Addressing Behavioural Safety Concerns on Qatari Mega Projects

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Abstract

This study explores the behavioural safety measures for addressing accidents on Qatar mega projects which are infamous for their high rates of accidents and fatality. Using extant literature and brainstorming as sources of preliminary information, questionnaire was used for collecting quantitative data, which was analysed using reliability analysis and exploratory factor analysis.

The finding suggests that there is a low level of behavioural safety awareness among the construction workers due to their lack of adequate safety knowledge, with the rate of accident exacerbated by use of improper safety gears or improper use of such gears. Putting production ahead of safety, due to urgency and timeliness of the projects, engenders poor disposition to safety among site workers. To turn the tides on the high rates of accidents and fatality, more proactive approaches to safety management is essential for engendering behavioural safety among the operatives. Such measures include enhanced communication and feedback on safety practices, increased use of safety signs to raise awareness, education and regular observation and appraisal of the employees. A key requisite for achieving a positive behavioural safety outcome is an increased commitment of the management team and the site supervisors who are expected to implement a robust safety policy as well as the carrot and stick approach for engendering positive safety behaviour.

With behavioural safety management recognised as an effective approach for mitigating health and safety concerns on construction sites, this study suggests measures for mitigating unsafe behaviours, thereby reducing accidents and fatalities on the Qatari Mega projects.

Keywords: Behavioural Safety; Construction; Site management; Qatar; Mega Projects

1.0. Introduction

International Labour Official (ILO, 2015) states that over two million work-related accidents and fatalities occurs each year. In 2016, the United States recorded about 8% increase in mishap injuries that happened within the year 2015, and the Department of Works and Labour statistic reveals that about 6,000 near-miss or deadly mishap worth of damages occurred. This is the first time ever that the records of work-related accidents reached up to 5,000 fatalities as documented by the Census of Fatal work-related Injuries (CFOI) and the third consecutive increase in yearly occupational injuries since 2008. The fatal injury rate increased from 3.4 in 2015 to 3.6 for every 100,000 full-time employees, the highest records so far since 2010 (BLS, 2017). Between the year 2016 and 2017 in United Kingdom industries, over 609,000 employees sustained a non-fatal injury at work, 1.3million employee suffered from work related illness or were made worst by the nature of their work, and over 144 worker deaths were recorded (Riddor, 2018). More than over 31 million workdays were lost because of workplace injury as well as work-related illness.

While the risk of injury and work-related illness varies across industry, the effects are being felt more in some industries than others (HSE 2018). Notwithstanding the positive impacts of the construction industry, which includes its significant contribution to nations' gross domestic product (GDP), the rate of work-related injuries within the industry cannot be overlooked, and Ibrahim et al. (2010) further highlighted this by emphasizing that construction activities have a huge impact on the health and safety of its employees. This is due to its unique nature of operating, such as outdoor operations, crowding together of the employee, the height at which most works are carried out, and the use of the heavy equipment and machineries (Choudhry and Fang, 2008). In 2016, the United States private industry recorded that out of 4,693 cases of fatalities reported, 21.1% were construction industry related, which suggests that for every five workers death in the year 2016, one death is recorded to the construction industry (OSHA, 2017). Apart from motorway collisions, the other major factors that contributed to worker's deaths is factors within the construction industry and includes causes like electrocution, falls, being struck by objects, and being caught in between machineries. These are called "Fatal Four", and about 63.7% of the construction workers deaths were as result of these fatal four, according to the BLS reports of 2016. Research shows that 631 workers lives would be saved annually if these fatal four can be prevented (BLS, 2017).

Meanwhile, the Qatari construction industries have become one of the largest industries in the world, with the country dedicating a large proportion of its annual budget to the construction sectors. The BMI Qatar infrastructure report predicted that there is probability of increase in the value spent by the industry by the year 2021, with the industry capable of contributing more portion to Qatar's GDP (Rawlinson, 2013). Consequently, health and safety of the construction workers have become an issue

of concern within the country. This is especially as over 500 workers died on construction site between 2013 and 2014 due to the construction work related issues (Gibson 2014). ITUC (2014) estimates at least 4,000 more workers will die before the start of the World Cup in 2022. The estimation of deaths in Qatar is conservative and based on the tragic statistics collected by two embassies only – Nepal and India – which account for around 50% of the total migrant workforce.

Due to the incessant rate of accidents and fatalities, health and safety has remained a paramount issue of concern within the construction industry. Musonda and Smallwood (2008) suggest that in developing countries, construction is the most hazardous activity therefore there is urgent needs to address the practices of its Health and Safety. Moreover, lots of efforts had been made to combat these challenges but the outcomes is still fall short of the recommended measures. This challenge has been a concern to both developed and developing countries, despite tremendous efforts that has been made to improve health and safety performance. Different countries have set up one or more accident prevention measures such as the development of safety engineering, to make physical environments safe, providing non-slip surfaces or railings and other mechanical factors that aid prevention of accidents and serve as barriers to dangerous mechanical accidents, and noise insulation, among others.

HSE (2002) suggests that most workplace related incidents and accidents are attributed to dangerous behaviours. Consequently, negligence of workers is a major cause of injuries and accidents that occur in most construction sites. Zin and Ismail (2012) argue that improvements on health and safety can only be attained if employee's behaviours towards safety are positive. This is further buttressed by Seo (2005), who opined that behaviour account for most of the causes of accidents and understanding and ability to modify the workers behaviour should be required to improving the occupational safety and health (OSH) performance of the industry. Behavioural approach improves safety by providing tools and procedures, for example safety training, incentives and compensation in addition to informational safety campaigns and interventions (Choudhry, 2012). In this approach, management are not concerned with changing the physical condition only, but rather concerned with improving safety by influencing employees' behaviour. It is therefore not surprising that behaviour-based safety (BBS) initiative is one of the trends in research and practice efforts toward improving safety performance (Al-Hemoud et al., 2010; Manu et al., 2017).

