (Lam et al., 2006). Better designs, reduced workers' compensation premiums, and reduced environmental damage are some other outcomes associated with PtD that have been observed (ISTD, 2003, as cited in Gambatese et al., 2005). Perhaps one of the greatest impacts comes from the efforts within PtD programmes to provide construction knowledge and expertise early on in the project timeline (Hecker et al., 2005). Lingard et al. (2014) provide evidence of the potential OSH benefits of ensuring that constructors' knowledge

about construction methods, materials, OSH risks, and means of risk control are integrated into pre-construction decision-making.

As the PtD concept is diffused throughout the construction industry, it is expected that the industry will react and change. Toole (2001) showed how the characteristics of a task, process, and industry have caused innovative building products to follow one or more trajectories. Similarly, Toole and Gambatese (2007) identified four specific trajectories that PtD is likely to cause: (1) increased prefabrication, (2) increased use of less hazardous materials and systems, (3) increased application of construction engineering, and (4) increased spatial investigation and consideration. Morrow et al. (2015) recommend that designers embed PtD into their work and highlight the importance of dispelling the view that OSH is a lone activity, reserved primarily for the experts to advise upon and direct when required.

Research has identified reasons for the minimal diffusion of PtD in some countries. Barriers to PtD implementation in construction exist (Gambatese et al., 2005; Toole, 2005), yet none are insurmountable. Questions remain, however, about how to overcome the barriers to diffusion. Further research is needed to identify a path forward that will be acceptable to the construction industry and will lead to diffusion of PtD. The current study is different from previous research in that it utilises experiential knowledge from a population where PtD is already practised and has taken hold. The knowledge gained from diffusion within one country provides an example of what to expect when PtD becomes part of standard practice in another country. Furthermore, previous research has mainly focused on direct and quantifiable impacts at the project level (e.g., project cost and quality). For the current study, it is posited that there are additional subtle and latent changes that occur within and among project team members and within the industry that are important and beneficial as well.

3. RESEARCH OBJECTIVES AND METHODS

The strategy chosen for conducting the research study was to gather and analyse experiences and perspectives from within the UK construction industry that have been gained from regulatory mandated application of the CDM Regulations. To do so, the researchers utilised focus group interviews as the mechanism to collect data. While they do not provide a cause-and-effect relationship, focus groups are particularly appropriate when exploring a topic that is difficult to observe and does not lend itself to observational techniques, such as the topic of attitudes and decision-making (Cohen and Crabtree, 2006). Focus groups also provide access to comparisons that participants make between their experiences, which is a benefit that can be very valuable and can provide access to consensus or diversity of experiences on a topic (Cohen and Crabtree, 2006), such as PtD.

The focus group interviews were directed at those in the UK who have been impacted by the CDM Regulations, including architects, design engineers, facility owners and developers, contractors (general contractors and trade contractors), manufacturers and suppliers, and health and safety (H&S) consultants. Selection of the UK as the focus of the study is based on the UK's experience with PtD in the construction industry. Efforts to mandate that designers consider the safety of those who construct or manufacture their designs dates back to the UK's Health and Safety at Work etc. Act of 1974 (Legislation, 2011a). This act obligates designers to ensure that their designs will be safe and without

risks to health at all times when the design is being set (installed and/or constructed), used, cleaned, and maintained.

In response to the EU directive of 1992, the UK passed into law the Construction (Design and Management) Regulations (CDM), which became effective in March 1995 (Legislation, 2011b). The objective of the Regulations is to reduce the total amount of risk that is introduced into the construction process, through effective management of OSH upstream of the construction activity. The crux of the Regulations as they affect the design profession is that the Regulations place a duty on the designer to ensure that any design that they create avoids unnecessary risk to construction workers (MacKenzie et al., 2000). The CDM Regulations were revised in 2007, with the aim of reducing the burden of paperwork and streamlining the process. In April 2015, revised CDM Regulations were approved that more closely follow the requirements of the EU directive of 1992 (HSE, 2015). The fundamentals of PtD remain, but the details, such as how the roles are allocated, have changed. The current research was conducted while the 2007 CDM Regulations were in force. The findings from the study do not take into account the changes made to the Regulations in 2015. It is expected that there will be changes in practice as a result of the 2015 revisions, which include the requirement of appointing a principal designer. While design professionals may initially not feel comfortable taking a leadership or co-leadership role in safety, this appointment is likely to further engage the design community in PtD and promote collaboration between design and construction disciplines on a project.

The targeted participants of the focus group interviews were representatives of six different professional "communities" within the UK construction industry: (1) architects, (2) design engineers, (3) facility owners/developers, (4) contractors (general contractors and trade contractors), (5) manufacturers/suppliers, and (6) H&S consultants. The initial aim was to have a total of 12 focus group interviews, two for each professional community, in order to have repeated groups (Krueger, 2002), and to provide multiple data-collection opportunities for each community within the resources allocated for the study.

Recommendations for conducting focus groups suggest that similar types of people be selected to participate in the focus group interviews (Krueger, 2002). The sample of focus group participants was taken from individuals who are members of, or whose employers are members of, one or more of the following construction industry professional organisations in the UK: the Chartered Institute of Building, the Royal Institute of British Architects, the Institution of Civil Engineers, the British Safety Council, and the Association for Project Safety. There may be some overlap in membership across the organisations.

Consistent with the recommendations for conducting focus groups (Krueger, 2002), convenience samples were used to ensure diversity within each professional community. In addition, the targeted size of each focus group, as recommended for focus groups (Krueger, 2002), was 6–9 participants. The researchers developed a series of questions exploring the PtD concept and its application for use as a guide in the focus group interviews. In addition to general demographic information about the participants (position, years and type of experience, education, employer type and size, experience with CDM Regulations, etc.), the focus group questions addressed each of the research questions referred to above. The first focus group session was used as a pilot, so as to ensure that the questions were applicable and clear.

The focus group sessions were scheduled over a period of several weeks, with approximately two hours allocated per focus group, at times that were convenient for the participants. Each individual who showed an interest in participating was contacted via email and/or telephone to confirm their voluntary participation. Interested participants then self-selected a scheduled focus group session in which to participate. As a result, the number of participants in each focus group varied. Due to the fact that some focus group sessions contained only a few participants, additional group sessions were organised to ensure participation by members of all the targeted communities. The researchers ultimately conducted 14 focus groups with a total of 110 participants.

4. RESULTS AND ANALYSIS

At the conclusion of each focus group session, the researchers asked the participants to submit completed demographic forms. In some cases, demographic forms were not completed and submitted by participants. A total of 62 demographic forms were received (56% of the participants). The following is a summary of the participant demographics:

- Type of firm for which the participant works (multiple selections allowed): H&S consultant (25% of responses), engineering (19.3%), architect (18.2%), contractor (9.1%), facility owner (8.0%), subcontractor (6.8%), manufacturer (4.5%), and other (9.1%).
- Services provided by the participant's firm (multiple selections allowed): H&S consultant (25.6% of responses), project management (21.6%), construction (19.9%), engineering (17.0%), and architecture (15.9%).
- Firm size (number of employees): More than 1,000 employees (42.6% of participants), 500–1,000 employees (11.5%), 250–499 employees (6.6%), 100–249 employees (13.1%), 50–99 employees (1.6%), 10–49 employees (8.2%), and 1–9 employees (16.4%).
- Years of experience: Mean of 23.0 years of experience working in the industry, and 11.3 years working with the CDM Regulations.

A large proportion of the focus group participants work for H&S consultancy firms. The roles that these individuals carry out can vary significantly with respect to the type of work actually performed and the project phase in which the work is performed. Nevertheless, the perspectives of the participants are of special interest to the study because of the participants' involvement in PtD and their understanding of safety management practices. With regard to design professionals, 25% of the 62 participants who submitted demographic forms are either an architect or design engineer. Contractors and owners make up even smaller percentages of participants. The number of participants in each role may have impacted the overall nature of the responses. In addition, the participant selection process was not random. The distribution of participants based on expertise, as well as the selection process used, limits generalisability of the results to the population at large. Research using a larger, randomly selected sample size and a different sample distribution will yield more statistically significant results.

During the focus group interviews, participant responses and discussions were recorded (handwritten and tape-recorded) for later analysis. Analysis consisted of basic descriptive statistics and text analysis in order to understand the participants' shared experiences. The researchers sorted the transcripts of the responses of the participants according to the

questions posed during the focus group session. The researchers then conducted content analysis of the responses, so as to identify words, phrases, and comments associated with each research question posed. Those words, phrases, and comments that had a high frequency of use were noted, so as to identify key concepts, themes, and terms, and so as to develop an understanding of the similarities and differences between different parties and projects. The analysis was conducted using multi-level keyword searches of the transcribed focus group discussions, so as to focus on and confirm trends in the response data. The findings of the analysis for each research question posed are presented below.

4.1 How has the CDM legislation affected project design, construction, and safety?

For design, the most-cited changes were increased modularisation and constructability, earlier incorporation of construction knowledge, inclusion of more engineering controls in the design, greater use of less hazardous materials, and slight increases in design cost and design duration. Constructors have experienced increased prefabrication, reduced material handling and less use of scaffolding, and more use of specialised equipment to remove the worker from hazardous conditions and eliminate hazardous operations. There was no clear trend in the responses with regard to impacts on construction cost and duration. In addition, the participants cited improved construction quality, worker productivity, and end-user H&S.

4.2 How has involvement in PtD affected perceptions of safety, roles on the project, and organisational and professional culture?

Generally, perceived effects of involvement in PtD related to greater collaboration and communication within project teams, and specifically between designers and constructors. Perspectives on safety, and the role that each individual can and should play in regard to safety, were also positively affected. OSH is now viewed as important to the overall success of a project, and designers now generally view construction OSH as an imperative. Perspectives on the designer's responsibility for OSH, and their ability to affect it, have changed. Construction OSH now immediately features in conversations in the planning and design stages. In terms of roles on projects, there is greater recognition that, as part of the project team, designers have a role in and responsibility for OSH. Project management efforts now include active assessments and management of OSH risks. OSH is included in project feasibility assessments. Other parties besides the architect/engineer, such as the quantity surveyor and the owner/client, are playing a greater role in project safety leadership. Impacts on organisational and professional culture have been closer relationships between disciplines (working more as collaborators), greater consideration of the needs and priorities of the other disciplines, a more thorough design approach (better professional design practice), and a more even spread of OSH across the disciplines.

4.3 To what extent have innovative processes and products been developed in response to the directive to address safety in design?

The focus group participants cited instances of changes having been observed in regard to the physical features of designs, the design process and tools, communication of safety hazards, and safety organisations. Most of the changes have been project-specific; the intent and application was to solve a problem on a project. Diffusion beyond the project to other projects or to other companies has been limited. In regard to the physical features of designs, most of the changes have been revised designs to eliminate hazards and facilitate

safe construction operations. That is, rather than creating some new design or product, it is more common for existing designs to be slightly revised. Examples of this type of change are the following: including anchorage points for fall protection in the design; modifying the size, location, shape, or materials of a design; and designing such that the systems can be prefabricated. In addition, much of the change has occurred in the structural, mechanical, and electrical systems within a facility. When new designs have been created, the examples cited by the focus group participants were mostly related to modularisation of designs and the design of features used in the maintenance of structures (e.g., window-washing systems).

4.4 What is done differently now compared to practice prior to the CDM Regulations?

Much of the difference since implementation of the CDM Regulations is related to how information is developed and shared, and how communication occurs. The differences noted ranged from general project team interactions to specific details on project documents. The project development process now includes more off-site construction and modularisation, greater collaboration between design and construction personnel, and a greater focus on safety throughout the project life cycle. With regard to differences in project documents, some designers are now placing symbols on drawings, so as to alert constructors to potential hazards (e.g., where a tripping hazard exists, placing a picture of a person tripping). Notes describing potential safety hazards and needed personal protection are also being added to design documents. Within design firms, online networks and databases have been developed to collect and share OSH knowledge. These systems are often tied to a firm's lessons-learnt resources. Lastly, many different risk-assessment tools have been created to help identify, evaluate, and mitigate the risks present in a design, as well as to provide a formal record of having conducted a risk assessment.

4.5 How has management of projects changed under the CDM Regulations?

Overall, the greatest change has been additional efforts to formally manage OSH risk. These efforts include ensuring that the appropriate parties and roles are in place, that the required documentation is created, and that OSH risks are recorded and addressed. Whereas construction worker OSH was previously confined to the management within the constructor's organisation, it has now been expanded to include the entire project team.

4.6 What can the US and other countries learn from the UK's experience, and what should be included in a path forward to enhance diffusion of PtD?

The focus group responses provide an indication of the needs and best practices for expanding PtD in the US and other countries in the absence of legislation similar to the CDM Regulations. The needed practices and resources are summarised as follows:

- The owner/client must be involved;
- Designers must be knowledgeable about how their designs influence construction means and methods, and about OSH hazards commonly present on construction sites, and designs which mitigate these hazards;
- The contractor must be involved, so as to ensure inclusion of construction knowledge;
- Design tools and resources must be supported, including a design risk-assessment process;

- There must be a means to motivate implementation of PtD;
- Designers must be engaged, so that they can be convinced and shown that they play a key role;
- There must be responsibility for implementing PtD; and
- Involvement in PtD must be expanded beyond the main project team members.

In addition to the open-ended discussion related to the research questions referred to above, the focus group participants brought up, or the conversations led to, other issues that are important to PtD. Below are some additional issues and experiences that arose from the focus group interviews and which are of interest to PtD implementation and diffusion:

- Much of the focus remains on end-user safety, not construction-worker OSH;
- The true benefit comes from working together and communicating; the CDM Regulations are simply the catalyst to enhance project team member communication and integration, which ultimately leads to improved safety;
- Changing the design culture in a way that respectfully engages designers recognises that the burden should not be placed solely on the designer and the design culture; apportioning blame in this way is not beneficial to the industry or to worker OSH;
- The extent of responsibility for mitigating OSH risks in the design remains unclear (i.e., how far should a designer go to design out hazards?);
- There is an unclear understanding of, and lack of confidence in, the ability of designers to positively impact construction safety as part of their design role;
- It is common to have a focus that is misdirected at meeting the CDM Regulations, rather than implementing PtD; and
- The PtD message needs to be expanded beyond the main project team members.

5. CONCLUSIONS

As an OSH intervention, PtD is an attractive concept. PtD provides an opportunity to eliminate and reduce OSH hazards in the workplace, and therefore greatly reduce OSH risk. Fewer job-site hazards means a safer place to work; there is less chance of getting injured. When employees feel safer on the job and are not distracted by unsafe conditions, improved worker morale, work quality, productivity, and organisational culture follow. Consequently, PtD is also an appealing proposition for employers, particularly construction employers. PtD helps to fulfil moral and regulatory obligations in regard to employee safety, health, and welfare, and can also lead to enhanced financial gains and recognition for a firm. The potential benefits from implementing PtD processes and practices in a workplace are clearly recognised.

When PtD is implemented, the design impacts are typically expressed in increased modularisation of the design, and in modified designs to accommodate and promote safer construction methods. When a safety hazard is identified, and alternative construction methods are desired to more safely conduct the work, the design is changed to accommodate the alternative methods. The alternative methods may be implemented on the job site, although much emphasis is put on prefabrication. PtD promotes and leads to prefabrication away from the job site, so as to eliminate safety hazards on the job site.

To implement PtD, design-for-safety checklists are now commonly used, together with risk assessment pro forma. These tools are applied as part of PtD processes, which commonly

consist of multiple design and constructability reviews throughout the planning and design stages. Utilising constructor, H&S consultant, and end-user input, "safety constructability" reviews are conducted to identify hazards and manage the risk. The result is modified designs, together with additional hazard-communication information placed on the design drawings, so as to alert constructors to hazards and communicate safety measures to be taken or regulations to follow. However, caution is advised not to create complicated, crowded, or overly extensive drawings by adding too many notes, especially notes that indicate an obvious hazard and are likely to be superfluous. Competency in understanding drawings and fulfilling project team roles should be addressed. A suitable contractor should be able to address the OSH hazards associated with typical designs. Designers do not have to inform constructors of "obvious" hazards, only hazards that are unusual or derive from some unique aspect of the design.

Perhaps the most important impact of implementing PtD is the change in the project team. There has been a transformation in how project team members interact, communicate, regard construction worker OSH, and conduct their work. These changes include more and improved communication, greater project team integration, increased interest in safety, and better overall professional practice. These changes are the success of PtD, which have ultimately led to safer construction sites and improved worker OSH.

The changes to the project team, professional practice, and the industry culture are important results and one of the successes that is attributable in part to the CDM Regulations. The traditional model for construction worker OSH risk management in the US has been to rely solely on the constructor to implement primarily downstream, lower-level safety controls. PtD is an effective intervention that can be part of a new model to address and improve construction worker OSH. Much like the current trend towards integrated project delivery and building information modelling, PtD is a model which involves integration of design and construction, collaboration between all project team members, and all parties playing a role. It is also a model in which a choice is made to design out the hazards before construction begins, rather than protecting against them during construction.

Changing an industry such that it adopts a new model for managing worker OSH risk is a difficult prospect. Making the change requires recognition that the current model, which is identified and clung to as standard practice, is not the best model.

PtD as a construction safety intervention is currently being employed, not only in the UK and countries possessing similar legislation, but also by some companies in the US and other countries. An environment of acceptance is needed for PtD to diffuse throughout the industry. Those in architecture, engineering, and construction who are involved in its implementation must accept that current practice is insufficient and should be augmented with inclusion of PtD. Causing this change, a change that requires internal reflection by the design community on its own practices, has so far been slow to occur and has been spurned by many in the US. Continued reflection on and consideration of PtD promotion by the design community, and diligence by industry organisations in this regard, are needed.

6. RECOMMENDATIONS

Actions undertaken to expand PtD must be selected and implemented with due consideration of the structure and the nature of both the construction industry and the PtD

concept. Doing so will increase the likelihood of PtD acceptance and diffusion, and ultimately its effectiveness and impact. Previous research suggests that diffusion and implementation of a construction worker OSH intervention such as PtD requires attention to four key attributes: knowledge, desire (motivation), ability, and execution (Behm and Culvenor, 2011; Gambatese et al., 2005; Hecker et al., 2005; MacKenzie et al., 2000; Toole, 2005; Toole et al., 2012). Each attribute addresses a fundamental need for effecting positive change and enabling desired outcomes. The research findings reveal that each of the attributes needs to be fulfilled in some way to realise PtD success. Evaluation of the focus group findings shows that, for each attribute, a variety of components can be identified that exist to address and accentuate the attribute within the context of PtD in construction. Selection and pursuit of each component depends on the resources available and the industry environment. Accordingly, both previous research findings and the findings of the current study highlight the key attributes and related components shown in Figure 1 (Gambatese, 2013).

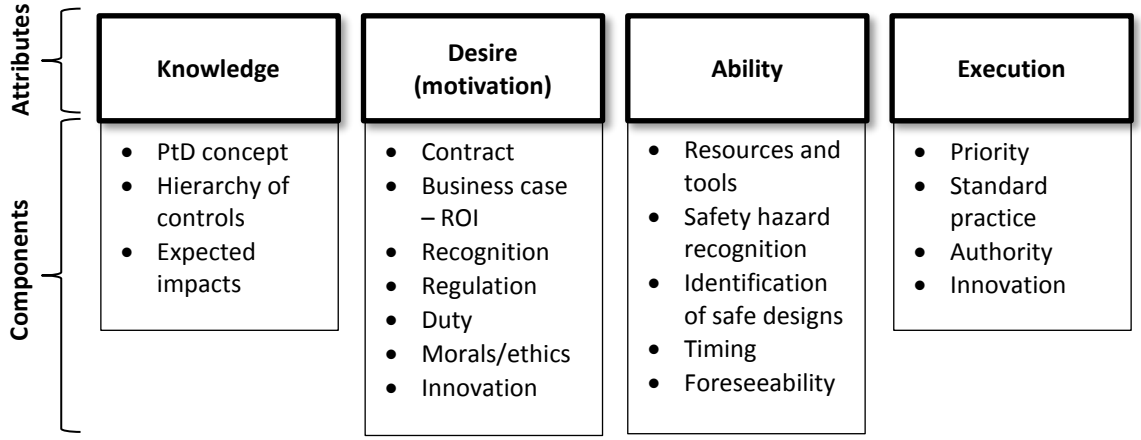

Figure 1: Attributes and components for PtD diffusion and implementation (used with the permission of Gambatese, 2013)

Careful consideration should be given to the selection, pursuit, and timing of components included in a PtD action plan. The availability of resources, the industry culture, the political environment, and the timing of the implementation (i.e., having the right information at the right time) must be considered. While a component may support a given attribute, implementation of the component may not be desired, or it may be delayed, based on the current nature of the industry and expected impacts.

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MARIJUANA USE WITHIN THE CONSTRUCTION WORKFORCE: THEORETICAL CONSIDERATIONS AND A RESEARCH PROPOSAL

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ABSTRACT

Alcohol and recreational drug use in construction is an area of growing concern. Workers are often found to have a higher prevalence of such behaviours than workers in other industries. Potential reasons for this are many. The social determinants of health negatively associated with work (the reasons why people drink or take recreational drugs) can be readily identified in construction work with temporary contracts, long working hours, and a lack of employment security for work within high-pressure and high-hazard environments. The legalisation of marijuana in several states of America has led to concerns from industry that there will be an increase in use amongst the local workforce, but it has also created the opportunity to study this phenomenon without ethical constraints regarding legality that may occur in other countries. This paper, presented for discussion rather than the dissemination of completed work, explores the theoretical issues that surround marijuana use within construction, focusing on its impact on construction site safety. This includes necessary considerations of accident causality, worker impairment, and physiological issues concerning the drug itself, as well as inherent problems with drug testing, and its effectiveness as a means of management control. This critical contextual review has been used to inform the development and proposal of a methodological approach to effectively examine this phenomenon empirically in the field, as part of a future research project to be undertaken in Colorado, USA.

Keywords: construction workforce, drug use, marijuana, safety, methodology

1. INTRODUCTION

There is growing concern over the use of alcohol and recreational drugs amongst construction workers, and the consequential impact this can have on sites, particularly in terms of site safety. Indeed, research on drug and alcohol use in the Australian construction

industry found that safety managers feel this problem is "a major issue that is only getting worse" (Biggs and Williamson, 2012:450). The legalisation of marijuana in several US states has resulted in various legal, moral and technical dilemmas for employers. Many assume that legalisation will increase use amongst their workforce, with negative consequences for safety and productivity.

Within the high-pressure, high-hazard construction site environment, any form of impairment can have serious repercussions, not only for the workers concerned, but for all those working on the site. Yet marijuana as a drug raises several unique problems. It is a natural product with different potencies, which are, in turn, influenced by how it is used, and its effects can therefore vary significantly. There is also a lack of scientific agreement on the quantifiable effects of marijuana on human performance, as well as inherent problems with drug testing using standard methods, as the longevity of marijuana in the body long outlasts actual intoxication. All of the above are aspects that require careful consideration now that the legal context has changed and states have granted their citizens the freedom to use marijuana recreationally without punishment.

This paper sets the scene for a proposed research project, itself aiming to establish how the legalisation of marijuana has impacted (or not impacted) construction site safety. At present, the impacts of marijuana use on construction safety and worker well-being and legalisation of marijuana are unknown. The theoretical and social context of marijuana legalisation is explored in depth, and then used to inform the development of a methodological approach to effectively examine this phenomenon empirically in the field.

2. MARIJUANA AND CONSTRUCTION WORK

Construction workers take drugs. The industry consistently ranks very highly for illicit drug use (e.g. Gerber and Yacoubian Jr, 2002; French et al., 2004; Minchin et al., 2006; Larson et al., 2007; Schofield et al., 2013; Bush and Lipar, 2015, cited in Fardhosseini and Esmaeili, 2016), with statistically significantly higher use than in other comparable high-hazard industries, such as oil and gas (Tan and Lloyd, 2016).

There are a number of reasons why this could be the case. Researchers have highlighted the links between work-related stress and drug use (Fardhosseini and Esmaeili, 2016), and the contribution of unsocial work patterns, long travel, and abnormal shifts to elevated risks of substance abuse (Miller et al., 2007). Remote job locations mean that workers are far from family and friends, they feel lonely, and so they become bored and tempted (Pinto et al., 2011). Feelings of powerlessness that come from short-term employment and job insecurity (Frone, 2013), and the very nature and pressure of construction work, including facing hazards on a daily basis (Biggs and Williamson, 2012), can also have a major effect, associated, as they are, with the social determinants of health, the reasons why people take drugs (Wilkinson and Marmot, 2003).

It is arguable that this "why" of marijuana use is perhaps the more critical consideration here, and research could better focus on such fundamental causes of poor worker health, rather than simply examining the symptoms, of which drug use is just one. The reader should be reassured that this work has been undertaken elsewhere (Sherratt, 2016a). For the purposes of this paper, the focus shall remain on the symptoms of drug use, specifically marijuana use, amongst the workforce, and the concerns this has raised for construction site safety, given recent changes in the legal status of marijuana for recreational use in the USA,

together with due consideration of the potential benefits and positive impacts of marijuana use and legalisation.

3. MARIJUANA, WORKER IMPAIRMENT, AND SAFETY

The physiological and psychological effects of marijuana have been well researched, not only because it is the most-consumed illicit drug in the world (Fernandes and De Campos Moreira, 2011:95), but also due to its potential medicinal benefits. Effects of its use have been found to include dizziness, tachycardia (accelerated heart rate), psychomotor retardation, and alterations to perceptual and motor speeds and coordination, while cognitive function, learning, and memory are also affected (Fernandes and De Campos Moreira, 2011). The extent of cognitive impairment caused by marijuana has been the subject of much debate recently, and no accepted answer has yet been found (Caulkins et al., 2015:35), although long-term users can have problems with brain development, intelligence quotient (IQ), reaction time (Caulkins et al., 2015), attention, and loss of memory, and can be prone to knee-jerk reactions (Fernandes and De Campos Moreira, 2011). Yet, as Caulkins et al. (2015:33) also note, problems in determining the extent of such cognitive functions are linked to the difficulties of separating the direct effects of marijuana from what they term "the personality traits" of the user.

However, these effects are not consistent from user to user; marijuana affects everyone differently. In part, this is because marijuana is a natural product, and its potency varies from plant to plant, with the result that there is no "standard" dosage. Active cannabinoids within the plant can vary in concentration from 0.3% to 30%, which results in variation in the levels in human tissues after use (Fernandes and De Campos Moreira, 2011). The way the drug is used also alters its effects, which can differ significantly (bioavailability of the drug can vary from 2% to 56%) due to what are termed "smoking dynamics" – for example, the hold time, the number of puffs taken, and the inhalation volume – all of which influence the degree of drug exposure (Huestis, 2007). A rough "timeline" of impairment has been established: peak concentration of the drug comes 10–30 minutes after inhalation, and it is then stored in the fatty tissues of the body, from where it is slowly released and removed (Fernandes and De Campos Moreira, 2011). The effects last for about 3–5 hours, after which the influence on physiology wears off and the user gradually returns to normal (National Highway Traffic Safety Administration, 2015). It should also be noted that marijuana use can create a "stone-over" effect, similar to an alcohol-related hangover, in which aspects of impairment can continue into the following day.

From the above, it is unsurprising that concerns have been raised over marijuana and safety, particularly in the workplace. It is often argued that any substance abuse creates a recognised serious risk to the safety of the user and others (Miller et al., 2007), and evidence has been established from controlled laboratory trials that "marijuana use reduces psychomotor performance in ways that increase overall risk of accidents, and in particular, impairs driving" (e.g. Ramaekers, et al., 2004; Ramaekers et al. 2006, cited in Caulkins et al., 2015:33). Miller et al. (2007) also note that although limited, previous studies that have examined the relationship between illicit drug users and occupational injury have found that drug users have higher injury rates, while Spicer et al. (2003) simply state that illegal drug use causes impairment, which, in turn, triggers occupational injury. Indeed, there are many studies that have correlated impaired coordination with a reduction in worker ability to perceive and respond to hazards (see Miller et al., 2007 for a summary of studies on

driving vehicles and piloting ships and aircraft). However, this body of research often examines the impacts of impairment within relatively controlled work environments, where decision-making can be linear and can follow relatively simple and prescriptive sequences. Construction sites are highly complex places, so impairment within these environments may be even more problematic.

Yet, in spite of such findings, and suggestions of a correlation between specifically marijuana use and accidents, causality is much harder, if not impossible, to prove. Indeed, Caulkins et al. (2015:xii) state that current literature is "insufficient to determine the extent to which marijuana use is causally linked to any of these outcomes". Wickizer et al. (2004) suggested that substance abuse may be a risk factor for occupational injuries and accidents, but there is conflicting evidence about the "risk gradient", with some studies unable to find a link, others establishing a weak link, and others an arguably clearer link, although all vary in the parameters of type of drug, frequency of use, and amount of use. The problem is the difficulty in establishing a direct correlation between workplace injury and drug use, and some researchers have even suggested there is no correlation at all (e.g. Pidd and Roche, 2014), while Frone (2013) goes further to argue that the claimed correlation between drug use and cognitive and psychomotor performance, on the one hand, and work safety, on the other hand, is not only unconvincing, but it is also to some extent prejudiced. Little is known about what proportion of construction site accidents are directly attributable to marijuana use (Biggs and Williamson, 2012), yet, given the inherent complexities and multiple causes behind almost any accident on a construction site (e.g. Gibb et al., 2001), the lack of any statistically significant causal relationship is perhaps not all that surprising.

It should be noted that marijuana use, and, by extension, marijuana legalisation, may have some positive benefits. Use of marijuana is well known to induce a short-term increase in relaxation, a decrease in stress, and an increase in appetite. For some construction workers, use of legalised marijuana may be beneficial in the same way that many patients have benefited from medicinal marijuana for years. In this study no presumptions are made about the net positives or negatives of marijuana use; however, it is recognised that being high at work is unacceptable.

4. DRUG-FREE WORKPLACE PROGRAMMES

The response to increasing issues concerning drug and alcohol use within any industry workforce has often been to implement drug-free workplace (DFW) programmes. As Gerber and Yacoubian Jr (2002:54) note with specific consideration of the construction industry, the "high rates of alcohol and other drug use coupled with the high risk safety-sensitive nature of the industry have prompted the development of a variety of drug surveillance and prevention strategies", and there has been an increase in policy development to improve safety through addressing problems of worker impairment (Biggs and Williamson, 2012). DFW programmes can involve a variety of worker education and assistance elements, but most tend to include some form of drug and alcohol testing of the workforce. This can be introduced in a number of ways, either carried out pre-employment, post-accident, randomly, or because of reasonable suspicion, or some combination of the four (Schofield et al., 2013), with the goal of deterring substance abuse amongst currently employed workers, and avoiding hiring drug-using applicants (Minchin et al., 2006).

Although testing programmes have been associated with reductions in safety accidents, again, causality has not been proved. For example, Schofield et al. (2013:99) found that construction companies using drug-testing programmes generally exhibited lower, although often non-significant, injury rates than companies not using drug-testing programmes, with results varying by trade and injury types. Waehrer et al. (2016) established that drug testing was only effective to lower minor injury rates with no lost-work, but they could not establish any relationship with lost-work injuries. The much-quoted work by Gerber and Yacoubian Jr (2002) found that construction companies with drug-testing programmes experienced a 51% reduction in incident rates within two years of implementation, although this did not continue to improve beyond the first few years of implementation, and the authors were careful to present this statistic as an association with no claim to causality, despite the misuse of this statistic since.