Although the behavioural safety has recorded significant success in many nations, such as the UK, Hong Kong and Finland as far back as 1988 (Mattila and Hyödynmaa 1988), and it is increasingly recognised as an effective approach for tackling health and safety issue in the construction industry (Manu et al., 2017), the concept has not been fully implemented in the Qatari construction industry. This is notwithstanding the high rate of accident and fatalities that has been recorded over the last three years. Worst still, the Qatari construction project team are multi-nationals and largely dominated by migrant

workers. This complicates the health and safety practices, especially as people from different nationalities and ethnics groups express themselves and understand the behaviours of others in different ways, which are informed by specific sets of cultural knowledge and conventions (Bust et al., 2008). As such, it is essential to understand the strategies for tackling the issues that are currently undermining health and safety management in the Qatari construction industry. In line with these, the aim of the study is to investigate the behavioural safety concerns on Qatari mega projects as well as the behavioural safety measures for tackling the challenges. The study achieves its aims through the following objectives:

1. To explore the behavioural safety concerns on Qatari mega projects.
2. To identify the prevalent behavioural practices that are contributing to the high rate of accidents and fatalities on Qatar mega projects.
3. To propose behavioural safety strategies for addressing the health and safety challenges on Qatari mega projects.

Based on factors identified from extant literature, a pilot-tested questionnaire was administered to site operatives and managers, and the returned questionnaires were analysed using reliability and factor analyses. The next section of the paper provides a theoretical background to the study by presenting a review of extant literature. This is then followed by the justification and explanation of the methodological approach to the study. Before culminating the paper in a conclusion and recommendation section, the findings of the study are presented and discussed. This paper provides a useful insight for addressing health and safety issues in the construction industry.

2.0. Literature review

The need for improving health and safety in construction workplace is a matter of top concern for construction industry across the world (Choudhry et al. 2007; Manu et al., 2019). The construction, manufacturing and agricultural industries are known for their high records of accident and occupational ill-health challenges. In the US, the construction industry was responsible for 20.5% of the accident fatality in 2014 (Kang et al., 2017) while it employed only about 5% of the population. In the industrialised world in general, the industry is responsible for about 20-40% of the fatal accidents (Aires et al., 2010). Between 2012 and 2014 alone, Qatar has recorded more than 500 workers of Indian origin killed in construction sites and over 382 Nepalese died within the same period of two years (Gibson, 2014b).

According to Hamid et al. (2004), several proactive measures are being made by construction industry to minimise the fatalities and incidence related to workplace accident. This is often attained through the

implementation and adoption of safety management systems that guarantee continuous management of worker safety throughout the construction activities. Li et al. (2015) highlight the need for the provision of safe system of work and safe working place as an effective safety management to reduce accident and the number of death and injuries in the construction industry. Earlier, Saarela et al. (1989) saw the use of the safety poster (informational campaign) to improve health and safety as less effective measure, stating in their argument that before positive change can be expected in serious accidents, the campaign material must be seen, understood and acted upon. Meanwhile the Qatari construction industry still practices the traditional approaches to safety management such as by focussing solely on improving the design of plant and machinery, risks minimisation, identification of work hazards, provision of personal protective equipment, and improved work methods. Regardless of the implementation of all these traditional approaches, the reports of the accidents and injuries in Qatari construction industry is still alarming. Therefore, it could be argued that the current approaches that are strongly rooted in the traditional approach are not sufficient to address the high number of occupational deaths (Sajwani, 2017).

Numerous studies have suggested that human behaviour either through action or inaction is a major cause of accidents at place of work (Haslam et al. 2005). In the field of safety science, unsafe behaviour remains popular. As far back as 1931, Heinrich stated that while estimating the direct causes of the accident, unsafe behaviour account for 88%, unsafe conditions account for 10%, while the remaining 2% are unpreventable. Other studies have also placed an important attention on unsafe behaviour, as the cause of the most accidents in many industries (Choudhry and Fang, 2008). HSE (2003) highlights that employee behaviour contributes to over 70% of the accident in the workplace. As such, behavioural safety approach has proven to be valuable in dealing with the occupational health and safety; and because of its success, many construction industries have recognised the approach as an effective means to achieve robust safety management system (Talabi et al. 2015).

The behaviour-based safety was first introduced in the United Sates and has overtime become a recognised manner through which people's side of safety can be managed. As more industries began to observe injuries at an accelerating rate, it became more obvious that having accessible safe equipment and hazard-free facilities was not enough in preventing accident; therefore, the focus was shifted to dealing with the behaviour of individuals. Different scholars have drawn various definitions among whom is Geller (2001) who highlighted that behaviour-based safety relates to a broader category of interventions such as plans, processes, approaches and tactics by which behavioural psychology principles are implemented to effect change to specific behaviours. Kaila (2010) explains that Behaviour-Based Safety highlights that employees ought to take responsibility for their own safety and avoid unsafe behaviours.