Indeed, Gerber and Yacoubian Jr (2002:67) twice reiterate in the conclusions to their work that "drug testing does not, in and of itself, constitute a drug-abuse prevention programme […] only one component". Indeed, it is highly probable that the introduction of a new safety-related programme, be it educational or simply involving drug and alcohol testing, reorients the workplace to safety, which then, in turn, sees improvements in practice. This cyclical relationship in safety management has been established by Lingard et al. (2017), where intervention and consequential improvement can readily be seen on sites, followed by an increase in safety failures, as the worksite reverts to "normal" practice. Indeed, ancillary benefits to safety have been found with many different types of intervention, as Goldenhar and Stafford (2015) found with "stretch and flex" programmes for worker health, which saw unintended improvements in many other areas, including safety. This hypothesis of the beneficial consequences of intervention is also acknowledged by Miller et al. (2007:566), Schofield et al. (2013), and Wickizer et al. (2004:107) throughout their DFW research.

Marijuana has certain characteristics that do not facilitate a simple testing process. The active ingredient in marijuana is tetrahydrocannabinol, known as THC, and this is what creates impairment. It has been argued that any presence of THC could be indicative of sufficient impairment, because although THC only lasts for a relatively short time in the body, consequential psychomotor effects can last for 8 days or more (Caulkins et al., 2015). However, testing methods (using urine, blood, or hair) do not test for THC; instead, they test for one of the cannabinoid metabolites. This chemical, called C-THC, is actually generated as the impairing effects of THC are wearing off, and has a much longer life in the body than THC itself. This time duration can vary from person to person, depending on the strength of the marijuana, the frequency of use, and the individual's physiology. C-THC can last in the body for over 30 days, and it varies considerably between users, even in controlled studies, where the dose and smoking pace is controlled. A standard positive test for marijuana (e.g. a urine test) therefore only indicates that drug exposure has historically occurred; it is not confirmation of current impairment (Huestis, 2007). Despite scientific best efforts, there are not yet accepted quantitative metrics that correlate a level of THC or its metabolites to the more familiar measure of blood alcohol. Although in Washington State, a legal level of impairment has been set at five nanograms of THC per millimetre of blood, this has not been adopted countrywide.

5. LEGALISATION OF MARIJUANA IN THE USA

Although marijuana remains a Class 1 drug under US federal law, some state law has seen a shift towards decriminalisation and legalisation of its use for medical, and most recently recreational, purposes. In 2012, Colorado and Washington both legalised recreational marijuana, and although the full impacts of this are unlikely to be established for some time due to their complex social consequences (both good and bad), initial benefits have been sufficient to encourage two other states to follow suit in 2014, and four more in 2016. The rather confusing situation is that marijuana is both technically legal and illegal, although the US Department of Justice has stated that it will tolerate state-led legalisation as long as there are effective regulatory and enforcement systems to ensure that public safety, health, and other law-enforcement interests are not compromised (Caulkins et al., 2015).

Yet, this adds a further level of complexity to that already established concerning marijuana use. First and foremost, legalisation can influence existing use patterns, as well as potentially encouraging more users. Caulkins et al. (2015) suggest that changes will also occur in frequency and intensity of use, and modalities of use, as well as the potency and quality of the drug now available. Secondly, construction companies can no longer test workers and penalise them for positive marijuana test results simply due to the illegality of marijuana. Now that marijuana is legal for recreational use in the state, and testing is not able to distinguish between current impairment and historical use, the situation becomes even more problematic.

Indeed, there was a reported increase of 20% in positive drug tests after the law change in 2012 (Assurex Global, n.d.), and although supporters of drug testing admit that it is "conceivable that an employee could test positive for marijuana despite not showing any outward signs of impairment" (Halverson, 2013), they are reluctant to acknowledge that this is not just conceivable, but given the problems with testing, it is actually highly probable. Yet this possibility does not seem to have tempered practice. Indeed, Minchin et al. (2006) report a case of an organisation that repeatedly fired employees for failed drug tests, rather than for any problems with the employee's work or safety performance, with no consideration that the employee's failed test may have had no link to immediate impairment. Organisations and other worker associations have also fallen back on the fact that marijuana remains a Class 1 drug under federal law, and they therefore do not allow the use of marijuana either medically or recreationally within their workforce at all (Halverson, 2013). The state legalisation laws generally do not prohibit drug testing of workers or organisational DFW policies, despite problems with what testing is actually indicating, or the lack of direct evidence of causality in workplace accidents.

As a consequence of failing drug tests, workers can still be fired, even in states where marijuana has been legalised for medicinal and recreational use (Bogot and Neville, 2015). In different cases, unemployment benefits have been both awarded and withheld from workers fired due to a failed drug test from using marijuana outside of working hours, although the marijuana was detected by testing during working hours. Indeed, the acknowledged problems of underreporting of accidents on sites (Sherratt, 2016b) are only likely to be exacerbated by such legal complexities. Similar inconsistencies exist with regard to worker compensation; in some cases, it has been awarded, and in others it has not, with further complexities added should the claim be made that intoxication was the cause of the accident. Case law is still developing precedent, and so it is perhaps unsurprising that

the recommended industry response has been to follow federal and not state law, so that businesses can ensure that they do not "go up in smoke" (Halverson, 2013).

6. CRITICAL REFLECTIONS

The above discussion has revealed some interesting considerations about the use of marijuana within the construction workforce, and the implications of its legalisation. Central to this is the continued reliance on testing, which is particularly pertinent when traditional methods of testing are inherently flawed. Furthermore, any testing is arguably an interference in a worker's private life (Fardhosseini and Esmaeili, 2016) and raises issues around employer violations of worker privacy, freedoms, and autonomy, which are all the more prominent in a situation where the state has seen fit to specifically grant those freedoms to its residents. Yet testing is likely to continue, not least because companies with an established testing programme are often able to receive discounts on their worker compensation insurances. Furthermore, the desires of the commercial drug-testing industry should also be acknowledged here. It is an industry worth millions, and it is therefore keen to continue to convince organisations that drug testing does reduce accidents on sites (Wickizer et al., 2004).

More worrying is the potential for drug-testing programmes to give employers a simple "get-out" in the case of any on-site accident. Despite the fact that testing positive for marijuana does not necessarily equate to worker impairment, it creates a straightforward "cause" for any site accident, enabling more systemic problems, such as poor management, to be ignored. That is, marijuana use can be blamed for accident causation when the actual impacts may be minimal or nil. While worker impairment must be recognised as a potential factor in site accidents, and should not be tolerated by managers or peers in practice, care must be taken to ensure that this new step in legalisation is not utilised as an excuse for poor safety management, or a way to simply "blame the worker" (Frederick and Lessin, 2000) for wider management failings. This also has the potential to lead to underreporting and concealment of incidents for fear of the consequences (Miller et al., 2007; Schofield et al., 2013) should a test prove positive after an accident has occurred.

There is a fairly strong disconnect between company drug-testing policies, the drug-testing methods themselves, and legal drug use. Where tests for impairment due to alcohol directly measure the amount of alcohol in the body at the time of testing, marijuana testing can show positive results many days after legal use and impairment. This disconnect causes some employers to adopt blanket policies where no marijuana use is acceptable, citing federal law. The risk is that workers will not report marijuana use, and that employers will cite any positive marijuana tests as a cause of injury, when management issues or other human factors are really at play.

7. A RESEARCH PROPOSAL

It has been established that there are several interrelated factors at play within the scope of this phenomenon. The legalisation of marijuana has led to increased concerns around impairment and safety (and indeed productivity), yet "science" is struggling to respond in terms of establishing causality, developing appropriate testing, and finding solutions to the ethical and moral questions that have now been raised. As Caulkins et al. (2015:36) note, there is an "inherent ambiguity that accompanies non-experimental findings on complex

human phenomena involving many potential causal pathways", and while human experiments are possible, generalisability often remains questionable.

Indeed, many of these questions would not be answered easily by research grounded in a positivistic paradigm, where establishing the validity and reliability of the findings would be a challenge. For example, issues around respondent self-implication and corporate protocol can soon disrupt any quest for the "truth" around drug use or safety, while the debate is still ongoing as to whether accident causality can ever really be "proved" (Hollnagel, 2014). Given ongoing arguments around the effectiveness of drug testing as a preventive tool, and the fact that despite its use as a deterrent, any post-incident testing actually comes too late for safety, as well as the inherent issues regarding marijuana longevity in the body, research focused on the science of testing is perhaps best left to the scientists. What should be explored, however, are the social consequences of such testing amongst the workers and management on sites. It could be suggested that this has already been carried out, and, indeed, "attitudes" to the legalisation of marijuana have been explored from a positivistic foundation, yet, as such researchers note, whether such attitudes are themselves valid, or even relevant, in terms of future utility is debatable.

Therefore, an alternative is proposed. A social constructionist approach (Gergen, 1999) grounds itself methodologically in the perspective that the world we experience is socially constructed by the people within it, through interactions, systems, and practices (Gergen and Gergen, 2004). This results in shared versions of knowledge within particular communities (Gergen and Gergen, 2003; Filmer et al., 2004), and the "truth" is simply the current accepted way of understanding the world. Social construction is therefore able to accept shifting truths. It allows for conflict between, or inconsistency within, the understandings of individuals, something that could predictably emerge, given the complex nature of the phenomenon under examination here. Indeed, such an approach has been demonstrated to be useful in exploring sensitive issues such as construction site safety, while also allowing for inconsistency, complexity, and change within individuals (Sherratt et al., 2013; Sherratt, 2016b).

Such an approach can ask deceptively simple questions, such as "How is the legalisation of marijuana working on this site?", which will, in turn, reveal how people are now making sense of this legal change and creating new shared understandings of marijuana use, both recreationally and in the workplace. Employing discourse analysis to explore conversations, focus groups, induction scripts or slides, site posters, and other documentary data (Sherratt, 2016b), marijuana, its legalisation, its role in impairment, and its relationship to safety on the construction site can be illuminated, and therefore better understood. It is perhaps important to note here that the sample for such a study will focus on the workers and site-based management, those for whom safety actually matters, as the majority of previous work in this area has focused on the opinions of employers or human resource or safety managers, and not on the opinions of those actually carrying out the work (e.g. Gerber and Yacoubian Jr, 2002; Fardhosseini and Esmaeili, 2016). Focusing data collection on the site is essential to explore how marijuana legalisation has actually changed understandings and practice. As Miller et al. (2007:570) note, informal norms take precedence over formal policies, and they are not readily revealed by a questionnaire completed by a senior manager.

Furthermore, a social constructionist approach, by exploring and highlighting the network of discourses that create our shared social understandings, is also able to better illuminate that highly sought-after, yet frustratingly intangible, asset, namely site safety culture. This very much reflects the goal of the approach, if not the methodology, of work currently being undertaken by Biggs and Williamson (2012) on drug and alcohol use on sites in Australia, where this work is itself grounded in a "safety culture" approach that seeks effective interventions, and where the goal of such interventions is "to render it unacceptable to arrive at a construction workplace with impaired judgement" (Biggs and Williamson, 2012:446). The project presented here seeks a similar goal, namely to explore how things are currently understood on sites, so as to better inform the development of programmes that seek to support a site safety culture where immediate impairment is not acceptable, but that are still able to find fit with the wider societal change in terms of legalisation.

8. SUMMARY

This paper presents a theoretical context and a research proposal. The legalisation of marijuana for recreational use in various states of the USA has led to the emergence of a complex and ethically influenced debate on construction site safety, with no clear way for the industry to respond to ensure effective management of this change on construction sites. This research proposal, which is grounded in a social constructionist approach to safety, seeks to explore this through the shared understandings of those who work on sites, and how they are now making sense of the legalisation of marijuana, their work, and their workplace.

The authors have presented this work for discussion, and they welcome feedback, comment, and critique from their W099 colleagues.

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This article was language-edited by a freelance language editor, Anthony Sparg. He has edited several academic journal articles and master's theses in the field of construction management. He has an MA *cum laude* in African Languages (isiXhosa), an MA *cum laude* in Linguistics, and a Higher Diploma in Education.

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CASUALISATION OF WORK IN CONSTRUCTION, AND THE PLIGHT OF WORKERS IN BLOEMFONTEIN

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ABSTRACT

Casualisation in the construction industry is influenced by unemployment or lack of decent jobs. Casualisation is defined as the procedure of employing people either on a daily, weekly or monthly basis for an undefined task or specified job without issuing a permanent contract. The study explored the reasons why unemployed people are choosing to become casual workers, and the challenges that they face in the construction industry. A qualitative research approach was used in the study to answer the question *"What does it mean to be a casual construction worker in Bloemfontein?"* In-depth interviews were used to collect the data. The findings show that unemployed people are choosing to become casual workers because they are failing to get permanent jobs in the private and public sectors due to lack of the requisite education and training. The findings also show that casual workers are victims of exploitation through payment problems. In addition, clients are failing to provide personal protective equipment (PPE) for casual workers. The Department of Labour in South Africa must therefore start to tackle casualisation and compel people who are using casual workers to pay them standard hourly rates (wages) and provide safety protections for them.

Keywords: casual worker, construction, decent job, unemployment, well-being

1. INTRODUCTION

Most unemployed people are struggling to get a decent job, and they choose to fight poverty and inequality by becoming casual construction workers. Bamidele (2011) defines casualisation as a method of employing people without issuing a permanent contract. Casualisation in the South African labour market dates from the time of apartheid, when racial policies were designed to deliver secondary education and job-market opportunities for non-white individuals in South Africa (Lilenstein et al., 2016). The lack of decent job opportunities for both uneducated and educated people makes South Africa one of the most unequal societies in the world, producing high levels of poverty. Although there has been a slight change in the poverty headcount ratio between 1993 and 2010, dropping from 56% to 54% over the period (Lilenstein et al., 2016), the rate of casualisation is still high, because of the significant number of unemployed youth in South Africa.

Casualisation is adopted in industries where the demand for employment is highly variable and where entrepreneurs are trying to avoid employing people in permanent positions in construction work, port work, migratory farm labour, and other jobs that require manual labour or unskilled workers (Bamidele, 2011). Most contractors have adopted the method of employing general workers through casualisation in South Africa, with the aim of maximising profits while keeping up with the competition, by making use of cheap labour (Okafor, 2007). People in developing countries are the victims of labour exploitation, which is evident in poor salaries, wages and a salary arrears system, poor motivation, and other ills that negate the intentions of decent jobs (Bamidele, 2011). This study is motivated by the fact that the problem of casualisation keeps growing, and little is being done to eradicate this problem in the South African construction industry, despite the existence of institutions such as the Department of Labour in South Africa, which governs labour practices through constituted employment acts.

2. CASUALISATION AND ITS ILLS

Casualisation can be defined as the procedure of employing people without a clear written contract, which is commonly designed for a short period, or the contract duration is not stated at all by the employer (Fapohunda, 2012). Bamidele (2011) states that casualisation is the procedure that is adopted by most construction entrepreneurs to make work less secure, by employing people as freelancers and on an occasional basis or on a short-term contract, instead of offering people either a fixed-term contract or a permanent contract. Okafor (2007), cited in Fapohunda (2012), asserts that casual construction workers are often victims of loss, including absence of a medical care allowance, no job security or promotion at work, no gratuity and other severance benefits, no leave or leave allowance, freedom of association that is often jeopardised, no death benefits or accident insurance at work, and no negotiation or collective-bargaining agreement.

Casualisation, which should be cause for concern for the Department of Labour in South Africa, may be the effect of having opened the economy to external forces with free-market principles, which may now be continuing to exert an influence on the nature of labour utilisation (Anugwom, 2007). Most construction entrepreneurs conceive of the construction industry as driven by unskilled labour under the supervision of either the foreman or the site manager, and they are manipulating labour employment regulations by minimising labour costs, through socialisation (Anugwom, 2007). The construction industry has adopted the strategy of socialisation so as to align the industry with economic restructuring that favours limited overhead costs by companies. Besides the designed strategies, policies and regulations to protect casual workers are either lacking or are poorly implemented, to the extent that casual workers are manipulated and cheated in the construction industry, through reduced salaries or wages and poor health and safety services provided to them (Okoye et al., 2014). Casualisation in developing countries, such as South Africa, is commonly practised in cities, because most people are migrating from the rural areas to the urban areas to seek decent jobs, and failure to find such jobs forces them to become casual workers (Yen et al., 2015).

3. METHODOLOGY

A qualitative research approach was adopted for this exploratory study, with the purpose of collecting data for and developing a casual workers model for this study. A qualitative research approach was adopted as Tracy (2013) maintains that it is useful for understanding a range of social issues, such as behaviour, or the reason for becoming a casual worker in Bloemfontein. Yin (2011) defines qualitative research as the process of collecting research data while embracing a mixture of orientations as well as methodological considerations, through a possible multiplicity of interpretations of human events, the inherent uniqueness of these events, and the methodological variations available.

The researchers used in-depth face-to-face interviews to answer the research question *"What does it mean to be a casual construction worker in Bloemfontein?"* Semi-structured interviews facilitate collection of data from respondents, according to Ritchie et al. (2014). The interview protocol contained open-ended questions. The chosen sampling technique was non-probability sampling, due to the fact that the study was not statistical. The researchers adopted purposive sampling to select the interviewed participants, as Ritchie et al. (2014) state that participants are chosen a the "purpose". The sample size of this study was 18 participants, and the majority of them were aged between 25 and 35 years old. The study was conducted between December 2016 and January 2017. The interviews were recorded using cell phones, and the researchers later transcribed the data in a field book. The data collected was analysed by focusing on the central research questions and eliminating responses that did not answer the research questions. Selection of the participants was unstructured, and the participants were chosen from the side of the street, where they stand every day to market their availability to do casual work. The study thus interviewed only people that are involved in casual work in Bloemfontein, South Africa. All the interviewees were uneducated, meaning that they had not completed their basic education (Grade 12).

4. FINDINGS, AND ANALYSIS

The main research questions guided the researchers to interview the participants and to analyse the interviewed data. The demographic information obtained shows that 72% (13 out of 18) of the participants interviewed were youth aged between 25 and 35 years old, while 28% (5 out of 18) of the participants were older men, aged between 45 and 50 years old. The race of the participants was black, and there were no female participants. Consequently, it can be concluded that black males are the ones choosing to become casual workers in Bloemfontein. The research question is answered in the following subsections, culminating in the development of a casual workers frame model.

4.1 What it means to be a casual worker in Bloemfontein

4.1.1 Definition of casualisation

Most of the participants described casualisation as the procedures adopted by unemployed people, where they stand at the side of the road close to the traffic lights in town, seeking construction employment in the form of renovating existing houses or building new houses, or other casual work, such as cleaning the yard or "hard manual labour jobs", where they are employed without a contract and accept any amount offered to them by their employers.

4.1.2 Reasons for becoming a casual worker

The majority of the participants explained that their reasons for becoming casual workers were that they were struggling to get employment in the private and public sectors because of their educational background, since they have not completed their basic education (high school). One of the participants explained that his parents passed away while he was still a teenager, and that he never had anyone to encourage him to go to school, so he chose to become a casual worker, rather than become a thief. Another participant explained that he had grown up working in the manufacturing industries in the townships of Bloemfontein. However, when the economic recession began and the firms embarked on mass layoffs, he was affected. In other words, being laid off influenced his decision to become a casual worker, where manual physical work could be undertaken despite a lack of education.

4.1.3 Challenges experienced by casual workers

Most of the participants explained the problems that they encounter as casual workers. The main problem is poor or late payment of wages, since the majority of their employers fail to fulfil their promises related to the agreed-upon payments. The following is a response that one of the participants gave:

> *One of my clients once took me to renovate his house, painting, and to install new tiles. After I completed the work, he paid me half of the agreed payment and promised to pay me the rest of the money in town. And when I arrived in the town, he instructed me to wait for him, as he was going to withdraw money from the ATM. And that was the last time I saw him, as he drove away without saying any word.*

The participants explained that their employers are oppressors (bullies). They said that some employers force them to work overtime, by threatening not to pay them if they do not cooperate with their instructions, or they refuse to take them back to town. Another challenge that the participants highlighted relates to the lack of employment, and they explained that they often go for a month without having any work, especially in winter.

4.1.4 Getting employment

All the participants explained that they walk to town early in the morning and stand at the side of the road, close to the traffic lights, where passing motorists who need assistance related to construction work or garden work will pull over and discuss the job description and the wages they are prepared to pay for the job. Other participants explained that they had placed advertisements on streetlight poles in town, marketing their skills, and that they often received calls from clients seeking their services (see Figure 1).

Figure 1: A casual worker's advertisement

4.1.5 Personal protective equipment (PPE) and site induction

The majority of the participants explained that their employers do not provide personal protective equipment (PPE) for them. When an employer provides PPE for a casual worker, the employer will usually deduct the cost of the equipment from the worker's wages. Another participant asserted that employers do not care about the health of casual workers. He firmly believed that employers care only about production. The participant explained that one is exposed to diseases when one does paintwork. He responded as follows:

> *When you paint a house without wearing a dust mask, you breathe the paint you're exposed to, diseases relating to lung problems, you struggle to breathe, and you get a headache.*

The same interviewee reported that when they are installing tiles, they prefer to wear knee caps, because they spend the whole day on their knees installing the tiles.

Regarding the issue of site induction, the participant responded as follows:

> *In 2016, I was taken to a construction site in Kimberley to work for three days, and I never heard of the word "site induction", what is site induction, and how does it help me.*
>
> *There is no site induction taking place, because most of the time we carry out small jobs which are straightforward without complications.*
>
> *Medium contractors are the one stressing the subject of site induction, while small contractors don't even talk about it.*

The textual data and the literature reviewed show that there are links between the dominant factors pertaining to casualisation in the construction industry. Figure 2 represents an attempt to link the identified factors. The figure shows that casualisation can be linked to serious economic challenges, in the form of poor job opportunities, failure to provide large-scale permanent employment in the industry, inability to standardise and police earnings in the industry, and the collapse of production entities where mass employment can be found in manufacturing. There are also regulatory factors to be considered. Such factors are not unconnected to poor social protection for casual workers and poor enforcement of labour laws in the industry.

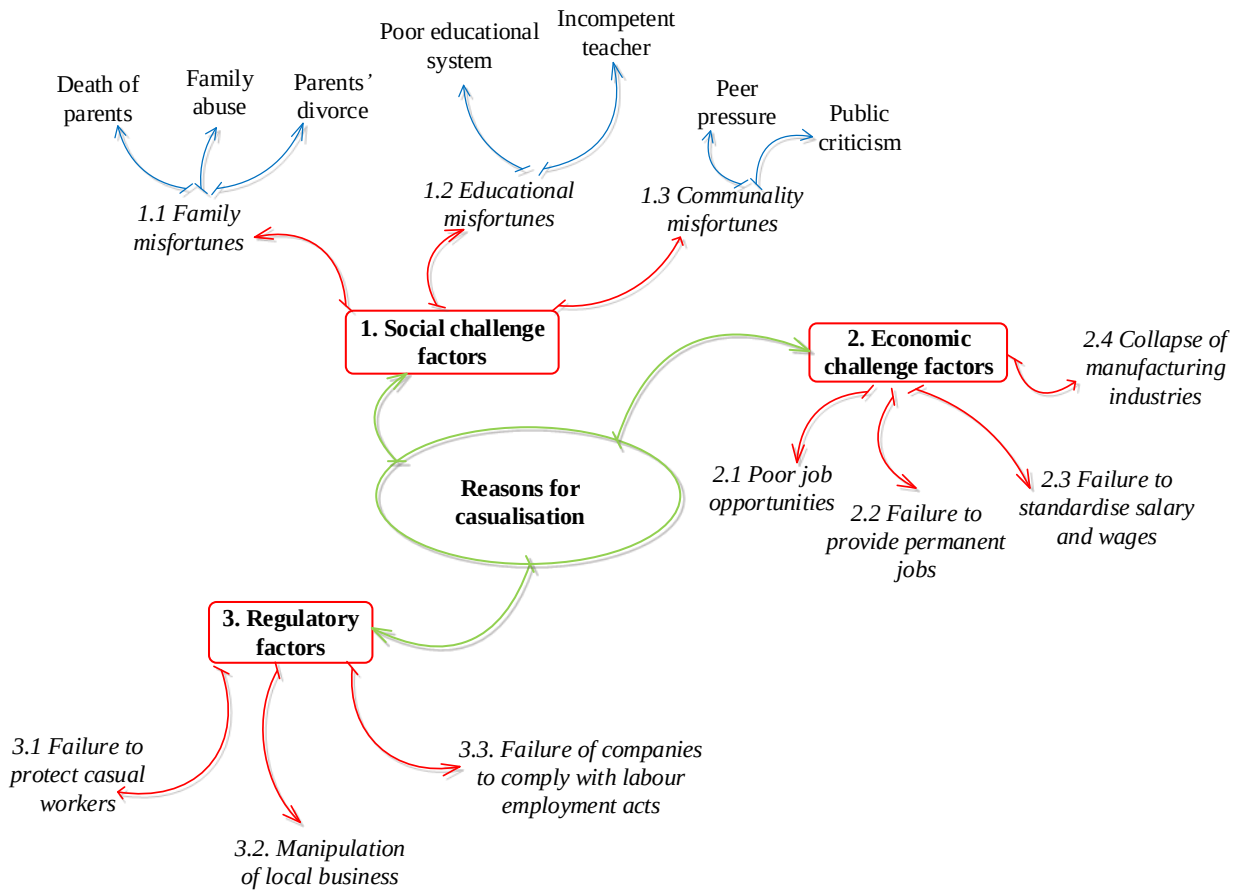

Figure 2: Casual workers frame model

The situation is compounded by the social challenges that have to be overcome by people involved in casual work. For instance, it's hard for someone with a complete lack of education and training to exit the general labour levels in the construction industry. There will be many such individuals without apprenticeships at the bottom levels of the industry. Figure 2 shows the factors that society should understand and address if casualisation is to be reduced in the construction sector.

5. DISCUSSION

Figure 2 shows a casual workers frame model, which highlights the factors influencing society, in particular the reasons that motivate youth to become casual workers in the construction industry. These factors were identified and grouped based on highlighted characteristics, as follows: social challenge factors, economic challenge factors, and regulatory factors. Social challenge factors involve the social lifestyle of the society and the social circumstances that influence unemployed people to become casual workers. The results show that unemployed people who choose to become casual workers are often victims of family, educational or community misfortunes. Economic challenge factors are characterised by the state of a country with regard to production and consumption of goods and services. Economic challenge factors include poor job opportunities, failure to provide permanent jobs, inability to standardise and police earnings (wages) in the industry, and the collapse of manufacturing industries. The manufacturing sector in South Africa is declining, as Mavuso (2014) indicates. The Industrial Development Corporation (IDC) in

2013 reported that while the manufacturing sector accounted for 20.9% of the gross domestic product (GDP) of South Africa in 1994, its contribution has since declined to around 12% (Mavuso, 2014). Economic challenge factors are critical, as Fapohunda (2012) asserts that the method of employing construction workers through casualisation in developing countries is a threat to the desired level of economic growth and development of a country. Regulatory factors pertain to the concept of management of employment acts. Regulatory factors relate to failure to protect casual workers, manipulation of local business, and non-compliance of firms with labour laws. Non-compliance is most worrying, as in South Africa, casual employees have the same rights as permanent employees if they work more than 24 hours in a month. Every employer must regulate the working time of each employee:

- *Following the provision of any Act governing occupational health and safety,*
- *with due regard to the health and safety of employees,*
- *About the code of good practice on the regulation of working time issued under section 87 (1) (a); and*
- *the code of good conduct issued by the Minister of Labour under section 87 (1) (a) will contain provisions concerning the arrangement of work and in particular, its impact on the health, safety, and welfare of employees* (Department of Labour, 2004).

6. CONCLUSION

An exploratory study on the behaviour and characteristics of casual workers is the focus of this paper. As the number of casual workers is increasing, and companies (private and public) are failing to provide permanent jobs for uneducated people in South Africa, the ills of casualisation look set to continue. The data collected in this study reinforces the perception that casualisation is a negation of decent jobs. The construction industry in South Africa appears to have stagnated in recent years, and growth is not predicted for the near future. This bleak situation is one of the reasons for the increase in the number of casual construction workers in South Africa. The reasons why unemployed people are choosing to become casual workers are explained in the casual workers frame model. The frame model discusses issues pertaining to social, economic and regulatory challenges. Social challenges relate to family, educational and community misfortunes. Economic challenges include casual workers' difficulties due to poor job opportunities, lack of adequate permanent employment, failure to standardise and police earnings in the industry, and the collapse of manufacturing industries in Bloemfontein. The study presented here is not exhaustive. The subject of the casual worker should be investigated over a longer period, so as to understand the reasons why unemployed people are becoming casual workers, and the casual workers frame model should be refined.

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This article was language-edited by a freelance language editor, Anthony Sparg. He has edited several academic journal articles and master's theses in the field of construction management. He has an MA *cum laude* in African Languages (isiXhosa), an MA *cum laude* in Linguistics, and a Higher Diploma in Education.

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CONSTRUCTION SAFETY THROUGH HOUSEKEEPING: THE HAWTHORNE EFFECT

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ABSTRACT

Clean and tidy sites have often been associated with positive safety cultures in construction. Poor housekeeping can result in the creation of additional hazards and dangers, in the form of protruding objects, which may also be sharp, and may result in situations that can lead to slips, trips, and falls on-site. They also create uneven ground levels, debris, and muddy conditions, which can all lead to an increase in accidents. Housekeeping also contributes to projects being finished in a timely manner, due to fewer distractions being created by what would otherwise be a chaotic situation. However, maintaining good housekeeping practices on-site has been known to be challenging, due to the rapid and complex nature of construction projects. In research that was conducted to explore the question "Why is housekeeping a continuing challenge in Lesotho construction?", the final outcome of site visits and observations revealed the classic phenomenon of the Hawthorne effect. Without deliberate or intentional "interventionary" measures or demands for regulatory adherence, subsequent visits revealed a transformation in site practices, specifically in housekeeping. The Hawthorne effect refers to a change in behaviour by the subjects of a study due to their awareness of being observed. This effect does not necessarily refer to positive or negative outcomes. In this paper, the transformation that occurred with regard to workers' practices is discussed critically in the context of this phenomenon. A key outcome of this discussion is whether housekeeping can be encouraged or improved using the notion of awareness of being observed. Finally, the ethicality of carrying out overt or covert observations is deliberated.

Keywords: Hawthorne effect, housekeeping, Lesotho, overt research

1. INTRODUCTION

Worldwide the construction industry has many challenges. One of the major issues that continually receives attention is safety. Safety issues vary considerably, and for this reason, they are very difficult to investigate. Practitioners, policymakers, and academic researchers alike share a keen interest in improving construction project safety. Safety in construction

projects extends to several stakeholders, namely site operatives, clients, and the general public. People less familiar with construction project practices may find it difficult to move around on-site. For example, a client visiting a site will need clear guidance on where and how to move (even after a safety induction). Moving around on-site is further complicated when the environment is not kept tidy, for example if there are obstructed walkways, toolboxes that have been left lying around, and waste materials that have not been carefully disposed of. Testing the premise that untidy sites lead to unsafe conditions, a research project was carried out to investigate housekeeping practices and their effects on overall site safety in Maseru, Lesotho (see Emuze et al., 2016). Observations and interviews were carried out on various sites to study the proposed aim. However, housekeeping practices of site workers were observed to steadily transform with subsequent site visits for observation. The change in behaviour was not as a result of any "interventionary" measures. Thus, this phenomenon was attributed to the Hawthorne effect. This paper explores the behaviour changes that were witnessed while conducting the described research project. This paper does not measure the extent of transformation in housekeeping practices that occurred during the site visits, but instead is based on the premise that behaviour change did indeed occur during the observations. In addition, this research proposes the possibility of using the Hawthorne effect to positively influence site safety with respect to housekeeping.

2. HOUSEKEEPING AND SITE SAFETY

Housekeeping is defined as the day-to-day cleaning and keeping tidy of a construction site (Lingard and Rowlinson, 1994). This is crucial for the prevention of accidents and injuries on-site (Lingard and Rowlinson, 1994). Poor housekeeping has been found to have contributed to almost half of the accidents that have occurred in the United Kingdom (Haslam et al., 2005). Untidy sites and poor housekeeping practices can lead to many types of hazards, such as trip hazards, falling objects, and sharp objects that can cause cuts. Haslam et al. (2005:410) explain that "from the perspective of those familiar with safety in a wide range of other industries, poor site conditions found in construction appear to be a symptom of the weak safety and risk management culture in the industry". Thus, good site conditions are symptomatic of a positive safety culture.

Site safety is important for all stakeholders, not only site operatives. For a start, when there is a poor safety culture on-site, there can be several implications, ranging from a loss of man-hours to fatal incidents. The term "safety culture" is loosely used to describe a culture in which safety is considered and accepted to be of topmost priority (Cullen, 1990). Cooper (2000:114) describes safety culture as the product of individual and group values, attitudes, perceptions, competencies, and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation's health and safety management. Furthermore, organisations with a positive safety culture are characterised by communication founded on mutual trust, by shared perceptions of the importance of safety, and by confidence in the efficacy of preventive measures (Cooper, 2000:114).

Safety culture can be improved by empowering workers and delegating safety activities (Törner and Pousette, 2009). Key components that may be present in a positive safety culture include clear policies, goals, objectives, procedures, manuals, records and audits that are used as tools to aid continual improvement of performance (Emuze et al., 2016). The above components represent the visible (explicit) aspects of a safety culture. By contrast, individual attitudes and personal beliefs of safety cultures are not visible or

explicitly captured (for manifestations of safety cultures at different levels, see Hofstede and Hofstede, 2005:7).

One effective method of improving the non-explicit aspects of safety cultures, e.g. individual attitudes and personal beliefs, is through motivation. A motivated workforce is necessary, as poorly motivated workers could make a workplace untidy, apart from other outcomes, such as rework, poor craftsmanship, fatigue, and poor technical supervision (Loushine et al., 2006). By teaching and empowering new workers to practice safely (including using good housekeeping methods), the general safety culture can improve considerably. Becker (2001) asserts that good housekeeping eliminates many safety problems, it improves morale, and it increases productivity, because workers generally appreciate a clean and orderly workplace where tasks can be completed unhindered.

As discussed in the introduction section, this study aims to explore the behaviour changes that occurred during a research project that investigated housekeeping practices. To further contextualise this study, the origins of the Hawthorne effect are explained next.

3. BACKGROUND OF THE HAWTHORNE STUDIES

The Hawthorne studies were originated in 1924 by the management of the Hawthorne plant of the Western Electric Company in Chicago, Illinois, USA (Ivancevich and Matteson, 1996). A study was set up to investigate the relationship between illumination and productivity, while the main studies, conducted between 1927 and 1933 in collaboration with the Massachusetts Institute of Technology (MIT) and Harvard University, were concerned with the effects of changes in rest pauses and working hours on productivity (Wickström and Bendix, 2000:363). Elton Mayo was the main initiator of the study, which focused on factors affecting productivity. This concept was inspired by the work of Émile Durkheim, who espoused a conflict-free group consciousness that challenged the concept of class conflict (Wickström and Bendix, 2000:363). In the investigation, the illumination was gradually decreased for the experimental subjects, while the control group received constant illumination (Roethlisberger and Dickson, 1939). Both sets of participants were observed to slowly but steadily increase their performance in inspecting parts, assembling relays, or winding coils (Wickström and Bendix, 2000:364). Once the illumination in the experiment room was reduced to a level corresponding to moonlight, the participants began to complain that they could hardly see what they were doing, and thus productivity finally started to decline (Adair, 1984). Overall, the experiment revealed that lighting did not significantly affect the productivity of the workers as long as it was kept at a reasonable level (Wickström and Bendix, 2000). Indeed, factors other than lighting were found to be more important (Ivancevich and Matteson, 1996), and this subsequently led to later studies.

Roethlisberger and Dickson (1939) summarised the findings as follows: the factors that were considered included physical factors causing fatigue and monotony, which were tested by means of four extensive experiments (a first relay assembly, a second relay assembly, mica splitting, and bank wiring). A factor that seemed to be responsible for most of the observed change was the improved personal relations between workers and management. This conclusion was based on transcripts of informally expressed opinions of the workers that participated in the experiment, as well as on the general impressions of the investigators (Wickström and Bendix, 2000:364). This led to the concept of the Hawthorne effect.

3.1 The phenomenon of the Hawthorne effect

The initial conclusion drawn from the Hawthorne studies was that the increase in output was partly caused by the experimental setup and the experimenters themselves (Bryman and Bell, 2003). The Hawthorne effect has now become a household concept in relation to observational research. The term "Hawthorne effect" is mostly used to refer to behaviour-modifying effects on the part of subjects of participant observations (Wickström and Bendix, 2000:363). Although this concept emerged from the Hawthorne plant, its implications today go beyond this context, and, as such, it is used in various fields of investigation (Marshall and Barthel-Bouchier, 1994). What is considered the Hawthorne effect is also referred to as "a nonspecific effect caused by participation in a study", rather than specific interventionary measures taken (Shephard et al., 1981; Wegman and Fine, 1990) in the field of occupational health. In pharmacology, the Hawthorne effect is often compared with the "placebo effect" (Wickström and Bendix, 2000). Fundamentally, most studies that have considered the effects of observation on subjects contend that there were changes in participant behaviour (Wickström and Bendix, 2000).

As stated in the introduction, this research aimed to explore the behaviour changes that occurred during observations of site practices with regard to housekeeping and site safety. The next section discusses the data-collection methods employed, and subsequent analysis of the data.

4. RESEARCH METHODS

The initial research project adopted a multiple case study approach using field observations, which were supported with follow-up focus group interviews (see Emuze et al., 2016). All the project sites were located in Maseru, Lesotho. A total of four projects were considered in this study. The research was designed to capture the complexity of housekeeping on the multiple project sites, and also to attend to contextual conditions. The observations were specifically conducted to understand human housekeeping activities, and the physical settings in which these housekeeping and other safety activities occur. The observations took a structured format, that is, specific practices, such as equipment arrangement and scheduling of site cleaning, were studied. The structure of the observations was informed by the reviewed literature on housekeeping and site safety. Although the observations undertaken had a structured format, the observers made allowance for "unexpected occurrences". Much existing construction management research (e.g. Rubrich, 2012; Forbes and Ahmed, 2011) and non-construction management research (e.g. Yin, 2013; Thomas, 2015) was considered when developing the data-collection instrument.

As part of the studied literature, the "5 Whys" technique was used as a tool to aid compilation of the discussion section of the initial research project (see Emuze et al., 2016 for data-collection and data-analysis details of the initial study). Site managers and other operatives were interviewed after the site observations. This paper does not focus on the subsequent interviews and the analysis of that data. The paper specifically focuses on the "Hawthorne effects" during the observations of housekeeping activities. This is because the observed behaviour modifications occurred before the interviews took place, hence the decision to exclude the interviews.

4.1 Ethical considerations

Data collection was conducted by students who had undergone research and data-gathering training. An "overt" approach was used during fieldwork. Site visits were regularly conducted for a few weeks, as the researchers intended to capture general practices of the workers with respect to housekeeping. The site operatives were briefed about the purpose of the study, namely to explore site safety practices. General consents for the empirical work were approved by the various site managers. In addition, the workers were informed in their morning briefings of the photographs that would be taken of site works. They were also informed that they had the right to decline participation without incurring any penalty. It was further explained that the study was for academic purposes, and that the findings would be used to teach prospective construction professionals.

5. FINDINGS

Many similarities were observed during the initial observations, particularly with regard to poor housekeeping practices. These similarities are explained in this section. The changes that followed during the subsequent visits are discussed later.

5.1 Site A

Excess materials, including construction waste, were observed in many areas of the site. Notable issues that were observed on the site included

Poor waste segregation,
Poor storage of materials,
Walkways that had been obstructed by reinforcement bars from demolished walls,
Lack of proper working methods, which had created trip hazards,
Poor tidying-up practices, which had led to electrical cables coming into close contact with flammable liquids, and
Wasteful use of materials, due to defects, rework, and poor workmanship.

Following the initial visit, workers' practices in relation to housekeeping began to show improvement. Workers began sorting their waste into different categories. Trip hazards were observed to be considerably fewer, and workers were showing signs of reducing waste. More importantly, the observers noted that a waste-disposal area, which was initially situated along the walkway to the site, and excess materials had been eliminated.

Before

After

Figure 1: Site A images

5.2 Site B

On this site, there were similar poor practices with respect to housekeeping. Some of the recorded observations are as follows:

Walkways that had been obstructed by construction waste,
Lack of appropriate cleaning instructions from the site foreman,
Poor signage to alert workers and other stakeholders to potential hazards,
External authorities (the municipality) in charge of intervening were ignoring poor site conditions,
Interchanging scheduled work sequences, which led to confusion and increased risks, and
Construction materials not being stored properly, e.g. storing valuable materials yet to be used in the same location as waste materials.

There was a visible transformation in the appearance of the site in subsequent site visits. For example, proper signage indicating potential hazards was erected on the site. In addition, a designated storage area for construction waste became evident on the site.

Before After

Figure 2: Site B images

5.3 Site C

This site had the least poor housekeeping practices at the initial visit. However, this site also had its challenges:

A lack of storage facilities,
Workers' toolboxes were littered all over the site, unattended, which created trip hazards, and
Overcrowding of workers, due to lack of adequate working space.

Due to limited space on this site, most of the project materials were stored off-site. Although this was considered good practice, the logistics of transportation and delivery of the materials stored off-site were improperly handled. The site workers seemed unprepared each time deliveries were made, thereby increasing the risk of accidents.

Before

After

Figure 3: Site C images

5.4 Site D

Similar to Site C, this site was relatively small, and this increased the problems of creating and maintaining a tidy site. Some of the observed issues are as follows:

Lack of adequate storage facilities,
Workers appeared incompetent, e.g. they forgot to install service ducts, and they had to rectify this omission, and so ended up doing double work,
Extra (waste) materials littered the site, e.g. the service ducts mentioned above,
Overcrowding of workers in a confined space, leading to activities not being completed, and
Dangerous placement of electrical cables and water pipes, creating trip hazards.

Initial improvements observed during follow-up visits included no overcrowding issues, due to efficient use of available workers. Other issues related to space management seemed to have been handled effectively during the follow-up visits.

Before

After

Figure 4: Site D images

6. DISCUSSION

During the visits for the empirical work, there were noticeable improvements on the sites, and these observations formed the basis for the development of this paper. It is important to note that the focus of this paper is not to quantify the extent of change or safety improvements that occurred on the sites, but only to acknowledge that change had occurred

during the time of observation. From the findings, it is evident that behaviour changes had occurred in housekeeping and site safety practices (see the figures above).

Since the study was overt, it is assumed that most workers knew they were being observed. Consent for the observations was sought from the site managers. Two observers visited the sites. The observers did not have the appearance of individuals in positions of authority, e.g. local authorities, or safety inspectors. This was part of the research design, so that workers could feel at ease and not become distracted or feel threatened by the possibility of being reprimanded for any wrongdoing that might be observed.

6.1 Benefiting from the Hawthorne effect

In this particular research, the behaviour modification observed was definitely positive as far as housekeeping and tidying up is concerned. This change possibly brought about a safer site. Choudhry (2014) asserts that one of the main types of safety controls is good housekeeping practices, i.e. day-to-day cleaning and keeping tidy of all parts of the site. Proper use of personal protective equipment (PPE) is considered to go hand in hand with good housekeeping (Choudhry, 2014), but this was not a behaviour change observed on any of the sites described in this paper. This is because PPE usage was not found to be problematic on the sites visited.

As explained in the methods section, intervention in housekeeping practices was not part of the research objectives. The changes in such practices that became apparent during subsequent site visits were spontaneously made by the site workers. Furthermore, on all four sites there was no record of regulatory authority interventions, or any issues in relation to housekeeping practices. The only common denominator present on all four sites was the presence of the observers, and hence it can be concluded that their presence played a role in the improvement in housekeeping and safety practices.

6.2 Conviction by conscience

Site managers, foremen, and operatives were all aware of the presence of the researchers. The change in practices could be argued to have occurred as a result of fear of being reported for poor practices, but this has been ruled out based on the empirical approach adopted, i.e. using research students that did not have the appearance of authority figures. Furthermore, the potential research outcomes were explained clearly, i.e. academic work that would lead to learning and promotion of site safety practices.

Experienced workers are often knowledgeable about good safety practices, as they have learnt them and practised them for many years (Nicolini et al., 2013). They have "learnt by doing", and this is the same approach they use to transfer knowledge to workers with less experience (Aboagye-Nimo et al., 2015). This type of safety knowledge is mainly tacit, and, as such, workers may not be conscious of learning or teaching it (Kamoche and Maguire, 2011). This would lead to improvement in personal beliefs and individual attitudes, i.e. aspects of a safety culture that are not explicit.

Since the workers knew that the observers were on-site to learn about good safety practices (which obviously includes good housekeeping), they could have been compelled to work safely. Psychologists explain that one's conscience will compel one to delineate what is right from what is wrong, what is proper from what is improper (Hitlin, 2008:1). In this case, there were already experienced workers on all the sites, and hence it can be argued

that they were encouraged to work safely as a result of the presence of the observers. Knowing that the observers on-site were there to learn, the workers would have had to use good practices. Rowlinson et al. (1993) explain that experienced workers take on father-figure roles when they are teaching less experienced workers on-site. In addition, they tend to ensure that these newcomers (who have less experience) are protected when working in this high-risk environment. For this reason, the workers on-site may have unconsciously led by example by using good housekeeping practices.

6.3 A new approach to effective housekeeping?

Involving apprentices or students who are on-site to study could be a useful way to get workers to improve their practices. One key factor is to let the experienced workers know that they are being observed by learners. By showing the workers that the observers are not on-site to report or reprimand them, the workers may be more inclined to work comfortably and safely without pressure.

From this study, it was acknowledged that workers generally worked more safely when they were being observed by less experienced workers. Furthermore, by teaching or transferring safety knowledge, the experienced workers continually transform and review their existing knowledge. Gherardi and Nicolini (2000) explain that safety (in this case housekeeping practices) is a situated practice, and, as such, site operatives will always have to reassess their safety practices with respect to new situations, in order to be able to teach less experienced workers.

If less experienced workers or learners are included in projects, the more experienced workers would thus be compelled to use safer methods overall. Although formal-setting (explicit) knowledge transfer is important in construction safety, on-the-job training has been described to be more effective in many situations, especially when workers have to identify risks and dangers on-site (Bartholomew, 2008). Learning of this type of practical and invaluable knowledge may be taken for granted, as it is mainly implicit. On-the-job learning as a method of safety knowledge transfer offers the learner an opportunity to acquire practical wisdom that would have been missed in many other situations (Gherardi and Nicolini, 2002).

Placing a learner on-site in order to compel workers to work safely is not the only factor that needs to be considered to ensure safer practices. There are several factors that need to be considered when ensuring site safety, and it may need to be considered as part of a whole. Sawacha et al. (1999) suggest many areas that need to be considered to help improve site safety, such as eliminating time and financial constraints.

7. CONCLUSIONS

This paper has focused on workers' behaviour changes that occurred during an exploratory study on construction site housekeeping in Lesotho. These behaviour changes, also known as the Hawthorne effect, were found to be as a result of workers being observed by academic researchers. Housekeeping on-site improved considerably as the observers visited the sites over a given period. These behaviour changes were not the result of specific interventionary measures. The workers were clearly informed of the presence of the observers, as well as of the aim and scope of the research.

The improvement in housekeeping practices as a result of workers being observed by individuals who are on-site to learn about good practices could be used as an approach to enhance site safety. The behaviour changes may stimulate changes in thinking among the site operatives. Experienced workers are known to play father-figure roles on-site, and, as such, tend to teach less experienced workers how to stay safe at work.

As explored in the literature, the behaviour changes when people are being observed do not necessarily have to be positive or negative. For this study, the changes observed on all four sites were positive with respect to housekeeping. In future, this method could be tested on different projects, with the sole purpose of identifying whether behaviour changes are always positive with respect to housekeeping and site safety.

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RECONCEIVING CONSTRUCTION IN THE CONTEXT OF HUMANISATION

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ABSTRACT

Construction, like agriculture, is potentially the most humanising of all activities, in that it has the potential to satisfy or contribute to the satisfaction of the fundamentals outlined in Maslow's hierarchy of needs. More than this, construction has the capacity to reflect and contribute to the assertion of "being", the ongoing struggle to define and assert our authentic self. Conversely, in both process and outcome, it also has the potential to dehumanise and to negate ontological potential. This paper examines the ethical and moral challenges arising from the societal responsibilities required of and inherent in the construction industry's raison d'être. Through an examination of the literature and of selected projects, the contribution to and the negation of an authentic ethic is explored, challenging stakeholders to evaluate the positive and address the negative in such a way that construction meets its obligations to society and to individuals. Within the context of humanisation, the objective is the development of a model for construction that promotes respect for all and accords equal consideration of all and to all.

Keywords: ethics reasoning, humanisation, sustainable construction

1. INTRODUCTION

Construction does not take place in isolation. It is a product of human endeavour, and, as such, it must be contextualised within an understanding of the wider functions of human endeavour and the forms it takes, both historically and globally. The historical context relates to the continuous development of humanity from our primitive states through progressive and retrogressive states to the present, and to where we aim to go in the future. Globally, the various forms that human social interaction has adopted contribute directly to the function of construction, and the means whereby it is achieved.

Human endeavour, and therefore construction, is dynamic, and construction is not static, but is subject to and therefore amenable to directed change. Underpinning human

endeavour are individual and collective struggles for authentic being (Žižek, 2012), which is a recognition that each person, each self, is capable of becoming more than they are (Freire, 1973), of achieving self-recognition, and thereby is capable of self-actualisation (Maslow, 1943).

This struggle, referred to as the human ontological project (McAleenan and McAleenan, 2017), is the dynamic of man in his environment as he interacts with and changes it to meet his needs at all levels (see Figure 1). It reflects more than the simple dialectic of man in conflict with himself, namely the dialectic inherent in the social relations that emerge from man as a social and historical being, wherein the objectives of human endeavour, the ideologies of being, and the meaning of existence, power, and authority relationships and conflicts between self and social interests create asymmetrical developmental outcomes and social irregularities.

Figure 1: Maslow's hierarchy of needs

Abstracting construction from the range of human endeavours, this work explores its capacity for and its impacts on humanisation, namely in advancing the human ontological project. From one perspective, the social function of construction is outlined, and its impact on social relations is examined. From the second perspective, the process of construction is examining and reflecting on construction as a means of satisfying individual human needs, from the most basic level to the highest level, namely self-actualisation (Maslow, 1943). In both perspectives, construction's potential for humanisation is counterposed with examples of construction, in process and in outcome, as deniers of humanisation, that is, as dehumanising processes and social constructs.

Central to humanisation is the development of agency, which is the faculty to critically assess the environment and decide upon an appropriate course of action that will contribute simultaneously to the development of an internal ethic and an external morality (Žižek, 2012). Human moral development and the capacity for ethical reasoning has been charted by Kohlberg (1971) and Eckensberger (2007) in their work on cognitive development, which demonstrates the development of reasoning in a number of stages, culminating in the highest stage, namely post-conventional reasoning on universal moral principles, in which everyone is accorded equal consideration and respect for their dignity and worth. Current perspectives on this level of reasoning accord the whole of nature the same degree of consideration and respect.

This work considers construction in the context of the principal stakeholders and the threefold objectives of construction sustainability (McAleenan, 2015). According to these three objectives, the long-term sustainability of a construction business is based on its ability to meet the needs of

- Public interests, i.e., the community that is served by construction,
- Private interests, i.e., construction businesses, owners, and shareholders, and
- Worker interests.

2. METHODOLOGY

A critical theory methodology was adopted to carry out this work. An analytical tool developed by the Frankfurt School of Social Theory and Philosophy, critical theory brings together various disciplines in the humanities, in order to transcend simple analysis and description of society, and to facilitate social change. According to this theory, science and engineering are not neutral practices divorced from the vagaries of human biases and the social relations and structures in which they are embedded (BSSRS, 1975).

The British Society for Social Responsibility in Science (BSSRS) has the following to say about the ideology of "scientism":

> The ideology of 'scientism' and its claim to be 'neutral' and 'objective' are powerful weapons for mystification and domination in the hands of our rulers. Increasingly decisions which are essentially social and political decisions are taken behind a smokescreen of scientific objectivity. If challenged such decisions are justified (and hence put beyond further challenge) by appeals to the neutrality of science and impartiality of scientists. (BSSRS, 1975:3)

Deconstruction, a Derridan (Derrida, 1995) tool applied to the field of literary analysis, provides a means to delve into the meanings and uses of language in construction, to arrive at new and different perspectives of key stakeholders impacted by the process of and the outcomes of construction. These shifts in perspective, seen from the social and historical experiences of the impacted stakeholders, provide a varied and often contradictory understanding of construction and the benefits morally ascribed to it. A semiotic analysis of the artefacts produced by construction, e.g. street furniture, have questioned the validity of architectural solutions to the client's definition of, and therefore requirements in relation to, the impacts of their work on the whole community,

including those specifically and negatively targeted by the outputs, e.g., homeless people, the youth, etc.

Critical theory has a particular focus on cultural analysis, particularly in view of the growing emphasis on "safety culture" (McAleenan, 2016a) in the construction process. Narrow simplistic definitions of culture, e.g., "the way we do things here", have been rejected in favour of a comprehensive and complex interpretation of the human/environmental dialectics in the makeup of cultures with a perception of continuity (Dawkins, 1993), connectivities that are regarded as being critical to an understanding of human existence and being. Man and events are continuous, in that they have emerged from a past, they impact on the future, and in the present they are infinitely interconnected with the surrounding environments.

At this point it is worth emphasising that construction and agriculture are the two fundamental achievements of man as a social and historical being, and the most visible anthropogenic effects on the planet. The Anthropocene epoch is the current geological age, and it is defined by man's pollutions (radioactive and plastic) being recorded in the geological record (McAleenan, 2016b).

Historically, the development of agriculture released man from the daily pursuit of the means of survival and created the surpluses in production that permitted the division of labour within the now settled communities. This permanence of settlement and the division of labour are the foundations of civilisation, of construction and progress towards attaining the higher levels described in Maslow's hierarchy of needs (see Figure 1). The ubiquitous nature of construction, from extraction to the built environment, and the infrastructure networks that criss-cross the landscape speak to the success of man. The urban environments that man has built embody successful satisfaction of needs, from the need for shelter and warmth (e.g. housing, energy, and sanitary services), to the need for health and security (e.g. hospitals, schools, and factories), to the need for self-actualisation (e.g. universities, sports facilities, museums, leisure facilities, etc.). The human environment reflects the attainment of the social "good", which is at the centre of ethical and moral behaviour (Fromm, 2003). The collective endeavours necessary to build and maintain the human environment reach out to care for the other, through provision of housing, sanitation, energy, health, welfare, and education facilities and opportunities. Individual self-development is facilitated via the opportunities afforded by the higher levels of education, the arts in museums, galleries, and concert halls, and the opportunities for physical excellence in the sports and health centres of excellence, which are integral features of even the smaller urban environments. Nevertheless, this rosy picture hides a reality about the urban environment, where the ability to advance the humanisation project is not equally accessible or available to all, which is a fundamental feature of the highest level of ethical reasoning, i.e., equal consideration and respect for all (Eckensberger, 2007).

Inequalities exist, and historically they have done so since the earliest periods of urbanisation and the division of labour. The division of labour transformed the social relations of production, such that the surpluses that allowed for the construction of towns and cities could also be expropriated and accumulated in private rather than in public hands, thereby creating extreme authority and power relations, which is a feature of but not necessarily a function of civilisation and urbanisation, such that today, eight people have

the same personal wealth as 50% of the global population (Credit Suisse, 2016; Oxfam, 2017).

The manifestation of these inequalities, and the dehumanisation that results, is clearly evident in the built environment, both in the artefacts of that environment and the processes involved in constructing them. Cities may appear as objective monuments to man's progress, but under scrutiny, they are a reflection of man's subjective interpretation of the world that he inhabits. Something as apparently innocuous as street furniture, which is mainly functional artefacts to light the streets, to ease the flow of pedestrian and vehicular traffic, to provide comfort, etc., serves also as a means of social control (Swain, 2013). The Camden bench (see Figure 2), with its abstract beauty, is an icon of "aggressive architecture", as it was designed to prevent antisocial behaviour, such as graffiti, drug dealing, and rough sleeping (Swain, 2013). Addressing the problems of the urban environment by preventing behaviours that are symptoms, rather than addressing the cause of the problem, means that the real problem is obscured, and those who are homeless, for example, are lumped together with those who deal in drugs, and they are equally dehumanised in the process. The client's brief, and the design solutions, have considered the problem not as one of homelessness, but as one concerned with the sensibilities of the non-homeless user of the city. Similar thinking to remove the homeless from the city centre influences design solutions such as cobbling and sloped surfaces, to prevent sleeping in underpasses, on window sills, and in doorways (Korody, 2016a, 2016b, 2016c). Neither the client nor the designer nor the contractor questions the validity of the brief, and what the brief and the solutions say about these stakeholders' perception of the function of the city, and the contribution that architecture makes to human progress or regress.

Figure 2: A Camden bench outside Freemasons' Hall on Great Queen Street, London

On a grander scale, construction projects contribute significantly to social control, and not always by deliberate intent of all the parties to the project. The process of gentrification, controversial in the contemporary period, is a process that can, by intent, or as an incidental consequence of other activities, transform the demographics of an urban area, to the detriment of the "poorer" original residents (Dooling, 2009; Jaffe, 2014; Haffner, 2015; Hatherley, 2017). For example, the High Line project in New York has had the effect of raising the profile of and the value of property in the Chelsea district, through which it runs, such that a previously "rundown" area has now become a focus of real estate development and expensive apartments. Concomitant with this has been the loss of the pre-existing population and established businesses due to higher rents being imposed. Similar occurrences of gentrification are being recorded in cities worldwide, and have been occurring for many generations (Quastel, 2009; Tracey, 2016). The redevelopment of Paris in the 19th century, following the revolutions of 1790, had a similar effect of removing the poor from the city centre and reconstructing the city with wide boulevards, designed as much to prevent the barricades of the revolution reoccurring as to gentrify the city (Sagner-Düchting, 1998). The Parisian boulevards are an example of architecture and construction for social control. Elsewhere, walls, some of them called "peace walls", have been erected to separate communities, such as in Belfast (Goodyear, 2012; Garcia, 2016), Berlin, and Palestine (Sharif, 2009), and it was even proposed that a wall be built between the USA and Mexico. Gated communities are designed to keep people out or manipulate the flow of residents in and out of an area, as in some of the designs for redeveloped housing estates in Northern Ireland in the 1970s. These communities are now reaching the point where the creation of private cities is seriously being considered, such as in Honduras (Associated Press, 2012), or where such cities have been constructed, such as in Gurgaon, India (Doshi, 2016), with issues of separation of communities or loss of land by certain people. Political and military occupying forces are using demolitions as collective punishments and settlement construction to alter the demographics and transform the political landscape (UNSC, 2016), or they have done so to contain and restrict support for insurgents, as in Vietnam in the 1960s and 1970s, or to separate ethnic groups, as in South Africa during the apartheid era.

Sport and sporting excellence contributes to the humanisation project, affording the urban dweller opportunities for relaxation, health, and socialising, as well as attainment of high performance. Its commercialisation, and the advent of global megasports projects, such as the Olympics and the World Cup, has created environments that negate equality and concentrate the benefits into the hands of a few, as monetised benefits and wealth. The negative consequences of Olympic projects since 1948 have been grossly disproportionate, resulting in massive municipal debt for the host cities (Johnson, 2012) (although this argument is countered by Rose and Spiegel (2009), whose study suggests that Olympic hosts benefit in the long run from increased trade), in the form of substantial decanting of populations to make way for the construction of stadia (Watt, 2013), acquisition of public space, or transformation of it into private or commercial space (O'Bonsawin, 2010), or, in one of the worst recent examples of a dehumanising process, the death of approximately 1,000 migrant workers on the Qatar World Cup projects (Gibson, 2014).

Environmentally, there is no question that construction has impacted on the landscape. The landscape that we see worldwide is a product of the influence humans have on nature; there is little that has not resulted from human intervention, either directly or indirectly (Berger,

2010). The task of humanisation is not to exploit nature to human advantage and progress, but to recognise ourselves as part of nature, dependent upon its health and well-being for our own health and well-being, a sort of mutualistic symbiotic relationship. Humans ignorant of their impacts on nature assume instead that we can "exercise, permit and adapt to" the changes we make to the environment (Soulé, 2010). Roads, for example, and other exurban developments can impact on the environment many kilometres into unfragmented habitat (Soulé, 2010). How much more, then, do larger-scale urban projects, extraction sites, and heavily used transport networks impact upon the "natural" environment, and what unknown detrimental effects will they have on the human project?

3. PROCESS

With over 100,000 deaths per annum, construction remains one of the most dangerous industries (Walters, 2010), not because it is a high-hazard industry (which it is) (other high-hazard industries, such as power generation, potentially present more hazards, but, conversely, are safer, with very low to zero "risk"). It is dangerous because of factors peculiar to the industry. Its dynamic and transient nature, where projects are continually day by day evolving from groundworks to completion, its heavy reliance on temporary, and often unskilled, labour, the high competitiveness of the tendering and contracting processes, narrow margins, poorly defined specifications, allowing for contractors to interpret too widely their meanings, poor standards of materials, and low wage corruption at high, medium and on-site levels.

The result on-site is low safety levels, a high number of health infractions, and little concern for the short- or long-term well-being of the workforce, which is reflected both in the low wages paid and the unsatisfactory workplace conditions. Migrant workers suffer disproportionately, with lower than minimum wages, poor working and living conditions (Gibson, 2014), and increased levels of discrimination (O'Connor and Goodwin, 2012). Additionally, on multilingual sites, workers experience communication blocks, with critical information often being conveyed in the form of pictographs and oversimplified multilingual phrases and signs (HSA, 2008; Hare et al., 2013). Whether in work camps or in city lodgings, isolation and separation from family and community support networks leads to personal isolation, with consequent increases in mental health problems and addictions (O'Connor and Goodwin, 2012). The various waves of Irish migration in the 19th and 20th centuries saw the major groups of the migrants being recruited in racialised employment as unskilled labour on construction sites (O'Connor and Goodwin, 2012), where they were subjected to racial and religious abuses and discrimination. Blacklisting programmes disadvantage workers when union officials and safety advocates are listed and denied the opportunity to work in the industry, as has happened in the UK. The message is clear, namely that organising to improve terms of employment and conditions of work is unacceptable to the contractors, and that workers on construction sites must accept the conditions offered.