Several practices, conditions, methods and behavioural issues have been associated with the alarming rate of accidents and fatalities in the construction industry. According to Siriwardena et al. (2006) certain acts of nature can result in worker exposure to health and safety risk within the construction industry. They identified such natural acts as earthquakes, floods, typhoons, storms, landslides, tsunamis, volcanic eruptions and so on as posing high risk for workers on construction sites near areas predisposed to such events. Construction work is safer in favourable weather conditions with construction in rainy weather having great possibility of causing accidents from slippery scaffolds among other effects. Lucy et al. (1999) found human error and sometimes negligence, as a major cause of accidents and diseases in the construction industry. According to their finding, human behaviour is a key justifiable factor for most of the accidents recorded in the construction industry globally. The study further attributes errors in judgment, poor concentration at work, low awareness of safety risk exposure or its management, and poor usage of PPEs as major human factors that exposes workers to accidents and diseases on construction sites.

A study by Biggs and Williamson (2012) highlights that during an audit test for alcohol consumption, nearly 500 construction workers in Australia were discovered to be above the cut off score (8) for hazardous alcoholic consumption. This will certainly have effects on the workers' ability and safety during work time if they are over the legal limit. This problem is not only in Australia but also in the UK, where more pure alcohol is consumed than Australia; and, more importantly, as the global drinking habits are changing (United Nations, 2012). Similarly, Van Gordon et al. (2014) highlighted that employees in construction industries usually find themselves working under pressure in order to meet targets set for them by their supervisors or managers thereby making them to take shortcuts and work unsafely. As such, organisational or managerial negligence can put employees at risk of being involved in accidents. In line with this, Frederick and Lessin (2000) pointed out that workers are sometimes encouraged to perform tasks using or following risky procedures because doing so could appear to be typically easier, faster, and more efficient or convenient for them than following the safe procedures which sometimes appear to be longer winded and stressful. This could easily lead to situations where workers are involved in accidents.

Another area of safety consideration in such nations as Qatar is that the employees come from different countries to work there, leading to varying cultural background as well as communication challenges. This requires training manuals to be translated and training to be presented to employees in different languages. Hofstede (2009) suggests that cultural dimension theory expresses the effect that a society's culture has on value of its members and how behaviour relates to this value. Different cultural backgrounds may influence behaviours on site and could potentially cause cultural clashes leading to miscommunication and unsafe behaviour or practices at work. This study contributes to the argument

by investigating the behavioural safety influences and measures for enhancing safety in such as multicultural construction site environment as in Qatari mega projects.

3.0. Research Method

This study employs quantitative method to data collection and analysis by building on relevant factors established from extant literature. This approach is deemed suitable as it is the most suitable approach when a study is seeking quantifiable data that could be released to statistical treatment so that it can support or reject any different ideas (Creswell, 2003).

3.1. Quantitative Data Collection

In addition to brainstorming sessions, a review of safety practices and measures was carried out by identifying influences and strategies for behavioural based safety in construction industries across extant literature. The brainstorming session and literature review, according to Field (2013) is an effective approach for establishing variables for measuring constructs of questionnaires. The identified factors were then put into a questionnaire, which consists of three main sections including the demographics characteristics of the respondents, factors influencing unsafe behaviour and measures for engendering safety behaviour. The use of questionnaire ensures that the research instrument could reach a larger audience over a short period of time without any significant cost implication (Walliman, 2009). The questionnaire was put on a five-point Likert scale, where 1 represents strongly disagree and 5 represents strongly agree. It was then pilot tested before being administered through an online survey platform. In addition to the respondents' information, the questionnaire consists of two main questions, which were aimed at evaluating the extent to which the respondents agree that a set of factors influence unsafe behaviour and the extent to which the other sets of factors can help to address unsafe behaviour on construction projects.

The questionnaire was administered to site operatives and managers on Qatari mega projects through networks of personal contacts, snowballing techniques and networking platforms. Figure 1 illustrates the methodological framework, including the data collection and analytical processes. Overall, 115 completed questionnaires were returned by the respondents, and were used for the quantitative analysis through reliability analysis and exploratory factor analysis. Table 1 shows the distribution of the respondents, including job roles, years of experience and safety qualifications, among others.