Addressing the skills deficit, especially in terms of OSH competencies, the ISSA education section has advocated integration of OSH education and training into vocational and professional programmes of study in colleges and universities that supply the industry with skilled trades workers and professional workers (ISSA, 2003). The industry has yet to understand and fully embrace the concept that OSH competencies are integral to the competences and skills of the trade or profession or in interpreting the various iterations of

the CDM regulations in the UK (HSE, 2014). Some employers have a focus on the lowest levels of OSH training embodied in the evidentiary base of the baseline construction-focused quasi-skills card, which is an item gained following a one-day general training programme, to be repeated every three years. Despite the fact that this card has been used for over two decades, and the fact that workers have been led to believe that they must have this card in order to get onto the site, fatalities, injuries, and ill health in the industry remain high, at approximately three times the average rate for other industries. That said, there has been progress in the UK, with the recent Health in Construction summits of 2016 and 2017 (HCLG, 2017), where the leading chief executives of the construction industry came together and asserted that construction workers' health and the health of those impacted by our infrastructure development has to become a force for good. One clear message that has emerged is that as an industry, we need to start to see the construction industry as a people industry, and not as an industry concerned with the use and abuse of construction and steel. We are not a bricks-and-mortar industry; bricks and mortar are simply some of the tools/materials that we use to promote and enhance social well-being and increase the health of our society (HCLG, 2017). What do we benefit if we harm those who work to make this a reality? Besides addressing the more obvious (although often neglected) hazards that impact upon our physical state, it is also incumbent upon us to ensure the mental health and well-being of all stakeholders, our construction fraternity, and the users/end users of our products. One overarching question for designers has to be "What can we do as designers to prevent mental health suffering within the construction workforce?" This is a challenge that is perhaps new and slightly alien to construction design professionals, but it is one that speaks to the humanity of structural, and not just social, engineering. Much of this work is in its infancy, and the months ahead should deliver much more of the needed detail, as the various professional bodies converse. Further evidence of construction coming to terms with the need to meet the challenge of "humanising" is the introduction of various higher education programmes; for instance, Ulster University has introduced "ethical reasoning" as an integral part of both their civil engineering and their quantity surveying undergraduate degree programmes (McAleenan, 2016a). Students at the University of Melbourne work with workforces in dramatically different cultural contexts – in rural Thailand, and in an indigenous Australian community – addressing among other things language difficulties, cultural and ideological differences and various physical competences to ensure delivery of safety on the different worksites (O'Brien and Hill, 2009). Education as a means of social praxis promotes dialogic learning, that is, it requires both interpretation of the subject and judgement of its worth and meaning, and that is the challenge to all educators in the construction field (McAleenan, 2016a). The challenge to the academic researcher is to deliver to the rest of the industry solutions or choices that will enhance and improve OSH, which will be derived from time devoted to thinking, contemplating and making sense of the many challenges of today.

4. HUMANISATION

The challenge in construction is to reconcile its function to provide for social needs with satisfaction of private interests. In the public sphere, where major social interests are played out, this will require opening up of genuine dialogue amongst all the stakeholders on the purpose, needs, and desirability of new projects, respecting throughout that those stakeholders most affected by the project, through decanting of populations, loss of amenities, adverse economic impacts, etc., must have a genuine and effective decision-

making role. In national jurisdictions that permit public consultations on these matters, this exercise should go beyond the appearance of "having a say", and should provide for full participation in and input directly to the decision-making process. To facilitate this process, full and honest disclosure of all information is essential in order that informed decision-making can occur.

The essence of social "good" is at the core of good construction, and this requires an analysis of the impacts of the project, with the negative as well as the positive being opened up for examination. The first of the three objectives of sustainable construction is that it must be good for society, and these social considerations take precedence over private interests, e.g. shareholder gain. In this, it falls to the legislature to ensure that within building and construction statutes and government policy this social benefit is the driving objective, both informing the statutory planning agencies of their focus and guiding clients and developers to accord sufficient prominence to the public good in their business activities. When considering the collapse of the Rana Plaza building in Bangladesh, and the 1,135 fatalities that occurred there (FCO, 2014), the degree of collusion between business owners, contractors, and public servants that led to the disaster is the result of national policy failures and the absence of sufficient checks and balances (ILO, 2015a). Construction in general and projects specifically need a potent system of checks and balances at all stages, so as to ensure that the projects meet public interests, adhere to current technological standards, and are constructed and maintained in accordance with consistently high levels of technical capacity and social competence.

Adhering to the social benefit objective extends to the process of construction, wherein the safety, health, and well-being of the construction worker and the end user are accorded due respect and equal consideration. Workers' trade and professional interest in employment is secondary to their interest in the industry as a source of employment, as a means of satisfying their fundamental human needs. For some, satisfaction of these needs may be their only interest; for others, the industry provides the means of also satisfying the higher-level needs, including the need for social interaction and the need for self-actualisation. The Seoul Declaration (ILO, 2008) places an emphasis on employment and work as being a significant contributor to human well-being. In practice, this means meeting the basic requirements for "decent work" (ILO, 2015b), beginning with compliance with the minimum standards for safe and healthy workplaces, providing sufficient remuneration, to enable workers to know that their employment will meet their personal and social needs, and providing security of employment.

Satisfying well-being extends the obligation to employers of more than mere compliance with minimum standards. Respect for the individual, a key element of a mature ethical reasoning (Eckensberger, 2007), means respect for the worker as an equal, respecting their competence and their agency. This entails a reappraisal of employment hierarchies of authority, wherein the wage payer (the employer) exercises authority over those who are paid wages, via the hierarchy of managers. This structure requires the fundamental relationship wherein the employer who pays the wages needs the employee to produce the capital in order for their wages to be paid. Notwithstanding the transactional relationship between employer and employee, once the contract of employment, or the building contract, exists, the parties to the process of construction can be viewed as partners in the enterprise, each contributing a necessary element to the project, and each respected equally

for that input. This is at the heart of the CDM regulations in the UK, wherein the key duty holders are statutorily obligated to work within their competencies, to inform the line manager and others in the team of their legal duties and obligations, and to jointly make decisions on all matters, from the earliest design stages to the completion of the project. Extending this principle to all parties to the project builds a culture of communication, as opposed to one of instruction, and depends for its success on cooperative participation, agreed objectives, open information, including financial records, and individual and collective agency. This model was successfully applied by the Semco company in Brazil (Semler, 2001).

The third objective of sustainable business addresses that which is good for the business or businesses involved in the project. Successfully addressing societal and worker interests does not negate business interests, it moderates these interests by balancing them with attainment of social benefit at societal level and at the level of individual needs. Where shareholder needs are prioritised over social and worker needs, businesses retract, and even close, to preserve the financial "bottom line". Thus, in times of recession, smaller contractors shut down, and workers are made redundant. The history of the Lavaca movement in Argentina (Lavaca Collective, 2004) demonstrates that the collective input of the workforce to problem solving is capable of ensuring the success of the business on a modified model, based on prioritisation of human needs over excessive profits. Hotels, factories, etc., closed by the owners were taken over and reopened by the redundant workers and successfully operated on a cooperative basis, to ensure that the workers and their families and communities retained the means of survival and self-worth. The collective mind can address problems in novel ways that, even based on simple "self-interest", ensure, in theory, the interests of all.

Successful business sustainability is an interrelated mix of satisfying public, private and worker interests. It is in this context that humanisation progresses. A humanising construction is not concerned with erecting on the landscape vainglorious monuments to architects, politicians, or profit, but is concerned with realisation of the potential of all, equally and with full respect.

5. CONCLUSION

Construction, as realised in practice, is problematic whenever the projects, from mega to minor, conflict with the fundamentals of human dignity and decency, whether in the building of megasports projects that displace communities, or in projects that expose workers to extremely bad conditions, or in projects that degrade the environment through a lack of concern, or by good intentions poorly informed by the science of ecology. This work advocates adopting a new approach to construction that places humanisation and man's attainment of authentic being at its heart. Future research to achieve this objective will need to examine the societal and political models for construction planning and policies. It needs to look at the social relations of and within construction and learn from models of successful cooperation, as well as models mooted but never applied, in order to develop appropriate national and cultural models that will restructure those relationships in a manner that will advance the human ontological project.

Ultimately it will require a review of education practices that will ensure that ethics and ethical reasoning are integrated into primary, secondary and tertiary education, so as to

evolve trades and professions that uphold the principles of universal respect and equal consideration for man and nature.

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IS THE LONGBOW BETTER THAN THE CROSSBOW? EMERGING ISSUES FROM MOBILISING A LONGITUDINAL STUDY ON A MEGAPROJECT

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ABSTRACT

Longitudinal studies of occupational safety and health (OSH) outcomes in construction projects are rarely conducted, due to the financial, practical and ethical difficulties of studying people, projects, and organisations over extended periods of time. Traditionally, OSH research in the construction industry is cross-sectional – where a 'snapshot' is taken, often with a retrospective view. The focus of this paper is the mobilisation of a longitudinal research study investigating OSH policy in an eight-year infrastructure megaproject in the UK. The research examines implementation of the project's "transformational" OSH strategy, in order to develop new understandings of the effectiveness of OSH interventions. The research design uses a "strategy as practice" lens and traces the various strands of OSH policy, from development to their adoption as practice. The research context is complex, due to the complicated contractual arrangements. The research design incorporates a rarely used "tracer" methodology. During the mobilisation phase of the research project, several challenges were identified, including interpretation and implementation of this tracer methodology, coping with a large team of researchers, obtaining ethics approval and establishing the governance structure, deployment of the team to the site, ensuring consistency in the data collection, managing data sets, and the reliability of the coding. The methodology adopted is time-consuming, and the very large data sets that are generated need to be managed. Complex research project management structures and processes are required, which would not be needed for traditional cross-sectional studies. Sufficient time needs to be allowed at the start of such research projects, in order to put the necessary systems in place. The paper will be of interest to OSH researchers and those contemplating longitudinal studies, particularly those employing a tracer approach.

Keywords: complexity, longitudinal research, megaprojects, occupational health, strategy

1. INTRODUCTION

This paper provides insight into the mobilisation of a unique longitudinal study of OSH policy deployment into practice on a construction megaproject. The project being studied is a water infrastructure project, where a 25 kilometre-long tunnel is being constructed

under a major river, and is scheduled for completion in 2023. The funding for this first phase of the study, provided by the Institution of Occupational Safety and Health (IOSH), covers the first three years of the eight-year construction project. The project provides a unique opportunity to study the impact of OSH leadership, policy and practice over an extended period "in-flight" (Pettigrew, 1990) using a longitudinal approach, i.e. collecting data over a longer time period or arrow flight (Woodward, 1970; Chau and Witcher, 2005).

The project has a high degree of complexity (Baccarini, 1996), due to complicated contractual arrangements. The management company is supervising three construction consortia and a further company responsible for the installation of the overall control system. The contract itself is based on NEC 3 (ICE, 2013), which is designed to foster a high degree of collaboration between the parties. The research team consists of three academics and four postdoctoral researchers (RAs) at a UK university working on a part-time basis. The academics, including the project leader, provide direction and oversight. The four RAs have specialisms including occupational health practice, design, quantity surveying, and project management. The team has considerable experience in OSH research, including in-depth knowledge of OSH on several internationally recognised infrastructure megaprojects, e.g. Terminal 5, the 2012 Olympics, and Crossrail.

The objectives of this research are to reveal new approaches to achieving desirable OSH outcomes, together with in-depth knowledge of how they can best be managed through the process of implementation. The research will also identify the practical lessons, knowledge, and good practice that are developed and can be shared with the wider industry.

In this paper we discuss the challenges that the research team has encountered during the initial mobilisation phase of the research, and the ways these have been addressed. This will provide insights into the use of longitudinal approaches in the OSH research field, so as to inform debate about the ways in which translation of H&S policy into practice is studied. The study is at a very early stage, having only recently been mobilised, and therefore the focus of this paper is on the team's experiences during this initial mobilisation phase of the research project.

This section has provided an outline of the context of the study and the aims of the research. The following sections provide an overview of the relevant literature, a discussion of issues arising during mobilisation, and how they were dealt with, and reflections on the practicalities of longitudinal research.

2. LITERATURE OVERVIEW

The majority of social science research is cross-sectional rather than longitudinal, and it employs quantitative rather than qualitative methods (Bryman, 2012). Menard (1991) defined longitudinal studies as studies where data is collected over one or more time periods, where the subjects, or cases, are the same, or comparable, from one period to the next, and where the analysis involves comparisons between periods. He defined cross-sectional studies as studies where data is collected once for each item over a narrow space of time, such that the measurements can be considered contemporaneous for all variables and cases.

In medieval military terms, a cross-sectional study can be likened to a crossbow, which is relatively easy to use and doesn't need intensive training, and where early versions had limited accuracy, sophistication and range. The cross-sectional approach takes 'snapshots'

at the time the study is conducted, and the findings are then extrapolated backwards and forwards, outside of the time frame in which the data was collected (Yin, 2003). This method relies heavily on a combination of the recollections of research subjects and on data derived from lagging indicators. By contrast, longitudinal studies can be likened to longbows, which are more accurate, have a faster firing rate, and provide more flexibility in battle, but require more skill. Longitudinal studies need experienced researchers who can 'fit in' to organisations, cope with a greater rate of data collection, and be more adaptable to deal with changes to their area of study which emerge over time. Such studies also require more commitment from industry collaborators to provide good access over sustained periods.

In his keynote paper at the 2014 CIB W099 conference in Lund, Sweden, Andrew Hale challenged the research community about the lack of longitudinal studies covering OSH in construction (Hale, 2014). Pettigrew (1990:284) stated that "longitudinal research in the social sciences has always been a 'minority taste' research into industry practice".

The aim of the research is to develop new understandings of the deployment of the OSH strategy, and the effectiveness of the resultant OSH interventions in large, complex multi-site construction projects with networked supply chains. In other words, the research will be monitoring change within the organisations involved in the construction projects. Menard (1991) states that the two primary purposes of longitudinal research are "to describe patterns of change" and "to establish the direction […] and magnitude of causal relationships". As such, using a longitudinal approach allows the study of the OSH interventions as they unfold, revealing not only their effectiveness, but also the ways in which OSH policies and practices intersect and intertwine with other organisational agendas. A recent study in the construction safety field revealed that out of a sample of 88 papers published in 2009, 50% were quantitative research-related, 25% were qualitative research-related, and only 10% were mixed-methods research-related. OSH studies, particularly in construction, have generally been cross-sectional. The paper called for more mixed-methods research, so as to improve generation of knowledge, as well as collaboration between researchers and practitioners. Menard (1991) states that the term "longitudinal" does not describe a single method, but rather a collection of methods, which is also the approach adopted for this study.

The tracer methodology has its roots in seminal work by Woodward (1970), who used it as a method to explore managerial control systems across three case studies. There are specific terms associated with this methodology. Tracers are the processes that are of interest and are traced during the research. Tags are a means of identifying items or ideas that are to be followed. Manufacturing processes were selected as tracers to be followed through the control systems of the organisations. The interactions of the staff and their behaviours were observed in terms of how they were involved in planning, making decisions, and carrying out tasks related to the tracer (Woodward, 1970). This allowed a broader understanding of the control systems, by studying smaller elements, or subsystems, from which more focused data collection could take place as the study evolved over time.

The approach was further developed by Hornby and Symon (1994), who provided a structure for examining the perspectives of stakeholders on processes in which they have participated. Cassell and Symon (1994) refer to organisational studies as being about highly complex processes which have a variety of actors over their time span. They promoted the

use of tags attached to tracers, which are followed to identify the important processes and key actors pertaining to the research focus, as well as critical documents, events and activities.

Using this methodology, the research team will be able to follow whichever processes and people emerge as relevant to shaping OSH outcomes, rather than making an assumption that the issues and influences relevant to OSH are all known from the outset. The methodology allows a variety of research avenues to be opened up and closed as their relevance is established. In this respect, the method is particularly effective in examining the effect of specific interventions as ongoing activity. In other words, the aim of this type of study is to iteratively examine emergent issues collected through interviews, and to build upon and respond to these in later stages of the research endeavour (Chau and Witcher, 2005). The approach is particularly apposite, in that it uses tried-and-tested research data-gathering techniques (e.g. interviews, observations, and documentation reviews), but within an innovative longitudinal framework. It allows data collection to be focused in specific areas of interest, thus making the data set more manageable, and it enables better understanding of the big picture, by looking at small elements of the organisation, rather than everything at once.

3. ISSUES ARISING DURING MOBILISATION

The mobilisation of the research consisted of a number of elements, some of which ran concurrently, including establishing the research methodology, mobilising the research, establishing the governance structure, obtaining ethics approval, and commencing the data-collection and -analysis phase of the project. This section describes the research mobilisation period from February 2016 (the official start date of the project) to December 2016, when Milestone 1 was successfully achieved. The following subsections describe the issues that arose, and how they were dealt with.

3.1 Establishing the methodology

From the outset, there was considerable debate as how the research methodology should be applied, and this continued as the project progressed. A key facet of the methodology used in this study is an adapted version of the longitudinal tracer study methodology (cf. Chau and Witcher, 2005) that was originally developed by Woodward (1970). In essence, the application of a longitudinal tracer approach allows core organisational processes or phenomena to be isolated and their progress to be followed via insights gathered at particular stages of their development.

Tags are being used to identify the important processes and key actors pertaining to the research focus, as well as critical documents, events and activities. By tagging particular people, processes and tools, the effects of interventions can be studied in real time. The choice of tags is crucially important to the success of a tracer study; tags should be relevant references to respondents, they should be malleable enough to enable issues to emerge, and they should provide sufficient data to generate and develop theory. It is essential that tags are grounded in practice and developed in collaboration with the industry partners, in order to ensure that fruitful opportunities are exploited. This is an emancipatory methodology, responding to the complex network of organisations and the approach that the people, teams and organisations are taking, and focusing on the nature, complexity and risks involved.

The flexibility of the methodology caused the research team considerable problems right from the start. Each of the seven team members had their own interpretations of what the methodology meant and how it might be deployed in practice. Team meetings would end up with long periods where the different viewpoints presented and what was meant by the various terms would be discussed. After several interesting but inconclusive discussions, a visual representation was developed, used both to stimulate ideas *and*, more importantly, to provide more focus. This resulted, after several more sessions, in the diagram shown in Figure 1.

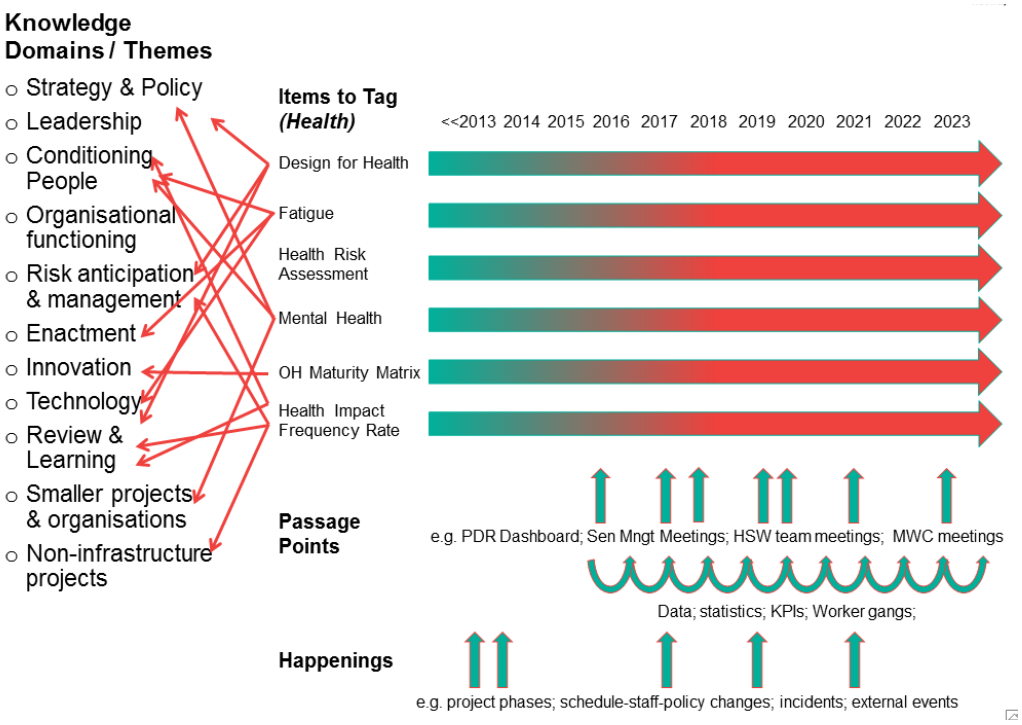

Figure 1: Tracer methodology schematic

The research team had to decide on how *they* were going to use and adapt the methodology, rather than stick with the latest existing interpretation. This helped the team reach consensus as to how the methodology was to be developed and deployed. The next task was to clarify the terminology that was to be used in the current context, namely themes/knowledge domains, tags, tracing, passage points, and happenings. This crystallised the team's thinking and provided a consistent message to communicate to others about the research methods.

Overarching themes, or knowledge domains, as shown in Figure 1 above, are the key areas covered by the study, which, based on the OSH literature, are likely to be of interest to practitioners and academics in the field of OSH strategy and implementation. Tags will be used to identify things that we are interested in, such as specific interventions or initiatives (e.g. inductions, and onboarding), and broader initiatives (e.g. mental health, and design for health). These tagged items or ideas can be traced, in order to see how the relevant areas of strategy are implemented over the project life cycle, and how this implementation is affected by other factors. The things that are tagged will be subject to change as the project moves forward – for example, project induction might evolve into a different format, and

the research will seek to identify the nature of the change, the causes of the change, and the impact on other tagged items and on the project outcomes. In terms of collecting data, passage points can be used in the same way that a suitcase tag would be checked on various occasions at different airports during the suitcase's journey. In this context, passage points will include meetings, interviews with key players, and KPI (key performance indicator) data.

Another phenomenon of interest is the 'stuff' that happens during the course of a project (the happenings), which affects the way the project is enacted, OSH performance, and resultant outcomes. These may be internal-expected (e.g. project phases, etc.), internal-unplanned (e.g. changes in key personnel, or incidents), or external (e.g. Brexit). A log of happenings relevant to the project will be maintained, so that the team can check how these affect the things that are tagged.

There was also considerable discussion of the theoretical perspectives to be used in the study. Given the fact that the topic under study was the implementation of strategy, the use of a "strategy as practice (SaP)" lens was considered a good fit by the team (Pettigrew, 1990, 1992; Jarzabkowski, 2004; Whittington, 2006). Further review of the literature established that work in the "organisational change" field (Tsoukas and Chia, 2002) would also aid in the understanding of how policy is translated into practice. The SaP lens will be used to examine the various strands of OSH policy, as they are traced from their development through to adoption as practice. Due to the emergent nature, both of the methodology and of the research being conducted, these discussions are ongoing but are increasingly more focused.

3.2 Mobilising the research

The research team took several months to assemble. Each of the RAs was allocated roles and responsibilities for the various activities according to their knowledge and experience. Each led on one or more subject areas, in addition to being allocated to build relationships with one of the joint ventures or the management company.

Following allocation of roles and responsibilities, the original research plan from the proposal was then updated, and revisions were approved by the IOSH. A high-level research plan was produced, covering the initial three-year research period. From this, detailed research plans were produced for individual elements of the Milestone 1 deliverables. The plans for the individual elements covered familiarisation with the topic and the staff involved, data collection, data analysis, and preparation of outputs. The plans are reviewed on an ongoing basis.

The initial team meetings were sometimes a little unproductive, as the team strove to develop the processes necessary to manage the project. As with any new team and/or project, the personalities involved need time to 'gel' together (or not) into a cohesive performing team. Geography was an additional challenge, with two RAs living 1–2 hours' drive away from the university, and the project being studied being a two-hour train journey away and involving sites located all over the city. This challenge was mitigated by having weekly meetings at the university – in person if possible, or via Skype. Other collaboration tools were used with varying degrees of success: OneNote, Slack, Google Docs, and good VPN (virtual private network) access to the shared drives. The meeting structure has evolved over time, as different approaches were tried, and they were discarded if they were

found not to work. The RAs meet together and with the lead academic every two weeks, and monthly as the entire team. There are separate monthly meetings between the main site-based researcher and/or the lead investigator and the industrial HSW (health, safety, and well-being) director and HSW leader, and regular meetings with the IOSH project manager.

After nine months, several particularly useful project management processes have been introduced, including the use of a standard slide pack as the review meeting agenda and to capture actions, adoption of a rotating chair and minute taker, to enable the leadership role to be shared across the RAs, and producing a document where the responsibilities of each team member (including ownership of particular key files, processes and records) were outlined, so as to give greater clarity of what was required from each person.

There were considerable advantages to having four RAs, as they have a vast range of experience and many ideas, resulting in cross-pollination of ideas. There were also some major disadvantages, in terms of the extra time needed to share information, the time needed to reach consensus, and coping with different styles of working. There was also an inherent perception among other project parties that we had four RAs who were 100% attached to the project, and it was easy for them to forget the 1.6 FTE (full time equalvalent) time restriction. A key consequence of having four rather than two RAs was the increased proportion of available researcher time spent at meetings – so that a one-day meeting involving all four researchers used up half of the week's total allocated time on the project. There was also the recurrent challenge of meeting deadlines for written outputs, due in part to the pressures of each RA needing to simultaneously work on their own outputs and comment on those of others. Better research planning and realistic allocation of time to the RAs will be required as the research progresses. For example, it was suggested that for future outputs, there will be a lead writer and a second support person, so as to minimise the number of team members involved.

A key enabler to building an effective research team was the fact that the personalities involved were able to reach a suitable compromise position for any issue that came up during the mobilisation. This point should not be underestimated, as research staff and academics are, by the nature of their work, often highly skilled at putting a viewpoint across and defending it against all comers. With a less collaborative team, it would have been much more difficult to make progress. What enabled the team to be more collaborative was using a rotating chair for the project meetings, rather than selecting one RA as the leader. By contrast, a more autocratic approach may have been more task-focused, but it would have been less effective, as it would have stifled debate and creativity. The methodology allows much flexibility in how data is collected and analysed, which suits a more cooperative approach to an emergent topic of study. What was needed was better project management, which was eventually achieved through the meeting structure and the rotating leadership model that evolved.

A series of initial research questions were developed to guide the investigation and collection of data, namely the following:

- How does OSH policy translate into practice on major construction projects?
- How is OSH policy propagated through complex organisations created by megaprojects?

- How effective are the OSH interventions that are implemented on megaprojects, and how have they been managed?
- Which findings will be of most relevance and use to industry practitioners and researchers?
- How do people cope with complexity and change in megaprojects?

These research questions are emergent due to the longitudinal nature of the research and the topic(s) under investigation. At research team project meetings, the topics are reviewed to determine which topics will remain under active investigation.

3.3 Governance structure

The governance structure for the project is a vital area of concern, given the research topic and duration. There are multiple stakeholders, whose needs must be taken into account and managed, and so a number of groups have been set up. An overall steering group represents the main stakeholders in the research and other key industry representatives. This includes the IOSH as the main funding body, which is keen to see that there is a focus on practical outputs for OSH professionals, as well as wider social and economic impact. In addition, there are two reference groups, from industry and academia, respectively, to provide sounding boards for findings and to maximise the applicability in terms of impact and benefit to the broader construction industry (e.g. smaller projects and other construction sectors) and the research community. Formal reports will be produced annually, with interim reports issued as necessary.

The governance structure provides the necessary independent oversight through the steering group and input from the reference groups. Management of these groups requires significant amounts of time for making preparations and arrangements for meetings and associated workshops. This has, on occasion, threatened to detract from the main research activities of collecting and analysing data. It is important that the governance process is proportionate and adds value to the overall research over the life of the project.

3.4 Ethics approval

Approval from the university ethics committee was required. The submission made to secure this included consideration of the following: the details of the project, the research team's experience in the methods proposed; participant information; observation/recording; consent; participant withdrawal; storage of data, and confidentiality; incentives; risk assessment; and declarations. As the research was mobilised, a number of research protocols and related documents were developed, namely a research overview, a consent form for recorded interviews, information sheets for interviews, observations, and meetings, an action research log, and a researcher diary.

There were several minor issues in relation to ethics. The first was the lack of understanding by the ethics committee of the realities of carrying out research on live construction sites. This was overcome by revising some of the initial material in the submission, and by meeting with the committee chair to discuss the research. The need for written consents for recorded interviews can discourage participation by some subjects, and, in fact, in two cases participants were happy to be interviewed and recorded, but unwilling to sign a consent form. These interviews proceeded with handwritten contemporaneous notes being taken, instead of recording.

In the case of a longitudinal study, there are a greater number of consents to be obtained, and there is the issue of researchers influencing outcomes in the organisations being studied. As participant observers, there is the risk that the researchers may influence the activities under observation. Some of this influence may be incidental, but some will be a direct result of the role the research team is playing, particularly as the project is keen to learn from the research team's work, and to adapt what they are doing. There is, therefore, an element of 'action research' in the approach. A protocol has been developed, which includes a log for documenting any activities that may influence how things are done.

3.5 Data collection and analysis

Data collection will be based mainly on qualitative methods, where interviews, archival analysis, and observation will be used. In addition, focus groups and surveys will be employed as a means of triangulation for any findings. The management company has been very supportive of the research, from board level downwards. Involvement in the research was contractually written into the works information, and this was seen as part of the transformational approach to OSH. The process of gaining access to work on the project was complex and consists of three stages on three or more separate days: attendance at the central onboarding facility (COF), for security and health checks; attending the employer's project induction centre; and, finally, site induction for any site to be visited (including office locations). All researchers are required to have a Construction Skills Certification Scheme (CSCS) card, as this is a requirement of all those working on the project, including office staff. Anyone who wishes to enter the tunnels will need to attend a tunnel safety training scheme course.

Initially, the research team had to learn about many different things at once, but this had to be balanced against the need to work within the team's allocated resources. The project OSH policies have to dovetail with those of the Tier 1 joint venture contractors (and their parent companies), and they are therefore likely to take different paths as the work progresses. Interviews with the key practitioners acting at these intersections will be used to reveal the interrelationships between these policy trajectories. The study of the phenomena emerging at these intersections will include reviewing specific OSH-relevant metrics (e.g. accident/incident data) and other data (e.g. minutes of meetings, documents, and newsletters, etc.), in order to explore the contexts and effects of policy implementation over time.

Building relationships has been important, and locating the team members alongside specific units of analysis was important, i.e. one researcher for each contracting consortium, and one for SI (systems integration) and the management company. This will allow the team to have a deeper understanding of the politics involved in the project, and the drivers in different parts of the project. There are geographical and logistical issues, due to the large number of sites (there will ultimately be 24 main sites and a main office), their accessibility, and the need to attend meetings at various times of the day. All this led to some initial inefficiency, but this has been overcome through better visibility of the on-site activities of the research team members, and better planning through calendar sharing.

Over time the data set has grown rapidly, and the data analysis needs to be carried out in a timely and efficient manner. Not knowing what might become important may lead to continuing to collect data, which might or might not be needed at some point in the future.

In the first nine months, the team carried out 49 interviews, observed 57 meetings, and undertook one survey. To aid management of the data, the team is starting to index files using meta tags (not to be confused with the longitudinal methodology tags) within an overall shared file structure, accessed via a VPN connection when away from the university.

A key area of discussion has been the use of NVivo for coding and analysing data, which is labour-intensive. Coding and indexing data is not made easier by the evolving nature of the research questions, which increases the risk of data having to be repeatedly recoded or refiled. Gaining agreement on coding structure has been time-consuming. Consistency of coding between different researchers will need to be managed. The team is already on its second iteration of the shared file structure, and is about to relaunch its third coding structure.

4. REFLECTIONS ON UNDERTAKING LONGITUDINAL RESEARCH

So is the longbow better than the crossbow? The answer is simple. It depends on where you are in the battle cycle, what fighting resources you have at your disposal, where the battle is taking place, how skilled your troops are, and how you plan to overcome the tactical challenges presented. Longitudinal research is similarly challenging.

The challenges identified in mobilising such research have included the following: the interpretation of a little-used longitudinal methodology within a large research team; establishing a governance structure for long periods of study; ethical considerations; data overload, from too many lines of inquiry and easy access; consistency of data collection; and the challenges of inter-rater reliability in coding. Other features, which have been covered in less detail, have included frustration at 'missing' the action, and the inherent uncertainty in working with ideas of organisational becoming. Further publications during the course of the research project will be able to provide more details on specific challenges.

Carrying out longitudinal research on such a large scale is a significant undertaking, and the team has a large amount of data which they need to make sense of in order to meet the research aims and objectives. The team has worked hard to mobilise the methodology and devise a project management approach that suits the needs of all stakeholders. The project is at a stage where the team needs to become more focused and concentrate on producing high-quality outputs. The processes introduced, e.g. the meeting structure, and the indexed shared file structure, are starting to regulate how the team operates and make it more efficient and effective within the resource constraints. The opportunity, provided by this unique study, to make a difference in how learning about OSH in megaprojects is generalised for use by the wider industry needs to be carefully managed to a successful conclusion. This is being made easier by the unrestricted access to all areas of the project – both people and data. The team are totally committed to the task, but they will need to bring all their experience to bear.

From a research community point of view, the study has already revealed some interesting insights into the application of longitudinal studies versus cross-sectional approaches. The relative advantages and disadvantages of the two approaches observed from the mobilisation of this study are outlined in Table 1.

Table 1: Longitudinal (longbow) vs cross-sectional (crossbow) research

Longitudinal		Cross-sectional	
Advantages	**Disadvantages**	**Advantages**	**Disadvantages**
Multiple data sources	Too much data; complexity of data	Short time scales	Limited data
Rich data	The time taken to mobilise	Quicker results	Triangulation can be challenging
Opportunity for triangulation	Takes longer to produce outputs	Lower cost	Limited understanding of context
Better understanding of context	High cost	Requires limited time on-site	Interpretation of results can be difficult
Better interpretation of results	Researcher objectivity – the risk of 'going native'	Ethics is easier	Difficulties in verification of results
Verification of results	Changes in the team	Reduced researcher bias	Remote working
Better validity of outputs		A smaller team	
		More focused	

It is too early in the project to draw firm conclusions regarding the benefits of using a longitudinal approach, and whether the benefits outweigh the challenges encountered. Certainly the team can see mistakes being made and fixed that may not have been revealed in a cross-sectional approach. Similarly, the team will be able to observe how OSH policies and interventions are developed and then discarded or changed during implementation.

5. CONCLUSION

A key feature of a longitudinal approach is the rich data set, which is both an advantage and a disadvantage. How the data set is managed will be key to the success of the project. Longitudinal studies with large teams need to allow time for setting up the project structures and processes required to manage the research activities. These are generally less complex in cross-sectional studies.

The data set emerging from this work will afford insights into the ways in which OSH policy instruments are enacted, mediated, translated and appropriated by a broad range of strategy actors engaged in the project. Understanding how OSH plays out within and across project-based temporary multiple organisations will allow for domain-specific insights to be generated, to address some of the specific issues that arise in this hazardous sector.

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THE PERFORMANCE OF CONSTRUCTION HEALTH AND SAFETY OFFICERS

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ABSTRACT

Full-time or part-time construction health and safety officers (CHSOs) are a requirement in terms of the South African Construction Regulations. Previous research findings and anecdotal evidence indicate that CHSOs are lacking in various competencies, are excluded from contributing to the management of health and safety (H&S) and sites, could be more effective, and require development. The objectives of the study were to determine the performance of CHSOs, barriers to the contribution of CHSOs to construction and construction H&S, and the potential of interventions to contribute to an improvement in CHSOs' contribution to and impact on construction and construction H&S. A descriptive survey method was adopted for gathering and processing data obtained through self-administered questionnaires. The sample stratum included a convenience sample of delegates attending a two-day construction H&S summit. The findings indicate that the contribution of CHSOs to H&S could be improved. Various factors constitute a barrier to CHSOs contributing to H&S. These include exclusion from decision-making, non-consultation by site management, lack of authority, and exclusion from managing sites, which constitutes marginalisation. This is underscored by the low ratings of CHSOs in their understanding and appreciation of various aspects, composite knowledge areas and skills, and the extent to which interventions could contribute to an improvement in the contribution of CHSOs to H&S and construction. Conclusions include that the function of CHSOs is important, and that the "CHSO" requirement in terms of the Construction Regulations is justified, that inadequate 'construction' knowledge and experience contributes to the exclusion of CHSOs from managing sites, and the actual barrier of CHSOs contributing to H&S, and that formal qualifications would empower CHSOs to contribute optimally to H&S and construction.

Keywords: construction, health and safety (H&S), health and safety officers, performance

1. INTRODUCTION

The *Construction health & safety in South Africa: Status & recommendations* industry report highlighted the significant number of accidents, fatalities, and other injuries that are prevalent in the South African construction industry (Construction Industry Development Board (cidb), 2009). The report attributed this to a lack of compliance with H&S legislative

requirements, and it stated that there is a lack of sufficiently skilled, experienced and knowledgeable persons to manage H&S on construction sites.

The South African Construction Regulations make provision for the appointment of either full-time or part-time CHSOs (Republic of South Africa, 2014). However, the cidb industry report *Construction health & safety in South Africa: Status & recommendations* highlighted the need for professional registration of construction H&S practitioners, due to, among other things, the finding that there was a lack of competencies and no formal registration process. The South African Council for the Project and Construction Management Professions (SACPCMP) was then mandated by the Council for the Built Environment (CBE) in terms of Act No. 48 (Republic of South Africa, 2000) to register construction H&S professionals. This, in turn, led to the identification of three such categories of registration, namely professional construction health and safety agent (PrCHSA), construction health and safety manager (CHSM), and CHSO. Registration rules were then gazetted for these three categories, for commencement on 1 June 2013 in the case of PrCHSA, and on 1 August 2013 in the case of CHSM and CHSO.

Given the findings in the cidb report *Construction health & safety in South Africa: Status & recommendations*, other ad-hoc research findings, anecdotal evidence, and exploratory research findings, a further study was conducted to determine, inter alia,

- The performance and contribution of CHSOs,
- The barriers to the contribution of CHSOs to construction and construction H&S, and
- The potential of interventions to contribute to an improvement in CHSOs' contribution to and impact on construction and construction H&S.

2. A REVIEW OF THE LITERATURE

2.1 Legislation and regulations

The amended Construction Regulations (Republic of South Africa, 2014) schedule several requirements with respect to CHSOs. Regulation 8, "Management and supervision of construction work", states that a contractor must, after consulting with the client and having considered various aspects, appoint a full-time or part-time CHSO in writing. However, the CHSO must be registered with a statutory body approved by the Chief Inspector, and must have the necessary competencies and resources to assist the contractor.

2.2 Knowledge and skills areas

The SACPCMP requires a report upon application to register as a CHSO that addresses the following nine knowledge areas: procurement management; cost management; hazard identification management; risk management; accident or incident investigation management; legislation and regulations; health, hygiene and environmental management; communication management; and emergency preparedness management (SACPCMP, 2013a).

The CHSO Scope of Services, in turn, states that CHSOs are expected to be experienced and knowledgeable in the following areas: construction project-specific H&S management systems; construction H&S management; H&S performance measurement and monitoring; and continual improvement (SACPCMP, 2013b).

However, a study conducted by Smallwood and Haupt (2008) prior to the drafting of the registration rules for CHSOs investigated the importance of 79 knowledge areas and 50 skills to CHSOs. These were then consolidated into eight and seven composite knowledge areas and skills areas, respectively. Except for financial management, all the composite knowledge areas have mean scores (MSes) of > 3.00, which indicates that these knowledge areas are more than important, as opposed to having limited importance. However, it is notable that two of the eight (25%) composite knowledge areas, namely OH&S and project administration, have MSes of $> 4.20 \leq 5.00$, which indicates that they are between "more than important" and "very important". Then, five of the eight (62.5%) composite knowledge areas (i.e. design, management/management of parameters, law, planning, and construction technology/technology) have MSes of $> 3.40 \leq 4.20$, which indicates that they are between "important" and "more than important". The MS for financial management is $> 2.60 \leq 3.40$, which indicates that this knowledge area is between "less than important" and "important". The implications of these findings are that CHSOs should be well rounded and well versed in knowledge, which is underscored by the fact that they fulfil a staff function, which means that they are required to be knowledgeable in the areas and provide advice and support. Furthermore, given the fact that a tertiary qualification does not exist for CHSOs, such well-rounded and well-versed CHSOs are not likely to exist. All the composite skills areas have MSes of > 3.00, which indicates that they are more than important, as opposed to of limited importance, although marginally so in the case of "negotiating". It is notable that four of the seven (57.1%) composite skills areas (i.e. leadership, general management, negotiating, and interpersonal/developmental) have MSes of $> 4.20 \leq 5.00$, which indicates that these skills areas are between "more than important" and "very important". Then, two of the seven (28.6%) composite skills areas (i.e. planning and technical) have MSes of $> 3.40 \leq 4.20$, which indicates that these skills areas are between "important" and "more than important". The MS for the "financial" skills area is $> 2.60 \leq 3.40$, which indicates that this skills area is between "less than important" and "important". The implications of these findings are that CHSOs should be well skilled in leadership, management, and technical matters, such as planning and construction technology, even though they fulfil a staff function. This is underscored by the fact that CHSOs must interface with a range of built environment practitioners, especially construction managers.

A previous exploratory study conducted by Smallwood (2011) investigated a range of issues pertaining to CHSOs. CHSOs were deemed to have between a "near limited" and an "average" understanding and appreciation of construction H&S, construction activities, construction management, and the construction process. Except for H&S and project administration, CHSOs were rated "poor" as opposed to "good" in the eight composite knowledge areas as discussed above. Similarly, except for interpersonal/developmental skills, CHSOs were rated "poor" as opposed to "good" in the seven composite skills areas as discussed above.

2.3 The contribution of CHSOs to H&S

The previous exploratory study conducted by Smallwood (2011) determined that CHSOs had contributed to and impacted on H&S. However, the contribution and impact was deemed to be between a moderate extent and a near major extent. However, the findings

indicate that the contribution of CHSOs to H&S could be improved to between a near major extent and a major extent.

The top four factors that constituted a barrier to CHSOs contributing to H&S related to exclusion of CHSOs from managing the site, including exclusion from decision-making, lack of authority, and non-consultation by site management. However, inadequate knowledge of the construction process and activities, construction management, construction H&S, and related experience also constituted a barrier and were deemed to contribute to the exclusion of CHSOs from managing sites, and the actual barrier of CHSOs contributing to H&S. This conclusion is underscored by the rating of CHSOs in their understanding and appreciation of various aspects, composite knowledge areas and skills, and the extent to which interventions could contribute to an improvement in the contribution of CHSOs to H&S and construction.

3. RESEARCH

3.1 Research method

The descriptive survey method was adopted to gather the data obtained through a self-administered questionnaire circulated to delegates attending a two-day construction H&S summit in Durban, South Africa. The questionnaire consisted of 24 questions, 23 of which were closed-ended, and one of which was open-ended. Nine of the 23 closed-ended questions were five- or six-point Likert scale-type questions. Thirty-six questionnaires were included in the analysis of the data. A measure of central tendency in the form of a mean score (MS) was computed to enable ranking and comparisons. The weightings relative to the five-point scale were as per the scale, i.e. 1 on the scale had a weighting of 1, 2 on the scale had a weighting of 2, etc., resulting in such questions having MSes of between 1.00 and 5.00. Certain questions required a sixth point or seven point, due to inclusion of either a "have not", an "unsure", a "does not" or a "will not" option, which was weighted 0, resulting in such questions having MSes of between 0.00 and 5.00.

3.2 Research findings

Table 1 presents the findings with regard to the qualifications that respondents opine CHSOs possess. The percentages represent the approximate percentage of CHSOs that are perceived to have a certain qualification.

Table 1: The qualifications of CHSOs

Response (%)						
Unsure	**Grade 12**	**N Dip.**	**BTech**	**BSc**	**BSc (Hons)**	**Other**
11.0	50.0	38.9	11.0	2.0	0.0	41.7

The respondents that identified the "other" category recorded the qualifications of HIRA, IRCON, and SAMTRAC. The findings highlight the low level of formal qualifications that CHSOs possess, and it can therefore be assumed that CHSOs are unlikely to possess the requisite knowledge and skills.

Fifty-two percent of CHSOs are employed on a permanent basis, and 48% are employed on a contract basis. Fifty percent of CHSOs are deployed on projects on a "part-time" basis,

and 41.3% are deployed on a "full-time" basis. Of the respondents, 57.1% indicated that other functions fulfil the role of CHSO, and 42.9% responded that other functions do not fulfil the role of CHSO. This finding relates to the basis on which CHSOs are employed.

Of the respondents, 85.7% indicated that CHSOs fulfil other functions, and 14.3% responded that CHSOs do not fulfil other functions. Infrastructure projects predominated in terms of the type of projects respondents provided H&S consultancy services for in 2015 (see Table 2).

Table 2: Type of construction projects respondents provided H&S consultancy services for in 2015

Type	Response (%)
Commercial	14.6
Industrial	13.1
Infrastructure	53.5
Residential	6.3
Other	11.6

Table 3 indicates that CHSOs report predominantly to site managers or site agents, or both. The "other" category included a variety of multiple management combinations. Clearly, there is a degree of dual and multiple reporting.

Table 3: Functions to whom CHSOs report

Response (%)					
Site manager	**Site agent**	**General foreman**	**Site manager and site agent**	**Other**	**Unsure**
30.6	33.3	0.0	11.1	22.4	2.8

Table 4 indicates the extent to which CHSOs have contributed to and impacted on H&S, on a scale of "have not" to minor (1) to major (5), where MSes range from 0.00 to 5.00. Given that the MSes for both questions are > 2.50, CHSOs can be deemed to have contributed to and impacted on H&S. However, given that the MSes are $> 2.50 \leq 3.33$, the contribution and impact can be deemed to be between a near minor extent and a moderate extent. However, both MSes are near the upper end of the range.

Table 4: The extent to which CHSOs have contributed to and impacted on H&S

Aspect	Response (%)							MS
	Unsure	Have not	Minor ……..…..Major					
			1	2	3	4	5	
Contributed?	0.0	0.0	5.6	2.8	61.1	19.4	11.1	3.28
Impacted on?	0.0	0.0	5.7	14.3	34.3	34.3	11.4	3.31

Table 5 indicates the extent to which factors constitute a barrier to CHSOs contributing to H&S, on a scale of "does not" to minor (1) to major (5), where MSes range from 0.00 to 5.00. Given that all the MSes are > 2.50, all the factors generally can be deemed to constitute a barrier to CHSOs contributing to H&S. However, a review of the MSes with regard to their range enables a more scientific review. The fact that the MSes are $> 3.33 \leq 4.17$ indicates that the factors can be deemed to constitute a barrier to CHSOs contributing to H&S, to between a moderate extent and a near major extent. The factors ranked first to twelfth are included in this range. It is notable that the top four factors included in this range relate to exclusion of CHSOs from managing the site, namely exclusion from decision-making, non-consultation by site management, lack of authority, and exclusion from managing the site. Four of the factors ranked fifth to twelfth relate to inadequate experience, and four relate to inadequate knowledge. Status level has an MS of $> 2.50 \leq 3.33$, which indicates that the contribution and impact can be deemed to be between a near minor extent and a moderate extent.

Table 5: The extent to which factors constitute a barrier to CHSOs contributing to H&S

Factors	Response (%)							MS	Rank
	Un-sure	Does not	Minor ……Major						
			1	2	3	4	5		
Exclusion from decision-making	0.0	0.0	0.0	8.3	8.3	41.7	41.7	4.17	1
Non-consultation by site management	0.0	0.0	2.9	2.9	14.3	45.7	34.3	4.06	2
Lack of authority	0.0	0.0	0.0	2.8	27.8	30.6	38.9	4.06	3
Exclusion from managing the site	0.0	0.0	0.0	11.1	22.2	33.3	33.3	3.89	4
Inadequate construction process experience	0.0	2.9	0.0	5.7	14.3	51.4	25.7	3.89	5
Inadequate construction management knowledge	0.0	0.0	0.0	8.6	28.6	40.0	22.9	3.77	6
Inadequate construction activities experience	0.0	0.0	2.8	11.1	22.2	36.1	27.8	3.75	7
Inadequate construction management experience	0.0	0.0	0.0	8.6	31.4	37.1	22.9	3.74	8
Inadequate knowledge of the construction process	0.0	5.6	0.0	11.1	13.9	38.9	30.6	3.72	9
Inadequate knowledge of construction activities	0.0	0.0	2.9	8.6	25.7	42.9	20.0	3.69	10
Inadequate construction H&S experience	0.0	0.0	2.9	20.0	20.0	31.4	25.7	3.57	11
Inadequate construction H&S knowledge	0.0	0.0	5.6	13.9	27.8	30.6	22.2	3.50	12

Status level	0.0	2.9	5.7	17.1	31.4	22.9	20.0	3.26	13

Table 6 indicates the rating of CHSOs in their understanding and appreciation of various aspects, on a scale of 1 (limited) to 5 (extensive), where MSes range from 1.00 to 5.00. Given that only one of the related MSes is > 3.00, CHSOs generally can be deemed to have a limited understanding and appreciation of the construction process, construction management, and construction activities. However, the converse applies with regard to construction H&S. However, a review of the MSes with regard to their range enables a more scientific review. The fact that the MSes are > 2.60 ≤ 3.40 indicates that the degree of understanding can be deemed to be between near limited and average for all four aspects. This finding confirms the findings of inadequate knowledge and experience among CHSOs, which marginalises CHSOs from contributing to managing the site and to decision-making.

Table 6: The rating of CHSOs in their understanding and appreciation of various aspects

Aspect	Response (%)						MS	Rank
	Un-	Limited ……Extensive						
	sure	1	2	3	4	5		
Understand and appreciate construction H&S	0.0	5.6	16.7	30.6	33.3	13.9	3.33	1
Understand and appreciate the construction process	2.8	16.7	33.3	19.4	19.4	8.3	2.69	2
Understand and appreciate construction management	0.0	13.9	33.3	30.6	16.7	5.6	2.67	3
Understand and appreciate construction activities	0.0	11.4	42.9	22.9	14.3	8.6	2.66	4

Table 7 indicates the rating of CHSOs in eight composite knowledge areas, on a scale of 1 (very poor) to 5 (excellent), where MSes range from 1.00 to 5.00. Only one of the MSes (12.5%) is > 3.00, while seven of them (87.5%) are ≤ 3.00. CHSOs' knowledge can thus generally be deemed to be poor as opposed to good in the latter composite knowledge areas. However, the range of the MSes provides further insight. MSes of > 3.40 ≤ 4.20 (namely that for OH&S) indicate that the rating can be deemed to be between average and good. MSes of > 2.60 ≤ 3.40 (namely that for law) indicate that the rating can be deemed to be between poor and average. MSes of > 1.80 ≤ 2.60 (namely those for project administration, construction technology/technology, planning, and management/management of parameters) indicate that the rating can be deemed to be between very poor and poor. However, the MS of 1.80 for financial management is on the cut-off point of the lower end of the range. MSes of > 1.00 ≤ 1.80 (namely those for financial management and design) indicate that the rating can be deemed to be between very poor and poor. The low MS for design is largely attributable to the fact that 50% of the respondents rated CHSOs as very poor in this knowledge area.

Table 7: The rating of CHSOs in composite knowledge areas

Composite knowledge area	Response (%)		MS	Rank
	Un-	Very poor……Excellent		

	sure	1	2	3	4	5		
OH&S	0.0	0.0	16.7	22.2	50.0	11.1	3.56	1
Law	0.0	19.4	25.0	30.6	22.2	2.8	2.64	2
Project administration	0.0	25.0	33.3	27.8	11.1	2.8	2.33	3
Construction technology/technology	0.0	17.1	45.7	25.7	11.4	0.0	2.31	4
Planning	2.8	13.9	52.8	22.2	2.8	5.6	2.31	5
Management/management of parameters	2.8	22.2	36.1	30.6	5.6	2.8	2.29	6
Financial management	2.8	36.1	50.0	5.6	5.6	0.0	1.80	7
Design	2.8	50.0	33.3	5.6	8.3	0.0	1.71	8

Table 8 indicates the rating of CHSOs in eight composite skills areas, on a scale of 1 (very poor) to 5 (excellent), where MSes range from 1.00 to 5.00. All the MSes are ≤ 3.00, and CHSOs' skills can thus generally be deemed to be poor as opposed to good. However, the range of the MSes provides further insight. MSes of > 2.60 ≤ 3.40 (namely that for interpersonal/developmental) indicate that the rating can be deemed to be between poor and average. MSes of > 1.80 ≤ 2.60 (namely those for general management, negotiating, leadership, planning, technical, and financial) indicate that the rating can be deemed to be between very poor and poor. Interpersonal/developmental skills are important, as oral communication is the most important operational management skill. Developmental skills are important for improving site staff's H&S knowledge and skills. General management skills in the form of planning, organising, leading, controlling, and coordinating are necessary to realise a healthy and safe workplace. Leadership skills are necessary to ensure that CHSOs are "followed", and that they can have commitment from site staff. Negotiating skills are important in that often site staff must be convinced to consider and address H&S in relation to all activities and actions. Financial skills are necessary as CHSOs work with budgets and allowables related to activities. Planning is critical for H&S, as the requisite resources, in the form of personal protective equipment (PPE), materials, plants, and equipment, must be available when related activities commence, and technical skills, such as plan reading, are necessary for conducting hazard identification and risk assessment.

The low ratings in the composite skills areas underscore the low ratings in the composite knowledge areas and CHSOs' understanding and appreciation of various aspects, and the extent to which factors constitute a barrier to CHSOs contributing to H&S.

Table 8: The rating of CHSOs in composite skills areas

Composite skills area	Response (%)						MS	Rank
	Un-	Very poor……Excellent						
	sure	1	2	3	4	5		
Interpersonal/developmental	5.6	11.1	19.4	50.0	8.3	5.6	2.76	1
General management	2.8	13.9	38.9	30.6	11.1	2.8	2.49	2
Negotiating	2.8	11.1	38.9	38.9	8.3	0.0	2.46	3
Leadership	2.8	16.7	36.1	33.3	8.3	2.8	2.43	4
Planning	5.6	13.9	44.4	27.8	5.6	2.8	2.35	5
Technical	0.0	28.6	39.3	25.0	7.1	0.0	2.11	6
Financial	5.6	25.0	47.2	16.7	5.6	0.0	2.03	7

Respondents were required to indicate the extent to which the contribution of CHSOs to H&S could be improved, on a scale of 1 (minor) to 5 (major), where MSes range from 1.00

to 5.00 (see Table 9). Given that the MS of 4.11 for education/training related to construction activities is > 3.40 ≤ 4.20, the extent can be deemed to be between moderate and near major. However, it is notable that the MS is near the upper end of the range.

Table 9 indicates the extent to which interventions could contribute to an improvement in the contribution of CHSOs to H&S, on a scale of "will not" to minor (1) to major (5), where MSes range from 0.00 to 5.00. Given that all the MSes are > 2.50, all the interventions can be deemed to have the potential to contribute to an improvement in the contribution of CHSOs to H&S, to a major extent as opposed to a minor extent. However, four of the eleven (36.4%) MSes (namely those for increased consultation by site management, inclusion in planning activities, education/training related to construction H&S, and education/training related to the construction process) are > 4.17 ≤ 5.00, which indicates that the interventions can be deemed to have the potential to contribute between a near major extent and a major extent to an improvement in the contribution of CHSOs to H&S. Seven of the eleven (63.6%) MSes are > 3.33 ≤ 4.17, which indicates that the interventions can be deemed to have the potential to contribute between a moderate extent to a near major extent to an improvement in the contribution of CHSOs to H&S. It should be noted that the MSes for these interventions (namely formal CHSO qualification, education/training related to construction activities, inclusion in managing the site, education/training related to construction management, inclusion in decision-making, increased authority, and optimal position in the site hierarchy) fall within the upper half of the range. Many of the barriers to CHSOs contributing to H&S (see Table 5) confirm the belief that education/training related to construction H&S, the construction process, construction activities and construction management is a prerequisite for inclusion in managing the site, increased consultation by site management, which was ranked first, inclusion in decision-making and planning activities, increased authority, and optimal position in the site hierarchy.

Table 9: The extent to which interventions could contribute to an improvement in the contribution of CHSOs to H&S

Intervention	Response (%)							MS	Rank
	Un-sure	Will not	Minor ……Major 1	2	3	4	5		
Increased consultation by site management	0.0	0.0	0.0	0.0	13.9	38.9	47.2	4.33	1
Inclusion in planning activities	0.0	0.0	0.0	2.8	8.3	47.2	38.9	4.26	2
Education/training related to construction H&S	0.0	0.0	0.0	2.8	16.7	33.3	47.2	4.25	3
Education/training related to the construction process	0.0	0.0	0.0	11.1	5.6	33.3	50.0	4.22	4
Formal CHSO qualification	2.9	2.9	0.0	2.9	14.3	45.7	37.1	4.17	5
Education/training related to construction activities	0.0	0.0	0.0	11.1	8.3	38.9	41.7	4.11	6
Inclusion in managing the site	0.0	0.0	0.0	2.8	25.0	30.6	38.9	4.09	7
Education/training related to construction management	0.0	0.0	0.0	11.1	16.7	30.6	41.7	4.03	8
Inclusion in decision-making	0.0	0.0	2.8	5.6	22.2	36.1	33.3	3.92	9
Increased authority	0.0	0.0	0.0	2.8	36.1	33.3	27.8	3.86	10
Optimal position in the site hierarchy	0.0	0.0	0.0	2.8	38.9	41.7	16.7	3.72	11

4. CONCLUSIONS

Approximately 50% of CHSOs are employed on a permanent basis and a contract basis, approximately 50% are appointed on a part-time basis, and about 41% are appointed on a full-time basis. It can therefore be concluded that employment of CHSOs follows the pattern of general employment in construction. The basis of appointment indicates that the nature of the appointment relates to the nature, the value, and the complexity of projects. Approximately 57% of respondents stated that other functions fulfil the role of CHSO, and about 86% indicated that CHSOs fulfil other functions. Therefore, it can be concluded that contractors endeavour to save costs through multiple-function appointments. Approximately 31% of the respondents indicated that CHSOs report to the site manager, one third of them indicated that CHSOs report to the site agent, about 11% indicated that CHSOs report to both the site manager and the site agent, and about 22% indicated that CHSOs report to a variety of management combinations. The conclusion drawn from this is that there is a degree of single, dual and multiple reporting. At the very least, CHSOs interact with the general management and the production management of the site.

CHSOs can be deemed to have contributed to and impacted on H&S to between a near minor extent and a moderate extent. However, given that the MSes are close to the lower end of the next MS range, namely a moderate extent to a near major extent, it can be concluded that the function is important, and that the "CHSO" requirement in terms of the Construction Regulations is justified. However, the findings indicate that the contribution of CHSOs to H&S could be improved to between a moderate extent and a near major extent. Furthermore, CHSO's contribution to and impact on H&S is likely to have been marginalised by their low level of qualifications, their inadequate knowledge and experience, the functions they report to, the basis of their employment, and other functions that they fulfil.

A range of factors constitute a barrier to CHSOs contributing to H&S. The top four, namely exclusion from decision-making, non-consultation by site management, lack of authority, and exclusion from managing the site, constitute marginalisation. However, four of the other factors are related to inadequate experience, and a further four are related to inadequate knowledge. Therefore, it can be concluded that inadequate 'construction' knowledge and experience contributes to the exclusion of CHSOs from managing sites, and the actual barrier to CHSOs contributing to H&S. This conclusion is underscored by the rating of CHSOs in their understanding and appreciation of various aspects, composite knowledge areas and skills, and the extent to which interventions could contribute to an improvement in the contribution of CHSOs to H&S and construction.

5. RECOMMMENDATIONS

The findings of this study lead to the conclusion that formal qualifications would empower CHSOs to contribute optimally to H&S and construction. Minimum qualifications could include a National Diploma: Building, followed by a BTech: Construction Management (Health and Safety), as developed by the Cape Peninsula University of Technology.

However, given the current reality, continuing professional development (CPD) is necessary. This should be provided by the SACPCMP for all the knowledge and skills areas. In addition, employers should provide in-house courses for all the knowledge and skills areas, particularly planning and construction technology.

CHSOs should report to the site manager, and H&S discussions between contract managers and site managers should involve CHSOs.

CHSOs should be an integral part of site management in the following: contributing to project planning, by providing the H&S needs for activities, including hazard identification and risk assessment; attendance of project progress meetings; principal contractor-subcontractor meetings; principal contractor-financial management meetings; and detailed H&S reporting, including the provision of statistics, deviation and incident reports, the cost of accidents, and the cost of H&S.

6. ACKNOWLEDGEMENT

This article was language-edited by a freelance language editor, Anthony Sparg. He has edited several academic journal articles and master's theses in the field of construction management. He has an MA *cum laude* in African Languages (isiXhosa), an MA *cum laude* in Linguistics, and a Higher Diploma in Education.

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CAUSES OF COLLUSION AMONG PEOPLE IN CONSTRUCTION

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ABSTRACT

Collusion is an unethical and disreputable agreement among parties of similar interests, with the intention of achieving a goal through immoral and dishonest means. Proper ethical procurement practice in the construction industry will enable the Construction Industry Development Board (cidb) to achieve their mandate, which is to promote uniformity in construction procurement, efficient and effective infrastructure delivery, and development of emerging contractors, including transformation. It will also enable the Competition Commission of South Africa (CCSA) to achieve their mandate, which is fair competition in all industries. With collusion occurring, it will be difficult for the cidb and the CCSA to achieve their mandate. This study examined the influences of this practice among competitors and stakeholders in the construction industry. Various causal factors of collusion among parties were extracted from a review of existing and relevant literature, and they were further evaluated to arrive at the specific ones that are relevant to the construction industry and the selected area of study. Using these factors, closed-ended questionnaires were prepared and administered to construction stakeholders with an adequate level of experience in the construction industry. The number of questionnaires distributed was 50, of which 45 were returned. Five of the questionnaires were not correctly and completely filled out. The distribution method used was self-administration. In addition, purposive sampling was used. The findings from the 40 respondents indicate that the major cause of collusion in the construction industry is greed of various stakeholders that are tasked with the responsibility of managing and monitoring construction contracts and activities, particularly the contractors. Political influence, among other factors, was also identified as a major reason for collusion. Empowering emerging contractors, a well-regulated environment, fair competition, and improving procurement management are the most important solutions that can prevent collusion from occurring. Furthermore, good ethical practice is one of the solutions that professionals should adopt. In view of this, agencies, institutes, and boards concerned with the monitoring and regulation of professionals, contractors, and general construction activities should therefore ensure that appropriate sanctions and punishments are applied for any members found culpable.

Keywords: collusion, construction industry, corruption, project performance, project stakeholders, unethical practice

1. INTRODUCTION

Public and private procurement, particularly high-value and large projects, usually involves opportunities which attract collusive tendering (Organisation for Economic Co-operation and Development (OECD), 2010). There are various forms of collusion, which cartels

mostly practice, namely price fixing, bid rigging, and market allocation or division. Price fixing is when two or more competitors agree on increasing prices or restoring or otherwise keeping prices where their services are being sold. It is not necessary for horizontal competitors to conspire to charge similar prices (OECD, 2008). Price fixing has many forms. Any arrangement between competitors that aims to restrict competition is prohibited by competition law (OECD, 2008).

In the bid rigging form of collusion, contractors conspire to raise prices. This occurs in both the public and the private sectors. Analysis of private and public tenders where bid rigging has occurred indicates that the company that won the tender was close to the maximum project value that the procuring entity was willing to pay (Ilango, 2014). In other words, competitors agree in advance who should win a certain tender. In price fixing, by contrast, not all competitors participate in the conspiracy. In this form of collusion, competitors drive markets among themselves. Competing companies will allocate themselves to specific clients or a type of clients, territories or products. For example, they will choose one competitor to bid on contracts led by particular clients or a type of clients. Thus, they will not be allowed to bid on a contract without appropriate prior allocation (OECD, 2008). Furthermore, the companies also agree to bid to only certain geographic areas, but to hide the conspiracy, they will intentionally bid a higher price to clients in geographic areas not allocated to (CUTS, 2008).