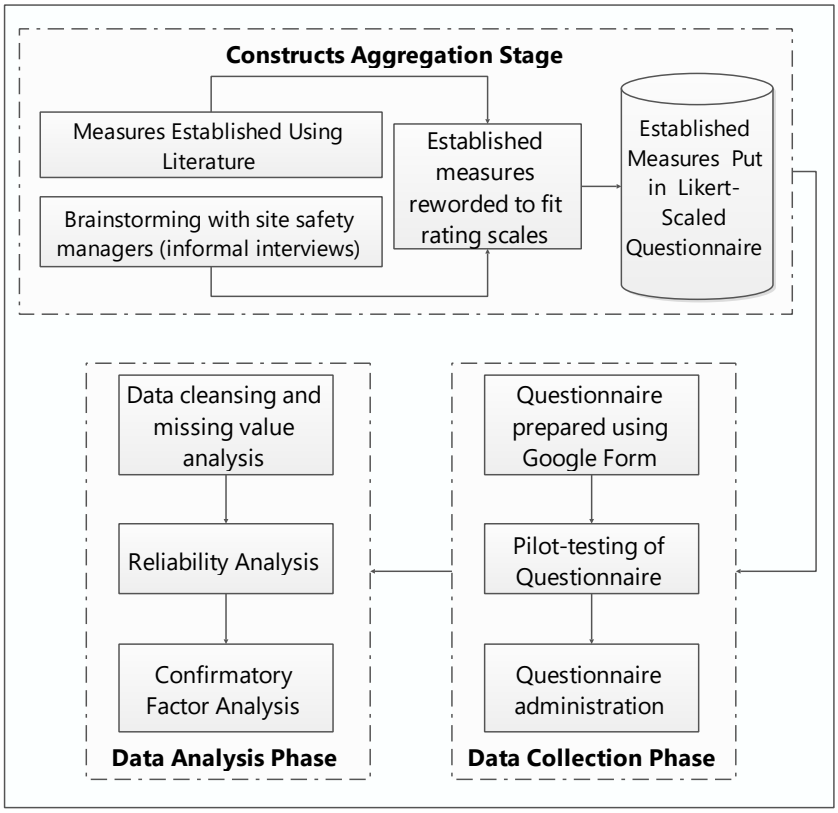

Figure 1: Overview of the methodological processes

Table 1: Overview of the respondents

Demographic characteristic	***Frequency***	***Demographic characteristic***	***Frequency***
Roles		**Safety Training**	
Carpenter	10	CSCS 1 Day	2
Electrician	10	On the job Safety Training	70
Equipment Operator	8	NVQ Modules	2
Iron worker	5	NEBOSH Certificate	18
Labourer	11	IOSH	1
Mason	5	NEBOSH & IOSH	19
Plasterer	5	No Safety Training	3
Plumber	3		
Pipe Fitter	4	**Education**	
Rod Busters	2	Secondary School or less	60
Welder	7	Bachelor's degree (B.Sc.)	49
Roofer	5	Master's degree (M.Sc.)	6
Painter	5	P. HD	0
Bricklayer	9		
Scaffolders	8	**Years of Experience**	
Safety officer/manager	12	0 - 3	21
Others	6	3 – 5 years	52
		6 – 10 years	30
		11 years and above	12

3.2. Reliability Analysis

The data analysis was carried out using reliability analysis and exploratory factor analysis. The reliability analysis was carried out to confirm the suitability of the data for further analysis and to remove any factor that does not contribute to the overall reliability of the constructs as recommended by Nunnally and Bernstein (2017). According to Field (2013), the value of Cronbach's Alpha ranges from 0 to 1, with a good internal consistency reflected by a value above 0.7. Using SPSS version 24, the Cronbach's Alpha Coefficient for the contributing factors in this study is 0.943 and that of the mitigating strategies is 0.936, both of which are excellent values (George and Mallery, 2003). A further evaluation test called "Cronbach's Alpha if item deleted" as suggested by Field (2013), was carried out to ensure that all items on the questionnaire are reliable and contributing to the good internal consistency. For this study, any item with Cronbach's Alpha coefficient above 0.943 for contributing factors and above 0.936 for the strategies indicate the item is not good enough and should be deleted from the list of variables. Based on this CF4 (0.944), CF22 (0.948), and CF24 (0.955) were deleted from the contributing factors while items MS10 (0.939), MS14 (0.937), MS21 (0.937) and MS36 (0.937) were deleted from the strategies as recommended by Field (2013). The remining factors were used for further analysis.

3.3. Factor Analysis

Exploratory Factor Analysis (EFA) was carried out to establish few uncorrelated influences and strategies for engendering behavioural safety practices in the Qatari construction industry. According to Tabachnick and Fidell (2001), the process of carrying out an EFA involves three steps, which are confirmation of data suitability, factor extraction and factor rotation. Kaiser Meyer Olkins (KMO) and Bartlett's test of sphericity were evaluated to determine the data suitability, as a value above 0.5 for KMO and a *p*-value below 0.05 for the Bartlett's test of sphericity confirm suitability of the data (Malhotra and Dash, 2009; Field, 2013). In this study, the KMO coefficient for the contributing factors and strategies were 0.932 and 0.853 respectively, both of which are excellent values (Malhotra and Dash, 2009). Similarly, the *p*-value for the Bartlett's test for the contributing factors and mitigating strategies are 2.854E-10 and 2.2223E-228 respectively, both of which are within the acceptable threshold (Field, 2013). In line with Field (2013), the diagonal of anti-imaging matrix was examined to exclude any factor with a diagonal value of less than 0.5. On examining this, none of the factors has its anti-imaging diagonal value below the acceptable threshold.

Factor extraction and rotation were carried out using Principal Component Analysis (PCA) and Equamax with Kaiser Normalization respectively. Factors that loaded in more than one component were removed as recommended by Tabachnick and Fidell (2001). The result produced four component factors for the factor contributing to poor behavioural safety and six (6) component factors for the

strategies for engendering behavioural safety on construction sites. Findings of the factor analysis and reliability analysis are presented in Table 2 and 3.

Table 2: Exploratory factor analysis and Cronbach Alpha for contributing factors.

	Extracted and rotated components	*Factor loading*	*Eigen value*	*% of variance*	[a]*Cronbach Alpha if item deleted*
A	***Lack of adequate safety knowledge***		***7.306***	***27.527***	
CF 5	Operating machine at unsafe speed	0.821			0.938
CF 8	Poor maintenance of machine	0.849			0.938
CF10	Protective equipment and guards provided but not used	0.792			0.938
CF11	Using of improper tools for different job category	0.764			0.938
CF13	Ineffective safety device usage on site	0.858			0.937
CF14	Irregular and hazardous housekeeping	0.778			0.937
CF17	Poor concentration at work due to personnel issue	0.763			0.939
CF19	Low awareness of safety risk exposure	0.861			0.937
B	***Employees' poor disposition to safety***		***4.835***	***23.023***	
CF1	Exposure of workers to unfriendly weather	0.637			0.940
CF2	Excessive noise on site contributes to negative safety behaviour	0.424			0.943
CF3	Negligence by employees	0.731			0.939
CF12	Alcohol consumption by workers	0.752			0.938
CF23	Workers rewarded for performing task at unsafe manner	0.584			0.941
C	***Putting production ahead of safety***		***3.043***	***14.492***	
CF6	Employees working under pressure to meet production deadlines	0.414			0.938
CF7	Employee work unsafely due to the fear of losing their jobs	0.475			0.942
CF15	Forcing workers to meet production deadline	0.710			0.939
D	***Improper safety gear***		***2.362***	***7.263***	
CF16	Worker improper dressing or apparel for job	0.808			0.938
CF20	Non-availability of personal protective equipment	0.853			0.937
CF21	Poor usage of PPE	0.823			0.937

Note: a – the Cronbach Alpha coefficient for the contributing factor is 0.943.

Table 3: Exploratory factor analysis and Cronbach Alpha for mitigating strategies

No.	***Extracted and rotated components***	***Factor Loading***	***Eigen Value***	***% of Variance***	[a]***Cronbach Alpha if item deleted***
1	***Proactive Approach towards Safety by the Management***		**3.582**	**11.193**	
MS32	Site management constantly laying good example for safety through the way they behave safely.	0.726			0.932

MS33	Barriers around excavations	0.642			0.933
MS34	Regular checking of ladders	0.648			0.933
MS35	Regular checking of scaffolds and platforms	0.666			0.933
2	**Effective Communication and Feedback**		**3.390**	**10.595**	
MS15	Regular observations and feedback	0.738			0.932
MS16	Sanction policy to control unsafe act	0.602			0.933
MS17	Conducting regular meetings on safety by trained safety personnel	0.702			0.933
MS20	Developing new safety rules and regulations	0.615			0.933
MS25	Site communication by management	0.786			0.932
3	**Provision of adequate equipment and safety monitoring**		**3.120**	**9.975**	
MS26	Constant safety monitoring apparatus on site	0.530			0.934
MS27	Proper risk response and risk management system	0.500			0.934
MS28	Adequate equipment that is aligned with the nature of the work	0.548			0.934
MS31	Swift response on safety violation	0.475			0.935
4	**Safety Education and Training**		**2.864**	**9.462**	
MS5	On the job safety training	0.512			0.935
MS24	Safety education and training on safety	0.589			0.933
5	**Safety enforcement and appraisal**		**2.792**	**8.561**	
MS11	Continuous improvement on safety inspection	0.535			0.934
MS12	Effective governance and strict regulations	0.529			0.934
6	**Safety Policy Efficiency**		**2.534**	**7.918**	
MS3	Stress free working environment	0.565			0.934
MS4	Regularly updating safety information	0.558			0.934

Note: a – the Cronbach Alpha coefficient for the mitigating factor is 0.936.

4.0. Discussion

Based on the objectives of the study, the findings of the study are discussed under two headings. The first section discusses the factors contributing to inadequate behavioural safety, while the second section discusses the strategies for engendering behavioural safety in Qatari construction industry.

4.1. Factors Hindering Behavioural Safety among the Site Operatives

Based on the findings of the exploratory factor analysis, the four factors that contribute to inadequate behavioural safety are discussed in this section.

4.1.1. Lack of Adequate Safety Knowledge

With the highest percentage of variance at 27.527%, lack of adequate knowledge of safety practice is considered to be the main factor contributing to unsafety behaviour. Inadequate safety knowledge in this case encompasses a scenario where an employee may have a low perception of the risks associated with their workplace activities or task. According to Li (2019), this may further be influenced by the employee's ability to make accurate and timely decision based on their cognitive ability which supports their tendency for spotting the hazards to prevent accident occurrence. Even when the management provide adequate safety device, some employees are naturally inclined than others to take risks. In a study carried out by Musonda and Smallwood (2008) in Botswana, it was found that only 4% of site workers wore eye protection gears. Although the study was carried out many years ago, it helps to explain the current situation on Qatari Mega projects, where some employees are either not well informed of the outcome of operating machine at unsafe speed or are left to be operating machine on their own because they claimed to have many years of experience of doing the work while failing to follow the established safety procedure.

On the mega projects, instances of unsafe behaviour include working on a forklift at unsafe speeds which could lead to accident with other vehicles and even with other employees, with the operators claiming that they are placed under pressure by their supervisor. This could explain the reason why Qatari mega projects have been known for poor safety outcome as Van Gordon et al. (2014) highlighted that a major cause of accident in the construction industry is because of employees usually finding themselves working under pressure to meet targets set by supervisors or managers thereby making them to take shortcuts and work unsafely. This even becomes more dangerous when lethal chemicals, dangerous machinery or working at height is involved. Housekeeping is one of the most reliable measures encouraging a company's attitude towards production, quality, and worker safety but poor housekeeping poses many hazards that can lead to tripping or falling. Congestion on site is another unsafe condition as it sets the stage for limited and insufficient working space, which can lead to occupational injury or accidents. While all these pose health and safety risks on their own, a combination of all these unsafety activities are recipe for looming disaster on construction sites.