Several investigations by a competition tribunal, the National Prosecuting Agency (NPA), and other authorities have shown widespread use of cartels and corruption within the South African construction industry (Hekima Advisory, 2014). This study examined the causes of collusion among stakeholders in the construction industry, with a view to suggesting appropriate measures for eliminating or reducing collusion in the industry.

2. A REVIEW OF THE CAUSES OF COLLUSION

Causes of collusion are the factors that motivate collusion to take place. Dorée (2004) asserts that the main factor responsible for collusion is contractor greed. An investigation by Khumalo et al. (2010) revealed that the practice of collusion has become standard business practice. A number of factors have been suggested by market participants on why they engage in collusive tendering. These include the fact that the time given to compile tender documents is not sufficient, construction companies do not have sufficient resources to complete the construction works, or they engage in collusion just to be known by clients for future projects.

Zarkada-Fraser and Skitmore (2000) suggest that collusive tendering and corrupt practices are committed by an informed professional, a person with a particular attitude and characteristics and a sense of right and wrong, but who has a set of personal and organisational objectives to meet. Public officials frequently use public powers for their own benefit, for instance allowing bribes from contractors in exchange for granting tenders (OECD, 2010). Ayodele et al. (2011) explain that corruption is when one uses one's powers to be dishonest, to perform illegal practices, or to act immorally Unethical practice in any industry, including the construction industry, is labelled violation of the Competition Act and the Construction Industry Development Board (cidb) rules and regulations.

Collusion arises from a poor regulatory environment, procurement management, and the way firms behave (Hekima Advisory, 2014). Ratshisusu (2014) contends that competition

among horizontal competitors, procurement practices that are transparent, and oversight that is effective is vital for the construction industry. Ayodele et al. (2011) explain the causes of corruption in their study of corruption in the construction industry. Their study highlights that poverty and politics in the awarding of contracts, or "Godfatherism", are the main causes of corruption in the construction industry.

The OECD (2012) has recognised that a transparent and anti-competitive public is vital to ensure that services and goods that are being delivered by the government offer value for money. However, according to the OECD (2012), procurement systems by the government can be stymied by bid rigging and other collusion practices. In view of this, this section examines various causes of collusion among stakeholders in the construction industry.

2.1 The regulation factor

Regulation is an important tool in any field of work, or industry, for that matter. Several investigations have provided literature on the effects of regulations, particularly regarding competition in markets (OECD, 2014). In South Africa, there are certain laws that have been passed to promote fair and competitive markets and eliminate unethical behaviours, with the aim of promoting growth and development in all industries. The cidb is empowered to regulate the construction industry in South Africa, through registering contractors and regulating by means of a set of regulation requirements. Companies must follow certain regulatory requirements, particular with regard to registering of contractors. These regulations by the cidb include grading of contractors, which is a critical tool to have, as it ensures that contractors in the industry have the minimum requirements to undertake any project.

However, Ratshisusu (2014) argued that the cidb system for grading contractors has two main deficiencies. Firstly, adequate information is not provided to clients. This information includes the ability and the capacity of contractors to undertake the construction works. Furthermore, if this information is provided to the client, it could help the client to establish whether the contractor is fit to undertake the works, based on the grading. This information can be made available by the cidb.

2.2 The company factor

Companies have a pivotal role to play in ensuring a culture of competition in the construction industry. In essence, there should be a culture of competition amongst companies, rather than a culture of cooperation through collusive tendering. According to Ratshisusu (2014), a culture of bid rigging has existed for some time in the South African construction industry, where only the top-tier companies participate. An investigation by Khumalo et al. (2010) revealed that the practice of collusion has become standard business practice, which South African companies have adopted. In this regard, Ratshisusu (2014:602) points out that the top-tier construction companies engage in collusive tendering so as to harm the clients, but also to prevent participation of new contractors. Munshi (2013) states that emerging companies believe that collusion has robbed them of opportunities to grow, and that these companies feel that they have the right to compensation. Ratshisusu (2014) contends that if bid rigging had not occurred among the top-tier companies, new companies could have emerged by now.

For instance, projects that involve the construction of residential properties, civil works, such as roads, and building works, such as convention centres, would have been a great

opportunity for small to medium construction companies to gain the experience needed to acquire the cidb higher grading. Take the Netherlands, for example, where companies have been in collusive tendering, with the aim of excluding emerging companies (Dorée, 2004). Ratshisusu (2014) suggests that collusive tendering cases in South Africa should be prosecuted thoroughly, so as to obtain better insights into the methods that should be used to destroy the culture of collusion. Furthermore, it is necessary to change the manner in which companies compete for projects, as a way of eradicating collusive tendering. Most emerging companies do not engage in collusive tendering, as they mainly rely on subcontractor works (Ratshisusu, 2014). Furthermore, almost all companies that have the capacity and the ability to deliver large infrastructure projects, according to Hekima Advisory (2014), tend to engage in collusive tendering, rather than competing with emerging contractors.

Regardless of the cidb Act of 2000, with the objective of encouraging the participation of emerging contractors in the construction sector, it was expected that the growth of emerging contractors would increase dramatically, to such an extent that they would compete against the top-tier companies. However, in reality, only the top-tier companies are able to obtain tenders for large infrastructure projects (Ratshisusu, 2014). Munshi (2013) argued that large construction companies are lacking transformation and skills transfer, and that they tend not to empower emerging construction companies. With regard to the above-mentioned issues, the cidb has put programmes in place, particularly for emerging contractors, on how to grow their companies in the industry. The programmes focus mainly on fostering an entrepreneurial culture (Ratshisusu, 2014).

2.3 The procurement factor

The process of procurement firstly starts with identifying a certain project. If it is a government project, then the budget for that project is drafted. It is then the government's responsibility to deliver the project. According to Dorée (2004), the government used to deliver public construction projects on its own, i.e. the professionals employed by the government would design, plan and construct the work without consulting external services. However, developing countries, including South Africa, have copied higher-income national systems of separating key functions. Thus, responsibilities are divided among a larger number of people, who essentially perform complementary activities. According to Sohail and Cavill (2008), these participants must comply with different control mechanisms, the purpose of which is to ensure accountability.

However, Ratshisusu (2014) argued that once two or more parties engage in collusion, or agreements, it is easy for them to break the rules. As a result, an environment is created where control mechanisms need to be strengthened. The concern of Van de Rijt et al. (2010) is the reason for frequent breakdowns of control mechanisms. Sohail and Cavill (2008) stated that the problem arises from separating functions, which creates the opportunity for breakdowns, because mechanisms for controlling are separated at each stage of the procurement process (i.e. planning, design, and construction). Furthermore, functions are sequential, i.e. one stage has to be completed before the next stage can start. However, in practice, functions overlap, and there is interdependence among the participants at different stages.

The type of procurement procedure plays a role for collusion to take place. According to Van de Rijt et al. (2010), the Dutch Parliamentary Committee (DPC), in reaction to collusion in 2002, proposed a tougher public sector procurement procedure as a strategy to combat corruption. This clearly shows that procurement procedures are prone to collusion.

According to the City of Cape Town and the South African National Roads Agency Ltd (SANRAL), the manner in which the government has planned large infrastructure projects has been prone to collusive tendering. When the CCSA was conducting an investigation into collusive tendering between 2006 and 2009, the government had already begun with large construction projects for roads, FIFA World Cup stadia upgrades, and Eskom power stations (Hekima Advisory, 2014). Furthermore, for road construction, SANRAL separated some parts of the work into packages, and then invited certain companies to participate in tendering. Ratshisusu (2014) explains that at the time there were contractors that were already capable of undertaking large infrastructure projects, so basically it was their chance to grow and gain experience.

Ratshisusu (2014) put forward the idea that large infrastructure projects, such as Eskom power stations and World Cup stadia upgrades, were prioritised by large companies, as there was an opportunity to make money. This clearly shows that the procurement procedure that the government uses for large infrastructure projects fosters collusion by companies (Ratshisusu, 2014).

Ratshisusu (2014) states that the government has poor capability to undertake or manage large infrastructure procurement, and that it is prone to collusive tendering. Furthermore, it has been said that the government lacks the required skills to procure for large infrastructure projects, such that they end up consulting external services which have the capacity to manage such projects. Hekima Advisory (2014) put forward the idea that the main cause of bid rigging is that management of the procurement process is being done by external consultants.

The manner in which the government awards projects contributes to collusive tendering. Usually projects are awarded to the lowest qualifying bid, which makes it easy for companies to decide that the winning bid should be low. It is vital to change the manner in which contracts are awarded. It was found by Ratshisusu (2014) that this principle of awarding the lowest bid always leads to the winner's curse, because certain companies will price low, with the intention of winning the bid, but with no capacity to deliver such work.

The awarding of contracts on the basis of the lowest qualifying bidder on bids that are sealed depends on a certain number of key assumptions, such as that the design is completed before tender. The consequences of this assumption would be that if the designs are incomplete, this means that there might be changes in the post-contract stage, which gives contractors a chance to negotiate for variations and ridiculous claims (Sohail and Cavill, 2008). In addition, the main reason the system of awarding contracts to the lowest bidder is prone to collusive tendering is that all aspects of the project are already finalised and detailed in the tender document.

According to Ratshisusu (2014), concerns have been expressed on the role of consulting firms when managing the procurement process, particularly in the private sector. As there is no express requirement for a public procurement process in private sector projects, the consulting companies are often provided the latitude to identify and recommend a suitable

contractor for a project. According to Sohail and Cavill (2008), the main concern is that consulting firms appoint contractors based on favouritism, and they tend to accept their participation in the tender process even if they don't have the capacity to undertake the work. Therefore, Ratshisusu (2014) put forward the idea that if a contractor does not have the capacity to undertake the work yet still participates in the tender process, the contractor will end up colluding, as they know whom they are competing against.

Khumalo et al. (2010) provide a number of similar reasons why tenders engage in collusion, or cover pricing, namely the short period for preparing tender documents, the cost of bidding, and avoiding offending customers by not tendering. Several findings by Dlamini (2010) describe that there are changes in the business cycle. Throughout the period of recession, or the downturn in the economy, collusive tendering, cover pricing, and bid rigging may be used as a means of distributing the available work so as to prevent financial disaster for those who are participating in the market. However, the findings by Dorée (2004) also highlighted that those who are participating in the market do not consider collusive tendering a violation of the law or a criminal offence. Also, it has been argued that competition law is not breached when a phony high bid is put in during the bidding process. However, Khumalo et al. (2010) state that any interaction between horizontal competitors with the aim of reaching an agreement through collusion is a violation of competition law. In addition, according to the OECD (2009), any joint decision with the aim of supressing other competitors is indeed a wrong practice as defined in the act.

The summary below highlights the factors that cause collusion. Khumalo et al. (2010) suggest that greed is the main factor. Sohail and Cavill (2008) suggest that political influence is one of the factors that cause collusion. Zarkada and Skitmore (2000) argue that poor ethics and corporate governance is a cause of collusion. Another cause of collusion, according to Ratshisusu (2014), is the size of the project. The OECD (2010) argues that most large construction projects are prone to corruption. Ratshisusu (2014) suggests that a poor regulatory environment is one of the main causes for companies to engage in collusive practices. Furthermore, it has been found that awarding tenders based on favouritism is also a main cause of collusion (Sohail and Cavill, 2008). The other cause of collusion is poor procurement management (Van de Rijt et al., 2010).

According to Sohail and Cavill (2008), the number of contractual links has an impact. The more contractual links, the more procurement systems are manipulated. Khumalo et al. (2010) suggest that entrenched interest is one of the causes of collusion. Ratshisusu (2014) suggests that the inconsistency of anti-corruption policies is another factor that causes collusion among people. Ray et al. (1999) argue that the period given to compile tender documents should be sufficient. Furthermore, good oversight and supervision of procurement procedures is vital (Sohail and Cavill, 2008). In addition to procurement procedures, Hekima Advisory (2014) suggests that too many stages in the procurement procedure can cause collusion. Sohail and Cavill (2008) urge that separation of key functions is also a cause of collusion. According to Ayodele et al. (2011), poverty is also one the factors that cause collusion and corruption among people.

3. METHODOLOGY

To examine the causes of collusion in the South African construction industry, a survey design was adopted, with the intention of obtaining information from individuals and

experts in the area of study. Using a quantitative approach, questionnaires were administered to construction professionals practising within construction, consulting and government establishments within the Gauteng region of South Africa. These included quantity surveyors, architects, construction managers, project managers, and engineers. The number of questionnaire distributed was 50, and 45 were returned, of which 5 were not correctly and completely filled out. The distribution method used was self-administration. Purposive sampling was used. A minimum of five years' experience was used as a basis for the choice of respondents. This was to ensure that the respondents possessed a minimum level of knowledge of the industry, by virtue of their practice and involvement in construction processes and activities.

The questionnaire was prepared to evaluate the perceptions of professionals regarding the causes of collusion, and it gave respondents the opportunity to rank the identified causes. The questionnaire was divided into two sections, where the first section solicited general and background information from the respondents, while the second section focused essentially on the causes of collusion in the construction industry. A cover page was also provided, which consisted of a cover letter providing a description of the lead researcher and the institution with which he is affiliated. The cover letter sought permission from the respondents to participate in the survey, and it also explained the main purpose of the study.

To rate the causes of collusion in the construction industry, a rating scale with five points was adopted. The adopted five-point scale was as follows: 1 = strongly disagree (SD); 2 = disagree (D); 3 = neutral (N); 4 = agree (A); and 5 = strongly agree (SA). The five-point scale was transformed to a mean item score for each aspect, so as to rank the factors. The ranking helped to identify the relative importance of each variable as recognised by the respondents. The calculation of the relative mean item score (MIS) was determined from the total of all weighted respondents and then related to the total response on a particular aspect. This was based on the principle that respondents' scores on all the selected criteria, considered together, are indices of agreement with the causes of collusion. The mean item score (MIS) was calculated using the formula

$$MIS = \frac{1n1 + 2n2 + 3n3 + 4n4 + 5n5}{\Sigma N}$$

where

n1 = number of respondents for factor 1,

n2 = number of respondents for factor 2,

n3 = number of respondents for factor 3,

n4 = number of respondents for factor 4,

n5 = number of respondents for factor 5,

and N = total number of respondents.

After analytical calculation and computation of the standard deviation (SD), the variables were then ranked in descending order of their mean item score, from highest to lowest.

4. FINDINGS AND DISCUSSION

From the received 45 questionnaires, 40 were completely filled out, and they were analysed accordingly. Figure 1 reveals the findings related to construction projects that frequently experience collusion. The respondents perceived that 17.4% of construction projects that experience collusion are road construction projects, followed by shopping mall projects (15.1%), building renovation projects (12.8%), stadia projects (12.8%), hospital projects (11.6%), public office projects (11.6%), railway construction projects (7.0%), and housing estate projects (7.0%).

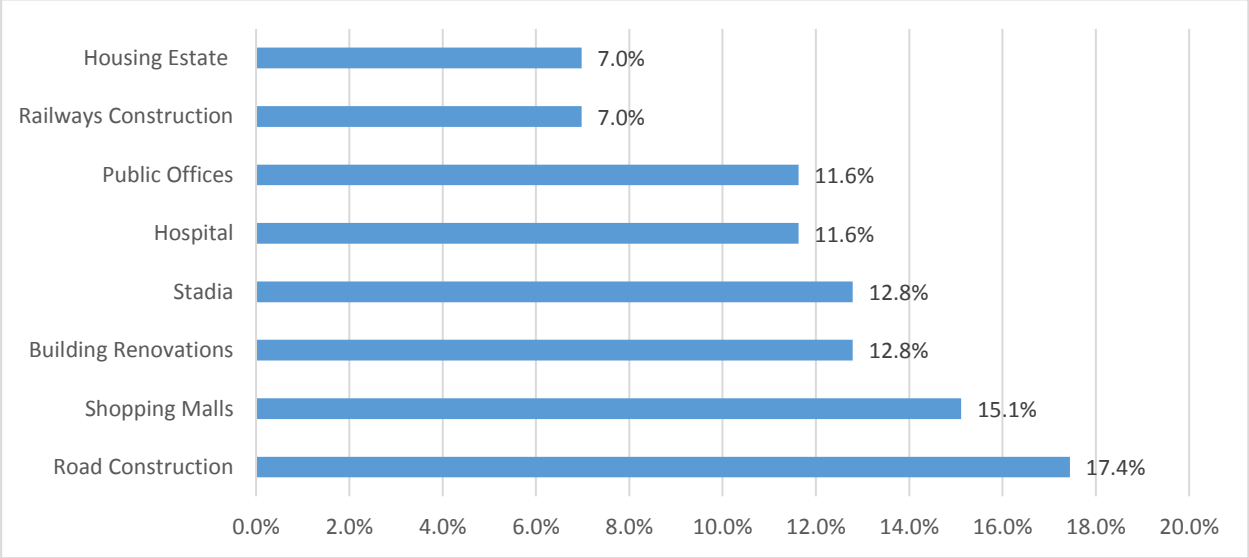

Figure 1: Construction projects that frequently experience collusion

Table 1 reveals the respondents ranking of the factors causing collusion in the construction industry. The Cronbach's alpha value for this section is 0.813, indicating a good level of reliability of the data. According to the ranking (R) using the calculated mean item score (MIS) and the standard deviation (SD), it was observed that the most common factors were the following: contractor greed was ranked first, with an MIS of 4.12 and an SD of 0.980; political influence, with an MIS of 4.00 and an SD of 1.204, was the second-most common factor; poor ethics and corporate governance was ranked third, with an MIS of 3.98 and an SD of 0.987; size of the project was ranked fourth, with an MIS of 3.90 and an SD of 0.944; poor regulatory environment, with an MIS of 3.76 and an SD of 0.969, was the fifth-most common factor; favouritism in awarding contracts was ranked sixth, with an MIS of 3.71 and an SD of 1.146; ignorance of clients was ranked seventh, with an MIS of 3.63 and an SD of 1.090; poor procurement management was ranked eighth, with an MIS of 3.61 and an SD of 1.022; high number of contractual links was ranked ninth, with an MIS of 3.59 and an SD of 1.048; entrenched interests was ranked tenth, with an MIS of 3.56 and an SD of 0.950; inconsistency of anti-corruption policies was ranked eleventh, with an MIS of 3.56 and an SD of 1.097; period given to prepare tender documents, with an MIS of 3.49 and an SD of 1.287, was the twelfth-most common factor.

Table 1: The causes of collusion in the construction industry

Factor	MIS	SD	Ranking
Contractor greed	4.12	0.980	1
Political influence	4.00	1.204	2
Poor ethics and corporate governance	3.98	0.987	3
Size of the project	3.90	0.944	4
Poor regulatory environment	3.76	0.969	5
Favouritism in awarding contracts	3.71	1.146	6
Ignorance of clients	3.63	1.090	7
Poor procurement management	3.61	1.022	8
High number of contractual links	3.59	1.048	9
Entrenched interests	3.56	0.950	10
Inconsistency of anti-corruption policies	3.56	1.097	11
Period given to prepare tender documents	3.49	1.287	12
Poor oversight and supervision	3.41	1.072	13
Too many stages in procurement procedure	3.29	1.031	14
Separation of key functions	3.05	0.921	15
Incomplete designs	3.00	1.025	16
Poverty	3.00	1.342	17

Other causes of collusion included poor oversight and supervision, with an MIS of 3.41 and an SD of 1.072, too many stages in the procurement procedure, with an MIS of 3.29 and an SD of 1.031, separation of key functions, with an MIS of 3.05 and an SD of 0.921; incomplete designs, with an MIS of 3.00 and an SD of 1.025, and poverty, with an MIS of 3.00 and an SD of 1.342.

The findings of this study are similar to the findings of Dorée and Kashiwagi (2015), where contractor greed was revealed to be the main factor that causes collusion. Sohail and Cavill (2008) suggested that political influence is also a main factor that causes collusion. A study by Ratshisusu (2014) revealed that poor procurement management is one of the main factors that cause collusion, which was confirmed by the findings of this study. Zarkada-Fraser and Skitmore's (2000) study suggested that collusive tendering is a decision made by an individual, which confirms the finding of this study that poor ethics and corporate governance is one of the factors that cause collusion. However, the findings are inconsistent with those of Sohail and Cavill's (2008) study, where incomplete designs was highlighted as a major factor causing collusion.

5. CONCLUSION

The objective of this study was to determine the factors that cause collusion in the construction industry. The reviewed literature revealed that the main causes of collusion include such factors as contractor greed, ignorance of clients, poor ethics and corporate governance, a poor regulatory environment, poor oversight and supervision, poor procurement management, separation of key functions, favouritism in awarding contracts, too many stages in the procurement procedure, incomplete designs, a high number of contractual links, political influence, poverty, size of the project, entrenched interests, inconsistency of anti-corruption policies, and period given to prepare tender documents.

The findings obtained from the analysis of the questionnaires administered to construction professionals revealed that contractor greed, political influence, poor procurement management, poor ethics and corporate governance, size of the project, poverty, favouritism in awarding contracts, a poor regulatory environment, inconsistency of anti-corruption policies, entrenched interests, and period given to prepare tender documents were the top causes of collusion among people in the construction industry. Empowering emerging contractors, a well-regulated environment, fair competition, and improving procurement management are the most important solutions that can prevent collusion from occurring. Furthermore, good ethical practice is one of the solutions that professionals should adopt.

Collusion in the construction industry will not only affect the performance of construction projects, but will also result in a bad reputation for stakeholders in the industry, particularly consultants and contractors. Therefore, to eliminate or reduce the occurrence of collusion, there is a need to empower emerging contractors, maintain a well-regulated environment, ensure fair competition among bidders, and improve procurement management techniques and procedures. Furthermore, stakeholders in the industry, particularly construction professionals tasked with the responsibility of regulating, maintaining and controlling construction processes and activities, need to maintain good ethical practice in dealing with other internal and external members of the industry.

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HOW THE ECONOMIC CRISIS AFFECTS WORKPLACE CONDITIONS AND OCCUPATIONAL HEALTH

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ABSTRACT

The article analyses the influence of business premises and workplace design factors on employees' satisfaction with the workplace, and the influence of satisfaction of employees on the overall health of employees. The purpose of the research is, firstly, to assess the influence of business premises, and, secondly, to facilitate improvement of employee health, through application of base parameters, and subsequent adequate changes to the workplace and work processes. The quantitative research was carried out in Slovenia in 2012 among 1,038 employees from the service sector. The results were statistically analysed using factor analysis and applied structural equation modelling. The results show that business premises factors of the workplace have an impact on the satisfaction of employees, and consequently on their health. With the aid of factor analysis and structural equation modelling, significant links with the following factors were established: orthopaedic problems, past health problems, cardiovascular problems, and state of health. The research covers a need that is becoming more important, as the focus on health and well-being issues is increasing. Implementing aspects of better workplace conditions introduces a better base of value for employees and employers.

Keywords: satisfaction of employees, overall health, Slovenia, workplace

1. INTRODUCTION

Employees spend a large part of their lives at work, and, as a result, the workplace typically influences their health. Employees encounter working condition problems related to environmental and physical factors in many organisations around the world (Pizam and Thornburg, 2000). Research on workplace health promotion, friendly workplaces, healthy organisations, job stress, high-performance workplaces, strategic human resources management, and leadership styles confirms the importance of supporting employees to be effective in their jobs in ways that promote their health (Lippel et al., 2011; Vischer, 2008; Shain and Kramer, 2004). Work-related injuries and diseases represent serious and costly burdens to all countries and are a major challenge to managers, unions, governments, and the workers themselves. Common health problems, such as spinal pain, diseases, allergies, respiratory problems, physical limitations, and mental illness, emerge at some point during a worker's life (Ford et al., 2014). Many of the health problems of the workforce can be attributed to worsening public health, with poor diets, growing obesity, smoking, and more

sedentary lifestyles all playing their part, and some problems can be attributed to working conditions and workplace stress (Ford et al., 2011; Quinlan et al., 2010). From a systematic review and meta-analysis, it is evident that job insecurity is associated with incident coronary heart disease (Virtanen et al., 2013). Virtanen et al. (2013) also found that depression could contribute to job insecurity coronary heart disease. Today, employee health is becoming a hard economic factor of production. Government agencies, businesses, and economists argue that workplace health and well-being ought to guide research and development, investment in technology, and customer relationship management. The issue affects not only the community in which the workplace is located, but also how the organisation is managed (Stone et al., 2013). Boustras (2015) stressed that despite the importance of legislation and existing enforcement authorities, safety in the workplaces of SMEs in times of financial crisis becomes a secondary issue.

The negative impact of the financial crisis on Spanish employees' perceived level of work flexibility, autonomy, and stress is evident from work-life balance impairment (Gregory et al., 2013). The financial crisis in Greece had a number of effects on the workplace (Boustras, 2015), such as job insecurity and work intensity, an increase in temporary uninsured work, violence and harassment, and absenteeism and presenteeism due to occupational stress. The economic downturn in Japan caused a prolonged increase in suicide mortality for Japanese working-age males in management (Wada and Gilmour, 2016). The long economic crisis in Slovenia poses an additional risk factor for mental health problems, which clinicians should internalise and monitor using screening tests. Symptoms of depression and anxiety can be masked in high utilisers of medical care in terms of physical complaints, reported injuries sustained at work or on the way to work, or psychoactive drug use (Avčin et al., 2011). In Slovenia, because of the recession, stress, depression, and suicidal emotions are increasing (Margan and Dodič-Fikfak, 2015). This creates new pathology – health problems are connected with the reality of getting and keeping a job, health indicators show that psychological problems are growing, the consequences of stress are stronger, and the rate of absenteeism and presenteeism among employees is higher. The current research provides an analysis of specific elements of the work environment and behavioural habits of employees in their jobs, with the aim of discovering the characteristics of the workplace that have the greatest effect on the individual.

1.1 Job satisfaction and occupational health

Two acclaimed theories of workplace stress identify the following stressors as key factors in the onset of stress-related illness. First, the demand-control-support model predicts that high levels of job demands, low levels of job control, and low levels of social support are strongly associated with negative health outcomes (Van der Doef et al., 2000). The second popular model, the effort-reward imbalance model, predicts that high levels of extrinsic or intrinsic effort and low levels of reward will significantly predict negative health outcomes. These two models are found to be good predictors of physical and psychological health outcomes, including heart disease, mortality, and depression, in many occupational groups (Mark and Smith, 2012; Kinman and Court, 2010). Factors such as high levels of workload and job demands, low peer support, and poor working relationships in populations would certainly suggest that these populations may be at high risk for stress-related illness. When

high levels of workload are present in a job, a person's basic needs for personal growth and performance must be met in one way or another (Herzberg et al., 2011). Job satisfaction is also considered to result from a set of factors characterising the context in which work is performed. Such factors are typically called company policies and administrative practices. The main such factors are technical quality of supervision, interpersonal relations, particularly with supervisors, physical working conditions, job security, benefits, and salary (Maamari and Smith, 2012; Herzberg et al., 2011). By contrast, dissatisfaction in a job may be caused by environmental factors, such as poor lighting, poor ventilation, poor working conditions, low salaries, and poor supervisory relationships. These are considered to be basic needs, and, for that matter, are the responsibility of the respective society, businesses and industrial institutions, which are expected to provide for their employees, so that they can self-actualise (Salaj et al., 2015; Herzberg et al., 2011; Kalleberg, 2011). Employees tend to reflect the wellness of their workplace environment through their well-being (Ljungblad et al., 2014). From the workplace perspective, happiness is connected with well-being, and it is about employees' physical health, psychological health, physical safety and wealth (Andrew, 2011). Poor management of the occupational health condition can lead to work-related illnesses (Arnetz et al., 2011). Arnetz et al. (2011) recommend interventions that target both the traditional psychosocial environment and the organisation's efficiency, in order to decrease employee stress and enhance mental well-being. Although convenient workplace conditions are requirements for improving productivity and quality of outcomes, working conditions in many organisations may present a lack of safety, as well as health and comfort issues, such as improper lighting and ventilation, excessive noise, and lack of emergency access (Kalleberg, 2011). Pech and Slade (2006) identify an increase in so-called employee disengagement. They focus on symptoms of disengagement, such as distractions, lack of interest, poor decision-making, and high absenteeism, rather than the root causes of disengagement. The working environment is probably a key root factor causing employee engagement or disengagement (McTernan et al., 2013). In recent years, employee comfort on the job, as determined by workplace conditions and the environment, has been recognised as an important factor for measuring employee productivity (Johns, 2010). The greatest challenge is that this model requires employees and managers to think about the workplace far more holistically (Gilbreath, 2012; Chu et al., 2000).

The broader research is devoted to an analysis of specific elements of the work environment and the behavioural habits of employees in their jobs, with the aim of discovering the characteristics of the workplace that have the greatest effect on the individual. The objective of this study is to use the discovered parameters and consequent changes in the work environment and work processes to ensure a sustainable effect on the improvement of employees' health.

The basis of this research is three fundamental hypotheses, within which we specify the sub-hypotheses:

- *Hypothesis 1:* Business premises and workplace factors have a significant impact on the satisfaction of employees with the workplace.
- *Hypothesis 2:* Workplace design factors have a significant impact on the satisfaction of employees with the workplace.
- *Hypothesis 3:* Satisfaction of employees with their workplace has a significant impact on the health of employees.

2. METHODS

The researchers carried out quantitative research using an array of questions, scales, and differentials, where most of the instruments were specially constructed with suitable measurement characteristics. The questionnaire demonstrated a high level of internal consistency, as measured by the Cronbach's alpha coefficient. The questionnaire consisted of 160 variables divided into eight content sections: general questions, business premises and workplace, workplace design, habits, conditions in the workplace, organisational culture, state of health, and mental health condition. One section of the questionnaire includes questions with pre-set parameters to choose from, and the other section includes three- or five-point Likert-scale items. For collection of data, the researchers designed an online anonymous survey questionnaire. The fundamental objective of the questionnaire was to investigate the relationships among the selected factors of workplace, organisational culture, and the physical and mental health condition of employees. One-thousand-and-thirty-eight employees from Slovenia, from organisations within the service sector, responded, which equates to a 98% response rate. All respondents performed only office tasks and participated voluntarily, with assurances given that their anonymity would be maintained. The data were processed with the SPSS statistical software, and they were subjected to factor analysis and structured equation modelling (SEM). The collected data were first processed with exploratory factor analysis, which was used to investigate the number of factors required for the presentation of specific information. This was followed by confirmatory factor analysis, which was used to test the quality of the metrics and the structural parts of the model. Confirmatory factor analysis was also used to test the hypotheses and the links and/or structure in the exploratory factor analysis of specific factors. In the last stage, the SEM method was applied, in order to overcome the restrictions of multivariant techniques and to achieve a statistically efficient and transparent assessment of relationships when dealing with several mutual relationships at the same time.

3. RESULTS

In the theoretical model of the researched influences, we included the construct "the workplace", which includes the questionnaire sections "business premises and workplace", "workplace design" and "conditions of workplace", and which comprised 60 variables. The "state of health" section of the questionnaire comprised 31 variables.

3.1 The "business premises and workplace" section

The "business premises and workplace" section of the questionnaire comprised 20 questions or statements regarding the description of the building (building and workplace location, accessibility and use of public transport, parking possibility, age of building, building construction characteristics, and renovation and maintenance information) and workplace specifications (workplace location, type of office, location of the superior's office, and cleaning information). Table 1 shows the connections of the 11 variables (or questions) of the "business premises and workplace" section with the following factors (or components): state of workplace, orientation of workplace, and state of business premises.