4.1.2. ***Employees' Poor disposition to safety***

This group shows total variance of 23.023% in this category for factors contributing to employee's unsafe behaviour, and it is considered as the second factor contributing to unsafe behaviour among construction workers on Qatari Mega Projects. Basically, safety could be enhanced when employees are working under friendly or favourable weather and under severe weather if adverse weather policy

is in place (Khosravi et al., 2014). If the employers do not have provision for adverse weather policy, the employee would not be able to know what is expected of them when they find themselves in such a situation and this leads to confusion on site which in most cases cause a negative safety behaviour on the side of the employee. Employee working in bad weather could lead to accidents from slippery, scaffolds falling, electrocution, and several other hazards that may be worsen by hot weather. Coupled with the adverse whether condition is the excessive noise at construction sites which could prompt temporary hearing loss that could subsequently contribute to accidents at work. In addition, an exposure to uncontrolled level of noise above regulated level on site resulting from such site activities as explosions, hammering, welding, heavy equipment and other machinery noises could cause occupational deafness or loss of concentration, which may result in other health risk exposures (Wu et al., 2020).

Apart from weather, noise and other environmental hazards that may increase susceptibility to accidents, some workers are negligent of safety procedure. This could be due to being under the influence of drug and alcohol (Flannery et al., 2019) or when they are actually rewarded for getting the job done on time irrespective of whether an unsafe procedure has been used or not.

4.1.3. Putting production ahead of safety

Safety goals can be inhibited on construction site if production goals and meeting deadline are put ahead of safety procedure (Kines et al., 2010). While the construction industry is constantly under pressure to meet the cost, time and quality targets, it is essential that site safety is adequately prioritised to protect all site workers. However, with this factor group having a variance of 14.492% which puts it as the third factor leading to unsafe behaviour, it does suggest that the urgency of getting the mega projects completed within a short period could be contributing to unsafe behaviours among the employees. Manu et al. (2014, 2017) in their study of the accident causal impact of construction project features reported that a constrained project duration induces time pressure on site, which influences accident occurrence.

On a typical construction site in Qatar, there are often different categories of workers with capacity ranging from those who can read and understand safety instruction and those that will need further interpretation (Amnesty International, 2013; Theodoropoulou, 2019). In such instances, a very clear instruction becomes essential for expected safety behaviour standard. However, when management places production above safety, this has a high negative influence on the motivation and knowledge of the employees who are already disadvantaged by poor literacy level or language barriers. This buttresses the early findings of Loosemore et al. (2010), which suggests that language barriers does not only prevent adequate interaction among site workers but also complicate safety management practices on construction sites.

The study suggests that employers trying to meet deadlines has eroded safety behaviour and encourage increased risk-taking behaviour among construction site employees. For instance, the finding suggests that some construction employees on site prioritise meeting target over following the safe system of work, using the right tools and equipment for their work when they are behind schedule. In addition, working for a longer than the working hours to meet up the target is found to be the norm for many site workers. This increases fatigue and accident proneness for the construction workers (Shao et al., 2019). When an employee is under the pressure of production, coupled with the management turning a blind eye on safety as a result of the needs to meet a target, the outcome is not only a safety risk but a threat to life of the employees (Kines et al., 2010). Additionally, the study suggests that there isconsumption of alcohol among the workers, which according to Flannery et al. (2019) could be a means of coping with the work pressure notwithstanding its elevated health and safety risk.

4.1.4. Improper safety gear

The use of safety gears, also known as PPE, such as hardhats, gloves and goggles, among others is very important for workers in the industry that reports the highest fatal injury every year (HSE, 2018), and could ultimately be the difference between life and death. However, a major factor that contributes to the high level of accident and fatalities on the mega project is an improper use or lack of appropriate safety gears to be used by the workers. In some cases, the employee decides not to use the personal protective equipment or the appropriate one because they are trying to get the job done on time, with an example being some workers deliberately ignoring the use of a guard while using a cutting machine.

Improper dressing or apparel for job is another unsafe behaviour that poses a threat to the health and safety of construction workers. This is a scenario where the workers will not be properly dressed as required for their job-specific roles on site, with some workers wearing sandals or bathroom slippers or other forms of shoes outside the recommended toe steel cap safety shoe. While workers could be blamed for not using the appropriate gears for work, some workers claim that their employers fail to provide them with personal protective equipment (PPE) as required by the health and safety regulation. Where employers fail to provide the safety gears, workers disposition to health and safety concerns will be negative, with outcomes likely to be an increased number of accidents on construction sites (Ismail et al., 2012). As such, it is important that workers are sensitised of their health and safety risks management by providing them with appropriate safety gears.

4.2. Strategies for Enhancing Behavioural Safety in Qatari Construction Industry

Based on the findings of the exploratory factor analysis, the six strategies for entrenching behavioural safety are discussed in this section.

4.2.1. Proactive Approach towards Safety by the Management

This group shows the highest percentage of variance at 11.193%, indicating that a proactive approach to health and safety management, including regular check of equipment and machinery is the best approach for engendering behavioural safety among the employees. As the group name, 'proactive approach towards safety by the management', implies, health and safety managers and other members of management team need to do everything reasonably possible to avoid occurrence of accident or illness rather than be reactive where concern is shown after an illness or injuries. When the management emphasizes proactive approach towards safety, it sends positives message to the employees, which positively influence their safety behaviour (Li et al., 2015). This could be achieved by management ensuring adequate barriers are erected around excavations on site to prevent accident and regular checking of ladders to prevent falls from heights. This is especially important as falling from height is one of the major safety hazards in construction (Li et al., 2015). The management must ensure that ladders used as means of access and egress are well constructed, properly secured and people who use the ladder are properly trained to avoid accidents. With the collapse of scaffolding, its lack of protection against falling or objects falling from it is a major contributory factor to accidents on site (Carbonari et al., 2011). It is expected that scaffolds are erected by the certified scaffolding company and inspections are carried out as stated in the health and safety regulation. These measures will not only prevent accidents on construction sites but will also make the site operatives aware of their health and safety responsibilities, thereby behaving in a more safety conscious manners.

4.2.2. *Effective Communication and Feedback*

Effective communication between the employee and management is the cornerstone of healthy organization safety culture, as this gives room from prompt hazards identification and reports from the employee and prompt response from the management side to mitigate the reported hazards. The requisites of this measure to drive safety consciousness as well as accident reduction is confirmed by the findings of the factor analysis, with the component having a variance of 10.595%, which places it as the second ranked measure. Any hazards that employees come across while carrying out their duties will be reported if a clear line of communication is established (Ismail et al., 2012). According to Glendon (2008), an effective communication between the management and employee will establish a relationship and trust among them. To aid the process of safety risk identification, communication, and

mitigation, it is important that hazards identification and correction process are effectively standardized, whilst still being able to further enhance the correction process.

Management commitment is essential to engendering safety behaviour among site operatives on construction sites (Ismail et al., 2012). Previous studies by Choudhry et al. (2007) and Ismail et al. (2012) argue that those companies with strong management commitment are associated with low accident records and are more likely to improve their safety performance compared to companies with no management commitment. For an organization to develop a positive safety behaviour among its employees, the demonstration of the strongest possible commitment on regular basis are required from the top management. The management team could further stimulate behavioural safety by means of regular observation of the activities going on the site and by giving prompts feedback to the employee that raise a concern on the health and safety matter. The use of carrot and stick approach, where poor safety behaviours are penalised and expected level of safety performance are praised or rewarded will help in raising safety consciousness among the employees (Guo et al., 2018). The management team is expected to place a strict sanction policy on non-compliance of the established safety rules irrespective of the position of the defaulters as this will deter others from taking unnecessary safety risks.

4.2.3. Provision of adequate equipment and safety monitoring

The use of adequate PPE is essential to preventing accidents and fatalities on construction site, which is unfamous for having higher rates of fatal accidents than most industries (HSE, 2018). Findings suggests that due to the urgency of the Qatari mega projects, getting job done is sometimes prioritized over safety ways of doing the job, which in turns put health and safety of the workers at risks. As a result, turning the tides on the incessant rates of accidents and fatalities requires that appropriate safety gears be not only provided, but the safety management team should also adequately monitor and ensure that employees are using equipment and gears that are suitable with the nature of works being carried out. Failure to monitor this implies that the safety managers may unconsciously encourage risky behaviour by failing to enforce safe behaviour and failing to reproof risky behaviour on construction sites (Choudhry and Fang, 2008).

The management's commitment to mitigating safety risks could be further demonstrated by ensuring that a safe working environment is ensured, and adequate provision are in place towards housekeeping. This is especially as a tidy workplace helps with reducing the accident of slips and trip which is one the most common accident in the construction industry (Whiteoak and Mohamed, 2016). Furthermore, management should ensure that workers do not work beyond the legal normal hours and provide overtime allowance for exceptional cases where they do.

Xu et al. (2019) suggest the need for collaborative safety monitoring approach to contain preparation layer, monitoring layer, integration layer, reporting layer, and intervention layer, which are essential for reducing the safety risks and engendering behavioural safety among employees. With the advent of latest technologies, the use of safety monitoring apparatus as a non-verbal means of communicating safety hazard in addition to verbal communication could help in instigating safety behaviour on construction sites (Park et al., 2018). This may include the use of noise monitoring and cancellation devices, IoT sensors, RFID tags, and vision camera among other automated approaches for health hazard monitoring and mitigation.

4.2.4. Safety Education and Training

Behavioural intervention could be achieved when adequate and comprehensive safety education and training are given to the employees (Khosravi et al, 2014). This training can be systematic and planned in line with the nature of the activities to be carried out. This is done to improve and develop skills and behaviour of the employees as well as the management team. Guo et al. (2018) considered safety training and education as one of the most effective tools for promoting safety behaviour in the construction industry. In addition to training, which may have its impacts hindered by the language differences among the multinational workers on a mega project, the use of the safety signs and training as strategies for improving safety behaviour is vital to get safety messages across on the construction sites. It is, therefore, the responsibility of the employer to ensure that their employees are familiar and have the clear understanding of the safety signs related to their workplace, especially as the safety signs may be difficult to understand for inexperienced employees who may not understand some uncommon signs.

4.2.5. Safety enforcement and appraisal

Workplace inspections help prevent incidents, injuries, and illnesses (Li et al., 2015). Through a critical examination of the workplace, inspections help to identify and record hazards for corrective action. Health and safety committees can help plan, conduct, and report and monitor inspections. Regular workplace inspections are an important part of the overall occupational health and safety program and management system, if present. Appraisal for working safely will encourage employees to put in their best knowing that their employer values safe ways of work and that they could be penalised or excluded for unsafe methods of work regardless of whether they cut corners to get the job done. According to Stajavkovic and Luthans (2003), one of the most powerful incentives influencing job performance is the supervisory feedbacks and recognition. As such, giving feedbacks and incentives as carrot approach as well as penalty or exclusion as a stick approach will engender safety behaviour among construction site workers.

The involvement of managers plays a pivotal role in the success of behavioural-based safety programme. It shows the importance of safety matters in an organization, as worker are encouraged to co-operate. This cooperation helps to drastically reduce injuries at the workplace. Managers may unconsciously encourage risky behaviour by failing to enforce safe behaviour and failing to reproof risky behaviour (Choudhry and Fang, 2008). To reinforce good practice, the employee who reports safety concerns or hazards should be rewarded or at least praised and their concerns should be acted as a matter of urgency as this will encourage others to report any safety concerns in the future (Guo et al., 2018). However, when the employees notice that the safety supervisor turned a blind eye to their unsafe method of work, whether due to their incompetency or as a result to the urge to get the work done quickly, this will quickly erode safety consciousness of the workers with the consequence being a potential health hazard on construction sites.