Table 1: The "business premises and workplace" section's rotated component matrix[a]

	Component		
	1	2	3
The distance of the window closest to my workplace is (less than 1 m...more than 4 m)	.838		
The distance of the outer wall from my workplace is (less than 1 m...more than 4 m)	.777		
My workplace is (in the basement/on the ground floor/other)	–.545		
The floor of the room where I work is clad with (wood/textiles/plastic/stone/other)	.505		
My workplace is in an office (cell room/open-plan office/other)	.454		
The orientation of my workplace has a large share of windows and walls		.972	
The orientation of the closest window surface is (north-facing/south-facing/other)		.971	
The room where I work was last thoroughly refurbished (building/heating/ventilation/other)			.705
The age of the building where I work is (less than 5 years...older than 30 years/don't know)			.700
The room where I work is regularly maintained (once a year... once every four years)			.609
The construction of the building where I work is (reinforced concrete/wooden/other)			.571

Extraction method: principal component analysis. Rotation method: varimax with Kaiser normalisation.

[a] Rotation converged in four iterations.

We confirmed the suitability of the data for factor analysis and correlations in the correlation matrix with the Bartlett test (p=0.000). The results of the KMO test (0.561) showed that the connections and the suitability of the variables are adequate.

Through the application of factor analysis, and based on the Kaiser criterion, we selected a solution with three factors, which explains 51.79% of the total variance. Upon completion of the rotation, we used the first factor of the section to explain 18.93% of the total variance, the second factor to explain 17.32% of the total variance, and the third factor to explain 15.54% of the total variance. The first factor, "state of workplace", includes five variables: "the distance of the window", "the distance of the outer wall", "the location of my workplace", "floor furnishing", and "kind of workplace". The second factor, "orientation of workplace", includes two variables: "sky orientation of the windows and walls", and "sky orientation of the window closest to my desk". The third factor, "state of business premises", includes four variables: "refurbishment of the room", "age of the building", "regular maintenance", and "construction type".

3.2 The "workplace design" section

This section, headed "The concept of my workplace" in the questionnaire, included 10 questions/statements on the possibility of controlling devices in the workplace. The Bartlett

test (p=0.001) confirmed the suitability of the data for factor analysis, while the result of the KMO test (0.655) indicates adequate connections and suitability of the variables.

Table 2: The "workplace design" section's rotated component matrix[a]

	Component	
	1	2
The windows are furnished with blinds	.750	
The window blinds are controlled from the workplace	.744	
The workplace is at least part of the day directly sunlit	.670	
The windows can be opened	.656	
The room is ventilated by a central ventilation system		.790
The intensity of the ventilation can be set with a switch in the room		.763
The room is cooled/heated with an air conditioner		.599

Extraction method: principal component analysis. Rotation method: varimax with Kaiser normalisation.

[a] Rotation converged in three iterations.

We specified two factors for the "workplace design" section, which together explain 53.03% of the total variance. After rotation, the first factor explains 29.57% of the total variance, and the second factor explains 23.46% of the total variance (see Table 2).

The first extracted factor was named "illumination of workplace", and it includes four variables: "windows with blinds", "local regulation of blinds", "direct sunshine", and "windows can be opened". The second factor was named "heating/cooling of workplace", and it includes three variables: "central ventilation system", "local regulation of ventilation system", and "air conditioning".

3.3 The "condition of workplace" section

The "condition of workplace" section included 30 questions and/or statements relating to evaluation of the level of satisfaction with different characteristics of the place, for example indoor quality characteristics, ICT equipment, condition of the furniture, cleaning and maintenance characteristics, possible facility characteristics as reasons for changing job, and overall satisfaction characteristics. The suitability of the data for factor analysis was confirmed with the Bartlett test (p=0.001), while the result of the KMO test (0.893) shows a high level of connection and suitability of the variables for examination. We specified three factors for the "condition of workplace" section, which together explain 59.21% of the total variance (see Table 3). After rotation, 15 variables were represented in three components.

The first factor explains 40.17% of the total variance, the second one explains 10.10%, and the third one explains 8.93%. The first factor, "satisfaction with the workplace", includes nine variables: "satisfaction with the conditions", "pleasant workplace", "feeling good", "satisfaction with business premises", "satisfaction with furniture and facilities", "evaluation of cleanliness", "evaluation of hygiene standards", "satisfaction with ventilation", and "desire to change jobs". The factor "climatic characteristics of the workplace" factor includes three variables: "concentration of humidity", "dry air", "too hot/cold". The third factor, "performance in the workplace", includes three variables:

"concentration problems", "influence of arrangement of workplace on work efficiency", and "work performance".

3.4 The "state of health" section

The "state of health" section of the questionnaire includes 31 questions/statements relating to health. It includes self-evaluation of state of health with regard to the following variables: "being a disabled person/chronic patient"; "having an occupational disease, having pain in the back, spine, neck, or high blood pressure, headaches, rheumatism, problems with blood flow, allergies"; and "being on sick leave/an operation, or other".

Table 3: The "condition of workplace" section's rotated component matrix[a]

	Component		
	1	2	3
I am pleased with the conditions of my workplace	.865		
My workplace is pleasant	.853		
I feel good in my workplace	.844		
The business premises is as new and is pleasant to work in	.782		
The furniture and facilities ensure a pleasant feeling	.688		
The workplaces are clean	.667		
The standards of hygiene in the business premises are high	.651		
Ventilation in my workplace is good	.613		
Due to the conditions in my workplace, I am contemplating a change of employment	–.597		
There is exceptionally high humidity in my workplace		.789	
There is only rarely dry air in my workplace		.734	
My workplace is exceptionally uncomfortably hot/cold		.665	
In my workplace I experience concentration problems to an exceptional degree			.671
The arrangement of my workplace influences my feelings and work efficiency			.622
As a rule, I have no problem with performance in my workplace			.596

Extraction method: principal component analysis. Rotation method: varimax with Kaiser normalisation.

[a] Rotation converged in six iterations.

The typical correlations of the correlation matrix were confirmed by a Bartlett test (p=0.001), while the result of the KMO test (0.774) confirmed the suitability of the variables for examination. The criterion of own value determined three factors of the section. The first factor explains 25.53% of the total variance, the second one explains 14.83%, and the third one explains 10.17% (see Table 4).

The information in 13 of the variables can be represented by three components, as displayed in Table 4. The first extracted factor is named "orthopaedic problems", and it includes four variables: "occasional pain in my back", "occasional pain in my neck", "occasional pain in my spine", and "suffer from rheumatism". The second one is named "past health problems", and it includes four variables: "sick leave", "therapies in health institutions or spas", "physician's help because of troubles at work", and "state of health". The third factor is named "cardiovascular problems", and it includes five variables: "high blood pressure", "regularly taking medicines", "chronic disease", "high blood sugar", and "blood circulation problem".

Table 4: The "state of health" section's rotated component matrix[a]

	Component		
	1	2	3
I have occasional pain in my back (muscle tension)	.877		
I have occasional pain in my neck	.838		
I have occasional pain in my spine	.831		
I suffer from rheumatism	–.383		
In the last year I have been on sick leave because of my own diseases (for 0 days...for more than 15 days)		.732	
In the last three years I have had therapies in health institutions or spas (for less than 7 days...for more than 29 days)		.726	
In the last five years I have sought a physician's help because of troubles at work (never...more than three times)		.596	
In the last 12 months my state of health has (remained the same/improved/deteriorated)		–.429	
I have high blood pressure			.734
Currently I regularly take pills/capsules/drops/salves			–.688
I suffer from a chronic disease			.601
I have high blood sugar			.599
I have a blood circulation problem			.446

Extraction method: principal component analysis. Rotation method: varimax with Kaiser normalisation.

[a] Rotation converged in five iterations.

3.5 Testing of hypotheses

We used confirmatory factor analysis to test the quality of the measurement and the structural parts of the model. In the measurement part, we verified the compatibility of pattern data with the theoretical model. We applied the following suitability indicators: a chi-squared (χ^2) test, RMSEA, CFI, GFI, and SRMR.

Two main analyses are included in the model:

- Business premises and workplace → satisfaction with the workplace → state of health; and
- The workplace design → satisfaction with the workplace → state of health.

Figure 1: The theoretical model

H_1: Business premises and workplace factors have a significant impact on the satisfaction of employees with the workplace.

Through application of factor analysis, and on the basis of the factor weight matrix, we identified the following factors of the "business premises and workplace" section: "state of workplace", "orientation of workplace", and "state of business premises".

H_2: Workplace design factors have a significant impact on the satisfaction of employees with the workplace.

Through application of factor analysis, and on the basis of the factor weight matrix, we identified the following factors of the "workplace design" section: "illumination of workplace", and "heating/cooling of workplace".

For the "condition of workplace" section, based on the factor weight matrix, we identified the following factors: "satisfaction with workplace", "climatic characteristics of the workplace", and "performance in the workplace".

H_3: Satisfaction of employees with their workplace has a significant impact on the health and health care of employees.

Through application of factor analysis, and based on the factor weight matrix, we identified the following factors of the "state of health and health care" section: "orthopaedic problems", "past health problems", and "cardiovascular problems".

Model fit information: $\chi^2 = 5.9$; RMSEA < 0.000; CFI ≈ 1.000; SRMR = 0.010.

Based on the results of the SEM shown in Table 5, we established that "orientation of workplace" has a statistically significant ($p < 0.001$) and a positive ($\beta = 0.106$) impact on "illumination of workplace". "State of workplace" has a statistically significant ($p < 0.001$) and a medium positive ($\beta = 0.521$) impact on "illumination of workplace". "Illumination of workplace" has a statistically significant impact ($p < 0.001$) on "satisfaction of employees with the workplace", with a negative standardised β coefficient (–0.228). The following two factors also have a statistically significant impact ($p < 0.001$) on "satisfaction of employees with the workplace": "state of business premises", with a negative standardised β coefficient (–0.217), and "state of workplace", with a negative standardised β coefficient (–0.165).

Table 5: The achieved values of the SEM final model

Causal path			Path coefficient	p
SATISFACTION WITH THE WORKPLACE	←	STATE OF BUSINESS PREMISES	–.217	***
SATISFACTION WITH THE WORKPLACE	←	STATE OF WORKPLACE	–.165	***
SATISFACTION WITH THE WORKPLACE	←	ORIENTATION OF WORKPLACE	–.033	.250
SATISFACTION WITH THE WORKPLACE	←	ILLUMINATION OF WORKPLACE	–.228	***
SATISFACTION WITH THE WORKPLACE	←	HEATING/COOLING OF WORKPLACE	–.087	.003
CARDIOVASCULAR PROBLEMS	←	SATISFACTION WITH THE WORKPLACE	.085	.009
PAST HEALTH PROBLEMS	←	SATISFACTION WITH THE WORKPLACE	–.166	***
ORTHOPAEDIC PROBLEMS	←	SATISFACTION WITH THE WORKPLACE	–.207	***

***p < 0.001

With β = –0.166, we established a negative link between "satisfaction with workplace" and "past health problems of employees". With β = –0.207, we established a negative link between "satisfaction with workplace" and "orthopaedic problems of employees".
For the case, all three hypotheses are confirmed.

Hypothesis 1: Business premises and workplace factors have a significant impact on the satisfaction of employees with the workplace.

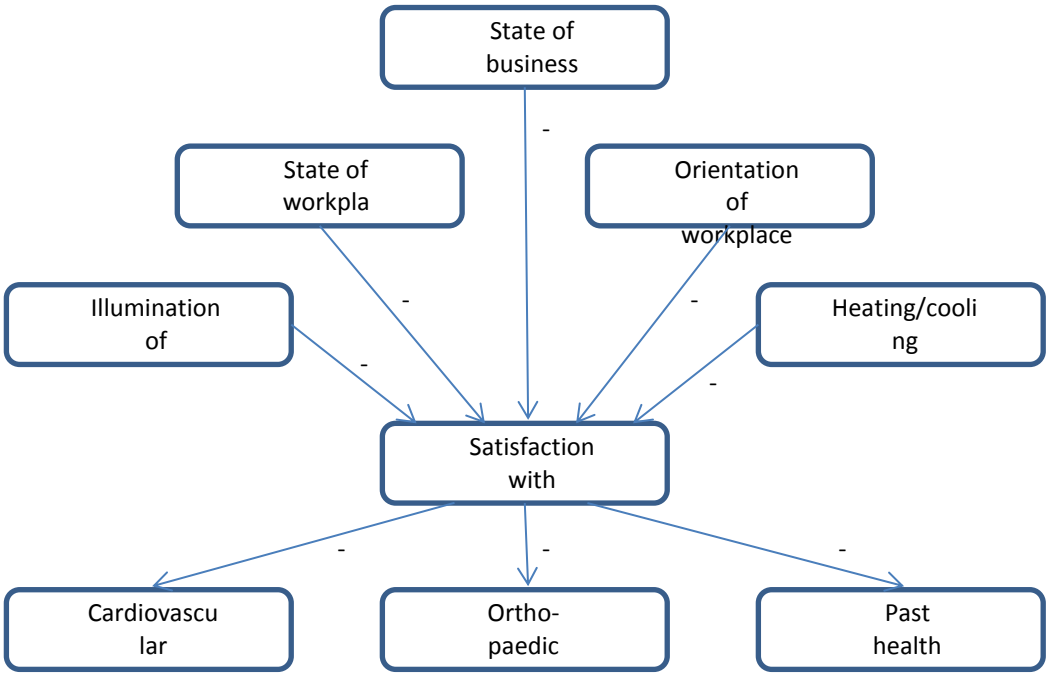

Figure 2: Results of the SEM

Two factors were found to be significantly important: “state of business premises” (refurbishment of the room, age of building, regularly maintained room, building construction), and “state of the workplace” (distance of the closest window, distance of the outer wall, position of the workplace, floor finishing, and office type, i.e. a cell room or an open-plan office).

Hypothesis 2: Workplace design factors have a significant impact on the satisfaction of employees with the workplace.

The factor “illumination of workplace” (windows with blinds, window blinds are locally controlled, direct sunshine by day, windows can be opened) was found to be the one with a significant influence.

Hypothesis 3: Satisfaction of employees with their workplace has a significant impact on the health and health care of employees.

The factor “satisfaction with the workplace” is characterised by nine items: “pleased with the conditions”, “pleasant workplace”, “feeling good”, “state of business premises”, “state of furniture”, “cleanliness”, “hygiene standards”, “ventilation”, and “changing jobs”. The links between this factor and the health factors “orthopaedic problems” (pain in back, pain in neck, pain in spine, rheumatism) and “past health problems” (sick leave, therapies, physician’s help, state of health) were found to be significant.

4. CONCLUSIONS

The main purpose of the study was to determine what constitutes a healthy workplace, according to the perceptions of employees in Slovenia. It was important to determine the perceptions of employees at the time of economic crisis, such as in Slovenia. The theoretical and practical solutions, which are identified in the reviewed literature, are taken into account, and findings are compared. In the discussion, we stress that some of the findings were similar to the findings from the literature review, and some are more specific.

Based on the SEM results, and similar to previously reported research results presented in the theoretical part of this article, the researchers found that some of the business premises factors of the business-building construct have a significant impact on the satisfaction of employees with the workplace, such as orientation of workplace, state of workplace, and state of business premises. The researchers found that business premises and workplace factors have a significant impact on the satisfaction of employees with the workplace (state of workplace, orientation of workplace, and state of business premises). This is in line with what is reported in the literature reviewed, where the physical conditions of the working environment are reported to affect job satisfaction (Kalleberg, 2011; Vischer, 2008). The factor “state of business premises” includes the characteristics “refurbishment of the room”, “age of building”, “regularly maintained room”, and “type of building construction”. In the case of Slovenia, the main business area is in the city centre, where the average age of business buildings is more than 60 years. Such buildings should be renovated or refurbished, which is unfortunately not possible during the economic crisis.

Illumination of the workplace is a factor of workplace design with a significant influence on employees' satisfaction with the workplace, and it comprises the characteristics "windows with blinds", "window blinds are locally controlled", "direct sunshine by day", and "windows can be opened". The effect of workplace lighting on employees, and the need for local regulation, has been investigated by several researchers (Haldi and Robinson, 2008; Nicol et al., 2006; Galasiu and Veitch, 2006) when measuring quality of the indoor environment. These researchers were focused on heterogeneous factors of indoor environment quality (IEQ), particularly physical ergonomic conditions of the workplace. Many of them reported a positive correlation between the satisfaction of users and the importance of individual control of conditions in their work environment (Toftum, 2010; Andersen et al., 2009; Haldi and Robinson, 2008). Some of them claimed that in office buildings, users mostly complained about (too) low temperatures, dry air, bad air or cold radiation next to windows, and lack of sound privacy in open-plan offices.

As predicted, we found that satisfaction of employees with their workplace has a significant impact on the health of employees. The factor "satisfaction with the workplace" is characterised by nine items: "pleased with the conditions", "pleasant workplace", "feeling good", "state of business premises", "hygiene standards", "furniture and facilities ensure a pleasant feeling", "cleanliness", "ventilation", and "changing jobs". The links between the factor "satisfaction with the workplace" and three factors from the "health and health care of employees" section were found to be statistically significant. These factors were "orthopaedic problems" (pain in back, pain in neck, pain in spine, and rheumatism), "past health problems" (sick leave, therapies, physician's help, and state of health), and "cardiovascular problems" (high blood pressure, taking pills, chronic disease, blood sugar, and circulation problem).

The results show the seriousness of the researched theme, especially from the health care perspective. It is obvious that employees show the symptoms of their health condition, including stress, depression, and cardiovascular diseases, as is reported by other researchers (Ford et al., 2014; McTernan et al., 2013; Virtanen et al., 2013; Drach-Zahavy, 2008; Noblet and LaMontagne, 2006; Shannon et al., 2001). There is also a connection between pain in the neck, spine and back and stress. In the economic crisis, it is hard to change jobs, so the main motivation is job security, which leads to low performance and occupational health diseases, causing high absenteeism or presenteeism. Findings from the research should be taken seriously, as we are aware that synchronous stressor strain effects tend to strengthen over time, with stressor-psychological strain effects increasing, especially when workers are constantly exposed to stressors (Ford et al., 2014). Even though the system of health promotion in the workplace is formally established in Slovenian companies and institutes, it is still evident, from a managerial perspective, that a straight-line relationship between employees' productivity and their well-being to keep employees creative and healthy is not being maintained.

Major changes in the economic situation nowadays necessitate future studies with in-depth research on impacts or connections between specific business premises factors and the occurrence of depression symptoms. The link between specific business premises factors and specific elements of organisational culture, research on the link of satisfaction with the

physical workplace, specific elements of organisational culture, and research on the link between perceptions of the workplace and specific elements of organisational culture and a possible positive influence on employees remain to be explored.

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AN EVALUATION OF COLLABORATIVE PRACTICES IN CONSTRUCTION CONTRACTING IN SOUTH AFRICA

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ABSTRACT

The purpose of this paper is to advance ways of promoting collaborative cooperation between contractors and their supply chain in South Africa. The research approach is qualitative, and the design is based on multiple case studies. It was found that collaboration in South African construction sites has taken a different form from that of the international construction community. The nature of collaboration in South African construction is one of mutual dependency as well as antagonistic relations within teams on-site. Industry professionals apply collaboration by means of incentive programmes and standard contracts. This paper reinforces the idea that supply chain management collaborative practice can be identified within the existing structures of site practices, thus showing that collaborative practices are an integrative management approach. There is a need to develop and implement alternative forms of contracts, such as negotiated and strategic alliancing contracts which are tailored to South African construction. Collaboration enablers, such as regular communication, frequent meetings, incentives, and reward programmes, can improve the morale of the construction team. Opportunities thus exist for eliminating non-collaborative tailored practices between contractors and their supply chain in South Africa.

Keywords: collaborative practice, contracting, supply chain management, subcontracting, South Africa

1. INTRODUCTION

The nature of supply chain management (SCM) is that of coordinated decisions and activities used to efficiently assimilate suppliers, manufacturers, transporters, retailers, and customers, in order to ensure that the right product or service is distributed in the right quantities, to the right location, at the right time, with the objective of reducing system-wide costs in the process of satisfying end-user or customer-level requirements (Singh et al., 2013). SCM is considered to be a process-orientated, or cross-functional, model which consists of planning, sourcing, production, and distribution that is not exclusively focused in one of these areas (Brandenburg et al., 2014). Thus, SCM focuses on understanding and subsequently improving the multiple systems and networks within a supply chain (Balwani et al., 2015). It is considered a broad spectrum that embodies a variety of characteristics, which requires understanding of the entire spectrum in order to enable managers to

implement the concept of SCM in business. In the construction context, SCM encompasses a network of organisations that are involved in varying processes and activities, which produce the materials, components and services that are integrated into procurement in order to deliver a building. According to Mamter et al. (2014), SCM in construction is concerned with the coordination of isolated quantities of materials, and is associated with specialised engineering services and installation which are delivered to specific construction projects.

Construction supply chain (CSC) is a supply chain (SC) according to the make-to-order system. Chunyu (2013) links this element to the structure and function of CSC, which is characterised by irreconcilable facets, such as it being concentrated, temporary, and complex. The fragmented nature of construction projects makes it difficult to adapt, not only for SCM, but also for developing lean supply (LS), even with the constant exhortation to learn from the manufacturing industry (Davis et al., 2010). Pryke (2012) adds that issues such as an increase in transaction volumes at lower-than-average values and higher levels of opportunism in the context of low barriers to entry have resulted in the industry having various interfaces (SC contributors), which hinders application of construction SCM (CSCM). Pryke (2012) thus summarises critical features of SCM for successful adaptation in construction. SCM in construction should focus on (i) the impact of the SC on construction site activities, and should aim to reduce the cost and duration of those activities (the primary concern, therefore, is to establish a reliable flow of materials and labour on-site), (ii) the SC itself, and aiming to reduce costs, especially those related to logistics, lead time, and inventory, (iii) transferring activities from the site to earlier stages of the SC, and (iv) integrated management and improvement of the SC and site production, that is, site production that is subsumed by SCM (Pryke, 2012).

As asserted by Egbu et al. (2004, cited in Emuze, 2009), implementation of CSC depends on the ability to create, manage and restructure relationships between individuals, firms, and networks within the supply chain. Cognisant of the effort required in the application of SCM in construction, Pryke (2012) recommends development of vertical integration in the design and production process and operations, so as to link the process into a chain, focusing on maximising opportunities to add value while minimising total cost. Such application requires a significant shift in the mindset of SC participants towards collaboration, teamwork, and mutual benefits (Pryke, 2012).

Chunyu (2013) defines a stricter model of CSC structure as one which explains the concept of SCM in construction from the angle of the participants in the building process. The CSC model promotes the need for collaboration among SC participants, so as to establish a high-trust environment and constraint mechanisms and information-sharing mechanisms, and for participants to share common objectives. Thus, SCM in the construction context is an innovative tool that is utilised in organising and managing resources. According to Myerson (2012), it is a performance-enhancement tool that is primarily a financial-control initiative, due to the fact that supply chains in construction are a major cost centre in a project.

This description of SCM suggests that it is not an emergent concept, as the construction industry has relied on knowledge of the manufacturing industry to implement it adequately (Chunyu, 2013). Azambuja and O'Brien (2009) state that construction has transferred key concepts of SCM from manufacturing to construction projects, in an effort to improve productivity and reduce project costs. In the tradition of SCM, the following key approaches have characterised construction supply chain (CSC) modelling (Azambuja and O'Brien, 2009): structure, information flow, collaboration, product demand, production variability, buffering, and capacity planning. In modern construction projects, these characteristics can be reflected either collectively or independently. This paper addresses collaboration as one of the key elements of CSC, as it possesses special characteristics that are included in the diversity of the end product as well as the composition of the team (Bouchlaghem and Shelbourn, 2012). Collaborative practice (CP), as a feature of SCM in construction, along with concurrent engineering and lean production, is becoming a core part of management paradigms in order for the industry to remain in the global market and fulfil the growing demand for better performance from clients (Bouchlaghem and Shelbourn, 2012). Despite its suggested benefits, there is little knowledge of the nature, viability and limitations of CP when adopted in a construction project (Bouchlaghem and Shelbourn, 2012), particularly in South African construction.

Collaboration in a supply chain relates to the capability of two or more independent firms working together, planning and implementing SC operations with common goals in mind (Scholten and Schilder, 2015). Lavikka et al. (2015) portray collaborative practice as a process that requires planning and synchronisation, which in the course of working together could potentially lead to spontaneous development of relationships between the parties involved. Collaboration as a core principle has multiple advantages, including the potential to encourage real-time information exchange, which is required to prepare for, respond to and recover from supply chain disruptions, while reducing their impacts (Scholten and Schilder, 2015).

The purpose of this paper is to identify ways of promoting collaborative working arrangements between contractors and their SC in South Africa. This is significant because the traditional procurement method that predominates in South Africa has contributed in no small way to the pervasiveness of antagonistic relationships, and their consequent problems in construction (Emuze, 2012). This paper begins with an explanation of collaborative practices, and how leading international construction communities have shaped the application thereof. It further sets the foundation for evaluating South African construction contracting. This is guided by three objectives, namely to determine the nature of CP in construction, to determine how contractors could apply CP in a supply chain, and to determine the key drivers of CP in a supply chain. This paper thus endeavours to suggest advantages of collaboration and the nature of CP as applied in construction, particularly in South Africa.

2. COLLABORATIVE PRACTICE IN CONSTRUCTION

Emuze and Smallwood (2014) describe collaborative practice in construction as the ability of firms or entities, project teams, and individuals to agree upon mutual goals, decision-making processes, and troubleshooting systems, while focusing on specific improvement to their normal performance objectives in a project undertaking. Collaborative practice has generated more attention in contracting firms as a result of a shift in responsibilities among contracting partners. Bemelmans et al. (2012:343) explain the increased focus on collaborative practice by pointing out the fact that the coordinating role previously held by the client has, in recent years, fallen upon the main contractor. This recent development has resulted in benefits and challenges that require careful examination.

2.1 Categories of collaborative practices

According to Anumba et al. (2002, cited in Shelbourn et al., 2012), there are four different modes of collaboration, which relate to types of interactions found among participants and the pattern of communication adopted in the project, namely

1. Face-to-face collaboration, which normally involves physical meetings in real time,

2. Asynchronous collaboration, which is conducted in a shared location but not necessarily in real time (e.g. electronic media, such as notice boards/memos),

3. Synchronous distributed collaboration, which is real-time interactions among participants from various locations (e.g. video conferencing), and

4. Asynchronous distributed collaboration, which is participant interaction from dispersed locations but not in real time (e.g. electronic mail systems).

It is common for SC contributors to assume one mode of collaboration, as outlined above. Construction projects as a whole are expected to consist of numerous subcontractors. According to Xue et al. (2010), collaboration has advantages that appeal to organisations, namely the following: increased probability of winning bids; faster, better, or cheaper development or delivery of products or services or markets; in-depth learning; meeting an external requirement; and saving costs. Collaboration is said to have a substantial positive impact on project performance, not only with regard to time, cost, and quality objectives, but also for more general outcomes, such as greater innovation and client satisfaction (Akintoye and Main, 2007).

Douma et al. (2000, cited in Akintoye and Main, 2007) explain that the need to collaborate is determined by a number of factors, namely market opportunities, time pressures, and the number of alternative options available. They list the following key drivers for strategic fit in collaboration: (i) collaboration is only advisable when participants have a shared vision of future developments and of the impact that these developments will have on their individual positions; (ii) a precondition for strategic fit is compatibility of strategies; (iii) alliance partners will only be prepared to make concessions when the alliance is of strategic importance to them; (iv) a successful union requires mutual dependency; (v) any alliance should have added value for the partners and/or their customers; and (vi) partners must

carefully consider whether the market will accept the alliance (Douma et al., 2000, cited in Akintoye and Main, 2007).

Over and above having a shared vision, there are five more critical factors that contribute to effective collaboration, namely (Shelbourn et al., 2012)

1. Stakeholder engagement, which implies that collaboration leaders need to ensure that all key participants are consulted on the practices to be employed during the collaboration,

2. Trust, which implies that time and resources are needed to enable all participants to build trusting relationships,

3. Communication, which implies that a common means of communication should be established and agreed upon by all participants in the collaboration,

4. Process, which implies that the outworking of the collaboration in relation to both business and project should be known by all key participants, and

5. Technologies, which implies that an agreement on those technologies to be used is required to ensure that the collaboration is easily implemented and managed.

Collaboration therefore requires trust between partners, clearly defined processes, and efficient communication infrastructures supported by appropriate technologies (Shelbourn et al., 2012). Trust between collaborators can never be overemphasised, reason Ochieng et al. (2013), who believe that without an appropriate level of trust, true collaboration would simply not take place, even if the other factors mentioned above are present.

2.2 Enablers and barriers to collaborative practice in construction

Collaborative practices provide a unique cultural environment which is not limited by boundaries, while other forms of relationships between entities are limited to synchronisation of decisions and processes (Kumar and Banerjee, 2014). Ideally, the relationships forged by collaborative practice are long-term partnerships; however, owing to the character of construction projects, one-time alliances are much more common (Lönngren et al., 2010). Love et al. (2004, cited in Lönngren et al., 2010) caution organisations that enter into one-time partnerships to be cognisant of possible repercussions and effects relating to self-governance (understanding their own capabilities relative to demand), responsiveness (the ability to immediately recognise the changes in demands that will have an adverse effect on operations), and flexibility (the ability to respond to changes in client needs and demands).

Further benefits of collaboration include added value to a project, increased revenues and profits, improved business efficiency, improved productivity of individuals as a result of being part of a team, improved customer/end user satisfaction, and an enhanced collective image of the groups within the collaboration partnership (Shelbourn et al., 2012). Scholten and Schilder (2015) argue that while collaborative practice results in benefits such as higher visibility, flexibility, and reduced lead times, they are mindful of the fact that such practice might not always be possible or be wanted by SC contributors.

Shelbourn et al. (2012) summarise the following requirements for collaborative practice. It is imperative to strike a balance between the enablers and the barriers of collaboration, and to further explore ways in which this can achieved. As indicated by Akintoye and Main (2007), for any collaboration to be successful, relationships between participants need to be exceptional, and teambuilding (coordination and integration of project organisations, so as to increase productivity, efficiency, motivation, goal attainment, group dynamics, and dispute minimisation) should be considered within contracting firms.

3. RESEARCH METHODOLOGY

The methodology adopted for this study is the inductive approach of conducting research. The rationale for selecting this design stems from the fact that an exploration of the research topic indicated that case study was the most favourable strategy to use, especially when conducting preliminary studies, as is the case with this study. Fellows and Liu (2015) confirm this choice of design, by alluding to the fact that research in construction is relatively 'nascent' and intermediate in maturity and its matching of the fieldwork context. An evaluative study using the inductive approach is appropriate to foster development of construction knowledge (Fellows and Liu, 2015).

The research study was carried out in five provinces of South Africa, namely Free State, Gauteng, North West, Limpopo, and Mpumalanga. Eight construction projects were investigated, of which three construction sites (case studies) were explored more extensively. The provinces were selected for the study because of the willingness of the respondents to participate in the study. The data-collection instrument used for the study consisted of an interview protocol. The protocol for individual professional interviews and the case study interviews consisted of 18 and 14 questions. The data-collection process produced two streams of respondents. Although a main interview template was developed, a second interview template, which was loosely based on the main template, was used for the case study respondents. As explained by Hair Jr. et al. (2011), respondents are chosen based on their specialised insight on the subject under investigation. Due to the varying involvement of the respondents, due partly to their job title and role, the scope and capacity of their activity on the project, their duration on the project, and the duration of their affiliation with the main collaborators (the client and the main contractor), the interview had to be structured with these circumstances taken into account.

The analysis of the interviews followed simplified guidelines for analysing textual data developed by Taylor-Powell and Renner (2003). The analysis process followed a five-step plan for analysing and interpreting narrative data. The five steps were (i) get to know your data by reading and re-reading the recorded texts, (ii) focus the analysis by questions or topic, time period, or event, (iii) categorise information by identifying themes and patterns and organising them into coherent categories, (iv) identify patterns and connections within and between categories, (v) and interpret, by bringing it all together. The themes were colour-coded so as to facilitate allocation of similar themes across each participant response.

4. RESEARCH FINDINGS AND DISCUSSION

The participants were unanimous in describing the nature of their relationship as one of mutual dependency, and adversarial when challenges arose. The majority of the participants perceived that the environment they worked in afforded them a measure of transparency and gave them the freedom to express themselves. Main contractor representatives complied with an open-door policy that encouraged subcontractors to propose innovative solutions for problems they encountered on-site. However, one project manager cautioned against being too transparent, and preferred sharing information on a need-to-know basis. Some supply and installation subcontractors were given a measure of independence. This, however, did not reassure them of trust on the main contractor's part, but was perceived as a nonchalant attitude towards their presence on-site. Numerous factors impacted the type of relationship between project participants, which centred on communication and frequency of project collaborations.

The most preferred modes of communication were face-to-face and asynchronous collaboration and synchronous distributed collaboration. The frequency of communication, however, was determined by two factors, namely familiarity of the team leaders (the relationship between the foremen and the subcontractors) and the duration of participants in the current project collaboration. A main contractor representative stated that subcontractors and suppliers whom they had worked with before on other projects were trusted, and therefore did not require constant communication or supervision, as both sides were familiar with the required standards of quality and efficiency. This proved successful, as some of the subcontractors were given additional tasks to complete on behalf of the main contractor. Subcontractors who had occupied the construction site the longest seem to have developed an understanding of the work ethics and cultures that persisted on-site, while participants who had joined the construction site at a later time struggled to establish a working system. This was true on both sides of the collaboration (on the side of the main contractor representatives, and that of the subcontractors). For example, one main contractor representative had been on his current project for only a week (20 months into a 36-month project). He had an authoritarian manner, which most of the subcontractors did not approve of, which led to a troubled relationship plagued by constant communication characterised by a hostile and unforgiving nature. On one project, the subcontractors perceived that they were sidelined by the main contractor and their representatives. The modes of communication did not seem to produce the desired outcomes, thus making both sides less trusting and respectful of each other. A commonality raised among all the participants was the fact that the main contractor's decision to act in "good faith" was welcomed by all parties involved, as it allowed integrity to develop among the construction team. Information sharing by the main contractor representatives encouraged a relaxed, favourable environment, as participants were assured that work assigned was completed according to the instructions.

Application of collaboration in an SC is guided by standard forms of contract, which include the JBCC Series 2000 and the NEC3 family contract. Both these forms of contract include provisions for subcontracting work. The main contractor would organise their

relationship with the subcontractor (domestic or nominated) as if they had not subcontracted. Thus, main contractor representatives maintained managerial roles, while the subcontractors were in charge of production.

The manner in which subcontractors/suppliers were appointed influenced how subcontractors were assigned to tasks, and whether they could occupy and maintain leadership structures. Two of the construction projects investigated had additional clauses imposed upon the main contractor, with an addition of three individual professionals who operated sites under the same clause. These client-imposed clauses required the main contractor to allocate 30% of the contract sum to appointment of local SMMEs (subcontractors and suppliers). While this was a much-needed intervention to improve the community, it meant, however, that new entrants were included in the collaboration, thereby tasking the main contractor with additional responsibilities. To alleviate these responsibilities, designated roles and project-tailored responsibilities were assigned to members of the SC. Subcontractors who had a longstanding relationship with the main contractor were allocated additional relationships of managing new subcontractors who had little or no experience in the trade.

The simple nature of material and equipment suppliers meant that no formal agreement was required to govern the partnership. As such, main contractors appointed suppliers on a negotiated quotation system. This relationship was easy to maintain, as suppliers engaged with a specific buying department from the main contractor.

The majority of subcontracted work included wet trades (labour only) and supply and installation subcontractors. For this reason, main contractor representatives served on supervisory capacities, enabling subcontractors to coordinate their employees free from interruptions from the main contractor. Subcontractors who lacked adequate understanding of basic site practices were allocated to work on tasks that would later be finished by subcontractors with more experience. Therefore, one trade consisted of a number of subcontractors undertaking the same work. This reassured the main contractor of quality in work executed. This also allowed subcontractors to work as a team in a favourable environment.

Worth noting is that one contracts manager opted to use a custom-made contract form, which incorporated some of the conventional contracts but omitted some clauses that he deemed were unnecessary for the project undertaken. The contracts manager justified this approach by alluding to the unrealistic nature of standard forms of contracts, which bound the main contractor in a partnership he was not satisfied with. The participants also preferred to use the guidelines of another regulatory body as binding obligations between them and the subcontractor, as this council was tasked with signing off on subcontracted work on behalf of the client.

Client representatives were also incorporated into the SC, especially on specialist trades, to ensure accuracy in the installation and operation of equipment. Subcontractors were then provided with first-hand instructions and advice from stakeholders who represented the client, enabling successful execution of work and trust among the SC contributors.

The key drivers for collaborative practice in a SC concern beneficial outcomes for the project and the participants. Subcontractors ranked job security as a motivating factor to collaborate with main contractors. The prospect of performing on the current project ensured that subcontractors had a continued working relationship in other future projects. Risk allocation and sharing was the driving force behind main contractor representative participation in the partnership. As pointed out by one professional, subcontracted work ensures minimum waste, and it reduces theft of materials and other resources, as they are the sole responsibility of the subcontractor. Subcontractors indicated that association with a reputable contractor enhanced their qualifications and raised their business ranking in the cidb database. Job satisfaction and successful project execution were other key drivers among SC contributors. The majority of participants stated that they love their job and they enjoy the satisfaction of being part of a large group of individuals and witnessing it come together and produce a structure or building that the client and the community at large can be proud of.

Social responsibility affected the attitudes of project participants. The mere thought of enriching a community surpassed any problems experienced by main contractor representatives when dealing with local SMMEs as part of the client requirement. The main contractor's willingness to subsidise financial and material resources on behalf of the subcontractors enabled the subcontractors to thrive and improve their performance on the project.

Contractor-led incentives programmes and innovation platforms developed an appreciative attitude among the subcontractors. In one such project, trophies were awarded to best-performing subcontractors as a way of motivating them to continually improve their skills. Delegating responsibilities to more than one subcontractor encouraged an environment free from pressure to complete a task in unrealistic time frames, thus giving subcontractors the confidence needed to complete the job.

Innovative forms of communication contributed to a successful relationship. In one project, besides the use of radios, notice boards, and site meetings, main contractors introduced the use of social media as a communication platform. The use of WhatsApp groups to communicate with various members of the construction team ensured information sharing and technical support when issues arose.

The establishment of business forums afforded the local SMMEs a platform to express and discuss issues they encountered on-site. These forums gave the subcontractor the opportunity to engage with the main contractor, thus building confidence in the participants that the project could produce better business outcomes.

5. CONCLUSION

This paper started by identifying three objectives that were explored in the reported study. The objectives included determining the nature of collaborative practice (CP) in construction, determining how contractors could apply CP in a supply chain, and

determining the key drivers of CP in a supply chain. The findings from the triangulated data sources showed that collaboration between partners was of a mutual nature. Collaborating partners shared the same responsibilities with labour-only subcontractors, but they had exclusive responsibilities in their relationship with supply and installation subcontractors, who were assigned different tasks but occasionally interacted with each other to coordinate tasks. Face-to-face and asynchronous collaboration characterised the nature of the relationship between the main contractor and subcontractors. Collaborations existed under at least three collaboration arrangements, as separate organisations that maintained their independence, large national organisations working with a small local group, and group structures where a parent organisation governed a group of subsidiary organisations.

All members of the SC were under legal obligations, as standard forms of contracts (JBCC and NEC3) were signed prior to commencement of work. In the three kinds of collaboration, the main contractor maintained a managerial role, while the subcontractor undertook the role of supervisor of works. The main findings suggest that job security, successful work execution, and client satisfaction are the key drivers for members of the construction team. Sharing of risks and having specialists complete various facets of the project encouraged main contractors to continue pursuing a collaborative relationship with their subcontractors. Incentive programmes, training, and induction programmes enabled smooth running of processes, trust, and open communication.

Given the fragmented nature of this project-based industry, SCM principles such as CP provide practical leeway to address some of the challenges faced by the industry as it strives to improve its productivity and competitiveness. This requires early participation of every member of the SC network, including subcontractors and suppliers on the project. It is necessary to redefine the roles of the multidisciplinary project team and allocate responsibilities according to each member's impact in the supply chain model adopted in the project. While the principle of collaboration is a predominant feature of SCM, other features need to be studied alongside this principle to ensure successful application of SCM in South African construction. Future studies should therefore seek to establish core principles of SCM within construction projects, and should ultimately move to develop a model for implementing various aspects of SCM seamlessly in South African construction.

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DEVELOPING A WORKER ENGAGEMENT MATURITY MODEL FOR IMPROVING OCCUPATIONAL SAFETY AND HEALTH (OSH) IN CONSTRUCTION

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ABSTRACT

Research on worker engagement (WE) has identified the increased importance of meaningful discussion, communication, knowledge sharing, and shared decision-making regarding occupational safety and health (OSH) practices within the construction industry. This paper reports on initial findings on the development of a meaningful discussion framework for improving OSH and engagement of the construction workforce. The main purpose of the framework is to rank levels of discussion amongst construction operatives and supervisors related to positive performance at work and enhancement of OSH. This reflects the legal and ethical requirements for management to collaborate with the construction workforce for the improvement of OSH. For effective WE in OSH to become the norm, the effectiveness of corporate OSH engagement programmes needs to be assessed using a valid and reliable tool. Also, there is a need for a practice-driven and -validated worker engagement maturity model (meaningful discussion framework) that not only identifies and aligns with existing organisational capabilities, as shown in the HSE leadership and worker involvement research, but also addresses a set of dimensions specifically targeted at construction workers. The methods used to develop the framework discussed here involved qualitative interviews to gain accounts of episodes of worker engagement, which were categorised using NVivo and ranked based on feedback from expert focus groups. The meaningful discussion framework highlights the link that higher levels of worker and organisational maturity can have with higher levels of construction OSH performance. This is based on a number of logically progressive worker maturity levels, where higher levels build on the requirements of already existing levels, from discussing issues affecting individual workers to issues that affect other workers, and ultimately to issues "beyond the site gate", such as design processes. Final validation testing of the model will be reported on at a later date.

Keywords: worker engagement, meaningful discussion, operatives, supervisors

1. INTRODUCTION AND BACKGROUND

The construction industry is one of the UK's most important economic sectors, with 2.1 million jobs, or 6.2% of the UK's economically active population employed in construction jobs (Rhodes, 2015). The industry has realised that managing people and their behaviour is a core requirement for better work-related performance and higher output. Managers have realised that employees are key factors that constitute the base of their accomplishments. Thus, engaging employees at work is an important element for the success of the industry and improving all the outcomes that lead to this success (Bakker and Demerouti, 2008; MacLeod and Clarke, 2009).

The concept of worker engagement was originally defined by Cameron et al. (2006) as a process where every worker on a construction site actively participates in improving health and safety by influencing others. More specifically, workers are keen to share their experiences and knowledge with other workers and managers, managers positively encourage worker participation to identify and resolve health and safety problems, and everyone on-site benefits from safer working conditions. HSG263 guidance (Health and Safety Executive, 2015) has identified worker engagement as a consultation process where management gives information to the workforce (including the supply chain and subcontractors), or employees, and they, in turn, obtain feedback from them before making decisions.

The definition developed for the research reported in this paper builds on these existing definitions, but includes factors identified in the literature search, namely meaningful discussion, motivation, empowerment, commitment, and trust. The current definition therefore considers worker engagement as

> a process where every worker on a construction site is motivated and empowered to participate in improving health and safety through meaningful discussion with workers before decisions are taken, where others are influenced, and it is committed to the sharing of experiences and knowledge, where managers positively encourage workers to identify and resolve health and safety problems in a culture of trust, leading to every worker on-site benefiting from safe and healthy working conditions.

This also includes aspects such as recognition of the positive influence that trained trade union safety representatives have through the exercise of their workplace rights and functions, through effective consultative structures and the duty of the employer to consult with them (see section 3(6) of the Health and Safety at Work etc. Act 1974).

Little research has been conducted on worker engagement specific to construction workers (operatives and working supervisors), and that is why this paper on meaningful discussion related to worker engagement is significant. Previous research has identified informal lines of communication, hazard reporting, and informal disciplinary roles (see Cameron et al., 2006). Following on the work of Cameron et al. (2006), research has identified that direct worker engagement in construction has been studied in relation to workers identifying hazards and reporting injuries, and that training is paramount for meaningful discussion.

However, for meaningful discussion to take place there should be some degree of trust in management's commitment to safety, where any unsettling of this trust relationship by management will potentially disrupt meaningful discussion. The views of workers related to trust in management and emotional commitment to the organisation can be assessed to measure progress in the meaningful discussion process (see DeJoy, 2005). Maloney and Cameron (2003) have suggested that meaningful discussion can only take place when workers possess some elements of capability, i.e. training, experience, and knowledge. Therefore, provision of the requisite training for workers and management, especially "soft skills" that are fundamental for informal communication and meaningful discussion, can help in the identification of hazards, the reporting of unsafe conditions and near misses. This creates an opportunity for a two-way communication mechanism, which is required for imparting information to workers and eliciting their views in a structured manner (Cameron et al., 2006).

Jensen (2002) and Cameron et al. (2006) reflected on five dimensions to workplace assessment which can serve as a guide to assessing the level of meaningful discussion:

1. The area of the issues that are covered, e.g. whether they relate to physical hazards or organisational management (safety culture, i.e. how safety is managed within an organisation);

2. The objectives in developing solutions, and where these objectives rank in the UK's hierarchy of risk control, e.g. "eliminate, prevent, control";

3. The depth of understanding of accident causation;

4. The range of solutions presented in relation to proactive and reactive decisions; and

5. The capability to transfer issues to the immediate chain of command, e.g. workers involving senior management, plant managers, or directors.

Research has continued to highlight the advantages of developing a highly engaged workforce, and for this reason many organisations are striving to enhance levels of engagement within their influence (Wollard and Shuck, 2011). Workers that are highly engaged are involved and immersed in their jobs, so that they enjoy the challenge (Staples et al., 1999), they lose track of time while working (González-Romá et al., 2006), they have stronger organisational commitment (Hakanen et al., 2006), they expend more effort on the job, and they are intrinsically motivated.

The importance of meaningful discussion within the construction industry lies in the perception of its importance in predicting positive performance at work and improvement of construction occupational safety and health (OSH). Most construction workers will support formal organisational goals if they understand how these goals benefit them, the business, their fellow workers, the organisation's customers, and society as a whole. Therefore, meaningful discussion within the construction industry can be considered a precondition for sustainable competitive advantage, and it can make a real difference in the survival of an organisation (see Macey and Schneider, 2008; Hoon Song et al., 2012).

There is also an important element of reciprocity in trust (Scholefield, 2000). For workers to be engaged and to strengthen their commitment to an organisation, an employer should invest in workers' well-being, and the workers, in turn, will feel valued and will directly reciprocate through renewed employer loyalty and by working harder and more efficiently.

There are also legal and ethical requirements for management to collaborate with the construction workforce for the improvement of OSH. This study therefore considers approaches to the development of a meaningful discussion maturity framework for the construction industry. Workers that are involved in the workplace should be engaged and should be given the opportunity to share their own views and opinions in matters related to improvement of the workplace and performance (Hummerdal, 2015). Baucus et al. (2008) identified that workers' inherent creativity is mostly suppressed as a result of lack of support from management and bureaucracy.

When discussion (face-to-face) is mediated by feedback and has a direct impact on the capabilities of workers, such discussion can be considered meaningful. Experience shows that within the construction industry, effective meaningful discussion is wholly dependent on individuals, teams, and organisations. Also, because of the transient and inter-trade nature of most construction projects, the industry is often characterised by groups of workers that are peripatetic and unacquainted with each other, working together over a limited period of time before disbanding to work on other projects (Dainty et al., 2006).

The reason for meaningful discussion, therefore, is to ensure that the flow of information is effectively managed, that messages are conveyed appropriately, and that the worker is able to interpret and act on such information in a way that is consistent with the expected intentions. Meaningful discussion is considered a fundamentally social activity, which includes engaging in conversation, listening to co-workers, networking, collecting information, and directing subordinates. Meaningful discussion will be more successful in a workplace where there are some predictive elements of co-worker knowledge, team tenure, co-worker and supervisory support, group orientation, and group cohesion (see Burt et al., 2008). Discussion that directly influences a worker's intellectual growth, learning, and curiosity and engages them in productive instructional activities can be regarded as meaningful discussion (see Hirumi, 2002).

It is also suggested that meaningful discussion promotes faster information acquisition, and it facilitates organisational socialisation. The work of Burt et al. (2008) shows that acquisition of information via socialisation, such as induction training, helps in getting to know the personal life of co-workers, their attitudes, families, and interests. These are relevant in developing positive safety-related attitudes, co-worker knowledge, and social relationships.

2. OBJECTIVE

The study reported on in this paper has been developing a framework against which to assess meaningful discussion in relation to OSH engagement. This is part of a wider framework being developed to encapsulate levels of worker motivation, commitment, empowerment, and trust. This section of the framework will serve as a guide that will be useful for workers and managers on construction sites in order to improve meaningful discussion on OSH.

3. METHODS, DESIGN, AND INTERVIEWS

The research objective dictated a qualitative approach to obtain rich data giving accounts of worker engagement episodes which could also describe circumstances and context. The specific type of qualitative design implemented was a phenomenological research inquiry that describes the lived experiences of construction operatives and supervisors regarding

the phenomenon of worker engagement as described by workers (see Creswell, 2014). This design was considered the most suitable for this study, as the type of description articulates the experiences for several operatives and supervisors who have all experienced different types of worker engagement. The phenomenological research design is based on strong philosophical underpinnings, and it involves conducting interviews (see Giorgi, 2012).

Gaining access to construction operatives and supervisors was facilitated by the research steering group, made up of construction industry OSH experts. A purposeful sampling strategy was utilised for selecting construction sites (from house building to large-scale civil engineering projects) and workers from a pool of site options available across the UK. The participants sought for the interviews were "engaged" workers and supervisors. Workers described as engaged will be operatives who show an interest in health and safety (H&S) issues, contribute to H&S, and/or regularly attend H&S meetings, while engaged supervisors will encourage engagement and regularly discuss H&S issues with their workers.

Phenomenological studies typically involve three to 10 participants (Creswell, 2014); however, this study conducted semi-structured face-to-face and open-ended non-leading interviews with 29 operatives and supervisors until saturation was reached (Charmaz, 2014). Each interview lasted an average of 40 minutes. The interviews were audio-recorded, with note-taking done on-site, and the recordings were later transcribed.

Development of the meaningful discussion framework involved using inductive and deductive logic. The inductive process involved working back and forth between the themes emerging from the interviews conducted and the information from the literature search until a comprehensive set of themes was established (Creswell, 2013). This involved collaborating and interacting with industry experts (the steering group) through presentations and workshops, in order to shape the emerging themes of meaningful discussion from the interviews.

Validation of the framework and categorisations was achieved through workshops with members of the steering group iteratively. The visual representation of the meaningful discussion framework was developed deductively with members of the steering group from the categories of information acquired from interviewing the research participants to reach a logically certain conclusion. It was considered ideal to work from the more general to the more specific context of meaningful discussion based on examples.

4. ANALYSIS AND DISCUSSION

The framework for meaningful discussion was conceived and developed by the researchers in collaboration with the industry experts. This resulted in a visual representation of factors radiating out from the individual worker to their immediate surroundings, and ultimately to factors beyond the site gate, as illustrated by a conceptual dartboard (see Table 1 and Figure 1). The reason for involving industry experts was to address the complex issue of diverse views regarding assigning and categorising the levels of the different issues discussed by the workers (Fontana and Frey, 1994). It was identified that meaningful discussion between workers, co-workers, supervisors, and managers was dependent on the fundamental principles of trust, motivation, empowerment, and commitment of the workers, which are some of the key features identified in the work of Cameron et al. (2006).

Table 1 outlines the development of meaningful discussion criteria that were adopted in assigning levels of issues that were frequently discussed, raised or flagged by the workers. The criticality of the issues identified, the impact on workers, and the relevant meaning of such issues, such as welfare, housekeeping, hazard spotting, etc., are summarised in Table 1.

Table 1: Areas of issues discussed by the workers, with their levels, criticality and meaning

Level	Criticality	Meaning
1	Personal work area; housekeeping; and work environment	Hazards that directly affect/relate to the worker
2	Welfare	Issues related to site welfare
3	Hazard spotting; site hazards; and hazard causes/procedures	Hazards that are associated with other workers
4	Proactive site solutions	Proactive discussion or proactive action to resolve issues
5	Beyond the site gate: boardroom/other sites; design; and mental health	Issues beyond the site gate that need management intervention

Figure 1 shows the output from the workshops with industry experts. The subjects discussed by the workers centred on personal work area and welfare, which are considered important to the workers. It is only when issues related to personal work area and welfare have been addressed, and there is that element of trust (Scholefield, 2000) in the management to act on problems, that a worker will have the confidence to raise other immediate issues that impact on either them personally or their work environment. Engaging with workers in resolving immediate issues, such as housekeeping, personal work area, and work environment, will reinforce some sense of empowerment, meaning, competence, impact, and belief that workers are being listened to (Conger and Kanungo, 1988). This is when workers feel empowered and emotionally committed (DeJoy, 2005; Hakanen et al., 2006; Schaufeli, 2013) to identify and raise other issues that pose as hazards to others. These involve issues such as hazard spotting, identifying site or work-related hazards, risk assessment, accident investigation, equipment design, and selecting PPE and equipment. These are more effective if involvement is on a voluntary basis, as this ensures ownership (Lancaster et al., 2001). The depth of engagement and meaningful discussion depends on a range of factors, as highlighted by Jensen (2002) and Cameron et al. (2006).

The Construction Design and Management Regulations (CDM) (2015) in the UK explicitly state the requirements of those who indirectly influence site health and safety during the pre-construction, or planning, stages (see Hare et al., 2006). This requires designers to manage health and safety risks. Regulation 14 of CDM 2015 places the duty on the principal contractor to consult and engage with workers in construction work to cooperate effectively in developing, promoting and checking the effectiveness of measures to ensure the health, safety and welfare of workers. However, the issues discussed by the workers clearly show

that inherent issues related to design were not reflected in their meaningful discussion. Other issues beyond the site gate, such as mental health and boardroom-level issues, were not captured in the discussions that workers had. But this is hardly surprising, as these are the most advanced levels of meaningful discussion, and therefore will be rare until full maturity is gained.

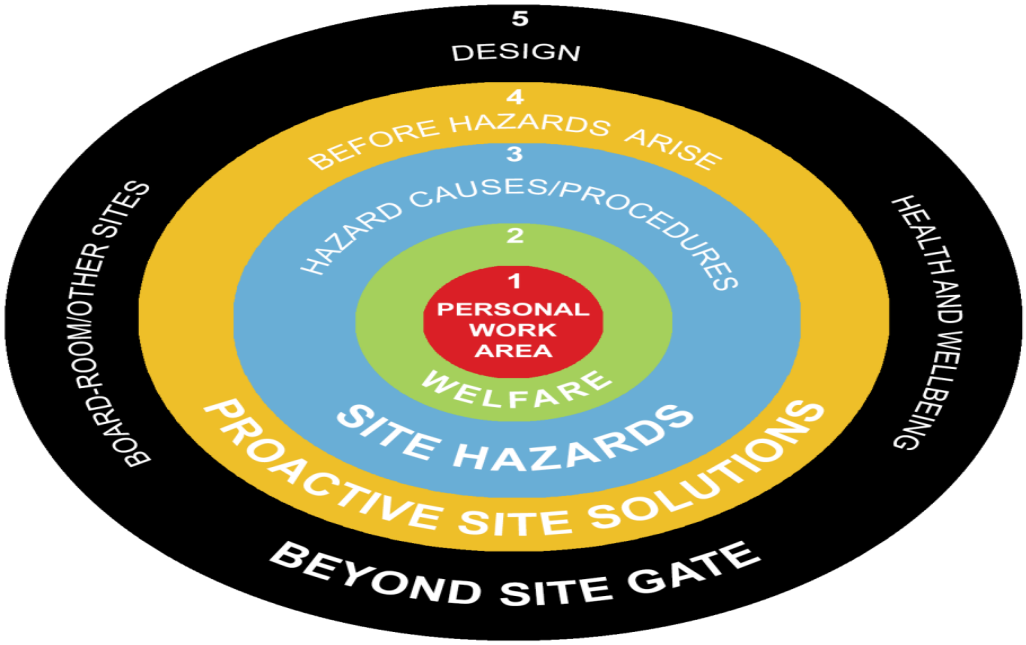

Figure 1: A conceptual framework for meaningful discussion

Table 2 shows the issues that were either discussed by workers or were established by the expert group, actions that were taken to resolve or mitigate the issues.

Nine of the issues discussed by the workers involved welfare (Level 2), which is considered significant to every worker on site. Two issues were related to personal work area or housekeeping (Level 1), while hazard spotting or site hazards (Level 3) accounted for 15 of the 30 issues discussed by the workers. Three of the issues related to proactive site solutions (Level 4), and none of the issues related to design, boardroom/other sites issues, family/personal issues, or mental health issues.

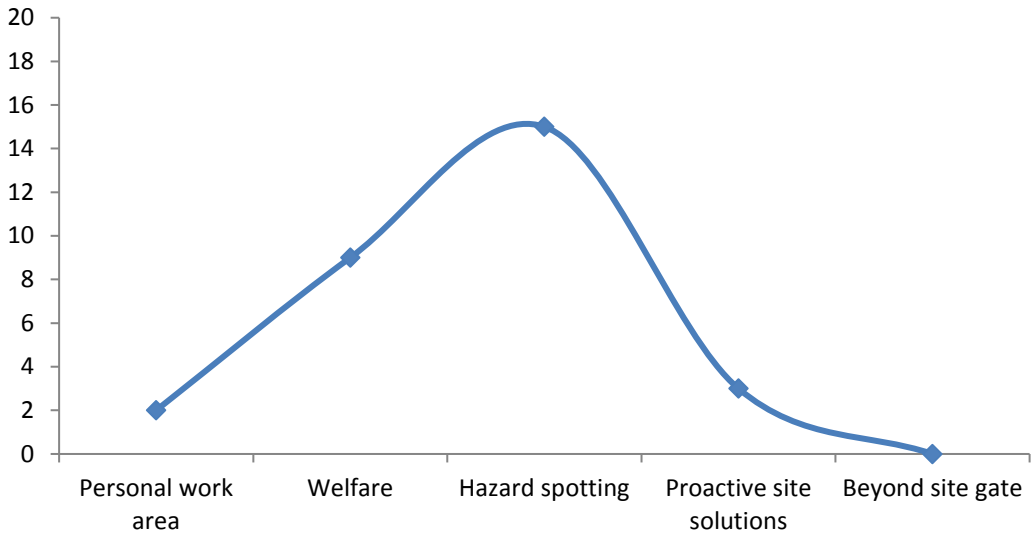

Figure 2: Frequency of identification of issues in the five levels

5. CONCLUSION

Based on the findings of this study, the level of mutual understanding between workers on construction sites, as well as close coordination and communication of design issues, was lacking (beyond the site gate issues). Although there seemed not to be significant barriers to communication between the workers, issues that were relevant to design professionals, construction phase plans, and contractors were not discussed. This gives a sense of the level of reach of the workers in terms of identifying such problems and communicating them to the relevant level. From the interviews conducted, site inductions, toolbox talks, and pre-start meetings were considered by the workers to be critical for the communication of health and safety information between management and the workforce. However, the opportunities for two-way communication relating to the mechanisms required to impart information to the workers and elicit their views in a systematic but not necessarily formal manner are considered to be still lacking. Suffice it to say that meaningful discussion is taking place, but that such discussion needs to go wider and farther than the examples shown in Table 2. For the operatives and supervisors to meaningfully discuss issues up to Level 5 of the framework, they will need to have the requisite skills, experience, competence and training. The expert group recommended further data collection from a sample of female workers and trade union safety representatives to ascertain if Level 5 discussion (beyond the gate issues) is identified.

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Table 2: Meaningful discussion, with the actions taken to resolve the issues, and their ranking

Level	The issue, and a description of it	Action examples
3	**Battery charging points**, e.g. batteries are being charged in the canteen	Extension cables ordered, and extensions delivered and now in use
2	**Earplug dispenser**	Earplug dispenser fitted to the board on the lower ground, and ready for use
1	**Temporary lighting**	Contractor supplied task lighting, but subcontractors are to supply their own if there is not enough on-site
1	**Housekeeping**	With lots of new faces on-site, people are not tidying up in last 10 minutes at night. All foremen should ensure that work personnel tidy up before leaving the site.
3	**PPE**	Everyone is not adhering to the five-point PPE rule. If the same people persistently fail to adhere to the rules, their boss will be informed to take the relevant action.
4	**Relevant tickets for scissor lifts**	Spot checks will be carried out; charge hands are to make sure that only personnel with tickets use machines
2	**No running water in joiners' canteen**	Supervisor to talk to subcontractor to resolve issue
4	**Work plan – plant, machinery & equipment**	Everyone to be aware that the crane operator will be working closer to the building
2	**Someone squatting over the toilet, broke seat and made a mess**	All personnel spoken to; if for any reason you need to do this, speak to management to see if alternative arrangement can be made
3	**Car park mud**, e.g. sparks complained that the car park was very muddy and no walkway	New tar car park now in operation, with walkway through the canteen
3	**Mixed wastes**, e.g. plasterboards, timbers, and metals all mixed in the bins	Everyone told to separate waste bins provided to allow forklift driver to put waste in relevant skips
3	**Bottom of plant room stairs has open area you need to jump over**	Area was boarded over to make suitable platform
3	**Stairs blocked off for pouring, and no dry routes to wing B**	New routes with barriers and no mud designed
3	**Machinery movement/awareness**, e.g. lots of MEWPS moving on-site	Safety advisor suggested signs be made and erected for MEWP working area
2	**People smoking outside building and canteen**	All personnel spoken to and told to use designated smoking areas. The designated smoking area to be made larger
2	**Canteen left untidy, and microwave not cleaned after use**	Foremen to speak to men, and more bins and signs to be put up
3	**PAT testing equipment**	All equipment on site tested
3	**Uncovered risers**	Barriers erected to protect it
3	**Water bottle not used during cuttings**	Brickies given water bottles, and they are under observation
3	**COSSH bins not being used**	Signs were made up and put up on-site
2	**No microwave in the canteen**	A new one was purchased and put in place
4	**Commendation**	Scaffolders commended for prompt action taken at east elevation scaffold
3	**Fire alarm**	Fire alarm did not go off with others during the fire drill. Supervisor to silent-test the alarm
2	**Toilet water running out frequently**	Signs to be put up to "pull up taps" after use; plumber to look at taps
2	**Water not fit for drinking**	Signs to be made to warn personnel that water from canteen sink is not suitable for drinking
2	**No closer on canteen door**	Supervisor will look into fitting new ones
1	**Cables on ground at west wing**	Cables to use nearest drop points and hung up off the floor
3	**Metal cutting with jigsaw very noisy**	When cutting metal (trays or ducting) with a jigsaw, do it outside if possible, or warn people in the area before cutting. Earplug dispenser to be put up on-site for easy access
3	**Using other workers' platforms without charging after use**	All team members to speak to other co-workers and to ask them to charge machines at night. Toolbox talk
3	**Signing in book to be used every day**	Supervisor to talk to all operatives to ensure they sign in, as it is also the fire drill check book

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