4.2.6. Safety Policy Efficiency

Efficient safety policy is essential to driving safety behaviour on construction site, as this provides a guide for identifying, monitoring and mitigating safety hazard on sites (Carbonari et al., 2011). Safety policy is a way an organization can express its commitment in prioritising safety in workplace (Torner and Pousette, 2009). The component group labelled 'safety policy efficiency' suggests that it is essential that the safety policy is formulated and regularly monitored for an organisation to effectively engender safety behaviour in the site workers. With the construction site being one of the most dangerous and hazard prone places to work (OSHA, 2017), a clear policy guidance on hazard identification, reporting and mitigation will give a sense of direction and its significance to the site workers who are expected to report any safety risk identified and behave in a safety conscious manner. Notably, having high standard policies will bring about collective values and individual attitudes that will foster better safety performance as well as positive management attitudes (Torner and Pousette, 2009). Such safety policy is not only expected to cover physical hazard on the construction site, as other health-related and psychological hazard could also constitute a safety risk. For instance, stress and associated fatigue, which may not be considered in a safety policy, could significantly contribute to the risk of accident on construction site (Shao et al., 2019). It is, therefore, essential that the safety policy consider both site environment specific risks as well as those related to work patterns and wellbeing of individual workers on the construction site. Other ways of sustaining the behaviour-based safety system include regular update to the observation checklist, conducting trainings for all employees, and appropriate feedback mechanism from managers. With an adequate and sufficient safety policy in place, the wellbeing of the employee such stress management, alcoholism and drug misuse at workplace would be adequately addressed.

Conclusion

The tendency of accidents occurring at our workplace, for example construction site, which this research is focused on, is high because of its uniqueness compared to other places of work. While incidences may not be totally eradicated from construction sites, its occurrence rate can be reduced to the minimum when all employees behave in safety-conscious manner. Using questionnaire as a means of quantitative data collection, as well as reliability analysis and exploratory factor analysis for getting insights from the data, this study investigates the causes of the unsafe behaviour among the construction employees in Qatar mega projects, which is infamous for high rate of accidents, and how to implement an effective behavioural approach to mitigate the occurrence of accidents on the mega projects.

Evidence generated from this study suggests that the level of safety awareness by employees on sites may be low, with some of the employees not complying with safety rules and regulations of which in-turn would leave workers being exposed to different hazards. This is further compounded as many of the employees have less than 5 years of experience of working in construction.

With the urgency of most of the mega projects, which are meant to be ready ahead of the 2022 World Cup, quick project execution is very important on the construction sites. The implication of this is that despite that many construction teams are often under the pressure of getting project delivered on time, within the targeted cost and with the right quality, the mega project teams are even under more pressure of getting the projects delivered ahead of the world cup. This may explain the reason why the evidence suggests that production is put ahead of safety if the work is done, regardless of whether the health and safety is put at risk. This implies that workers deliberately cut corners in their use of safety gears which could rather make a difference between life and death when accident occurs. In addition, working for a longer than the working hour to meet up the target increases fatigue and accident proneness for the construction workers. In addition, the finding suggests that an improper use or even lack of safety gear is another practice that contributes to the high level of incidents on the mega projects. When workers failed to use the personal protective equipment or the appropriate one either because they are trying to get job done on time, their lack of adequate knowledge coupled with the supervisors turning a blind eye, the outcome is usually a high rate of accidents with fatality.

The study suggests that a proactive approach towards safety is expected of the management in order to reduce accidents on the mega projects and engender behavioural safety on the site operatives. This could involve adequate analysis of safety risks ahead of construction activities with precautionary measures effectively put in place to prevent foreseeable accidents. Once the activities have commenced, it is also essential that regular observation and appraisal of safety practices and behaviours are carried out during the construction activities. This will ensure that unsafe practices are penalised, and safety behaviour and practices are recognised and praised to engender behavioural safety. Ahead of rewards and penalties, adequate training should be given to the workers as parts of their induction process as

evidence shows that many of the craftsmen lack adequate knowledge of site safety. The supervisory team have a significant role to play in leading by examples and demonstrating their commitments to behavioural safety through the carrots and stick approaches and by providing adequate safety gears for the site operatives. This is especially important as the supervisors could significantly influence the workers' disposition to safety and risky behaviours on construction sites.

Other measures that are important for engendering behavioural safety include an effective communication of safety risks, behaviour and practices on the construction sites. Construction sites of most of the mega projects are truly multinational with the employees coming from different parts of the world, mainly from Africa and Asia. The language differences among the employees complicates safety management practices in the Arab regions where some of the workers are unable to speak either Arabic or English language. It is therefore that safety signs are used, and safety induction is conducted for the new worker in languages they understand. This could be facilitated by their co-workers who speak their language as well as English language that is mainly used on the construction sites. This will ensure that every worker understands their responsibility regarding health and safety on construction sites.

This study was carried out on mega projects, and the findings and recommendations are specifically for the mega projects as the dynamics on these projects, due to their scale and complexity, can be different to other projects. Further studies could focus on other Qatari construction projects to understand the relevance of the recommended strategies for engendering behavioural safety on other projects. In addition, the study focussed on engendering safety behaviour to improve health and safety performance on mega projects in Qatar. Other site safety management measures, than behavioural approaches, could be further explored.

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