Safety in Building Construction Works: A Review of the Causes of Accidents and Safety Regulations Requirements in Kenya

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Abstract

The construction line of work is one of the adequately regulated fields but still perceived to be the riskiest. Notwithstanding the fact that numerous accidents stay unreported, the unrelenting accidents figures from Kenya and globally indicate that the construction industry is a long way from arriving at the aim of zero injuries. Hence, the need to appraise the causes of accidents in building construction works, evaluate the safety regulations requirements, and recommend strategies towards minimizing the accidents in Kenya. It was revealed from the reviewed works that, falling from height and lack of constant worker safety training were the top-most direct and underlying causes respectively behind most fatalities and injuries in building construction sites. The literature findings also postulated that, the fundamental safety regulations requirements entail the following aspects: safety training, medical surveillance, reporting and investigation of accidents, and maintenance of safety records. Consequently, this study advocates the following: provision of commendatory training resources to workers, participation of employees in safety decision making, daily site meetings with workers, reconnaissance of workers' health, whistle blowing to get rid of unscrupulous contractors, safety records to be maintained (either in paper or electronic format with appropriate backups to safeguard the documents in case the computer crashes or the system fails), the government to direct all contractors to post a summary of accidents and safety violations recorded the previous year on their websites (this will trigger a safety cognizant culture among the contractors since none of them will want the image of their organization to be tarnished and its character harmed before the customers), and lastly, employment of innovations in effectuating the safety regulations requirements in building construction works.

Keywords: **Maintenance of Safety Records; Medical Surveillance; Reporting and Investigation of Accidents; Safety Training**

Introduction

According to Safeopedia (2018), safety incorporates all initiatives and courses of action taken to protect the life and physical integrity of people. The construction line of work is an integral industry of the economy in numerous countries and frequently observed as a constituent of economic growth, particularly in developing nations (Muiruri & Mulinge, 2014). Nevertheless, the construction industry is simultaneously perceived to be the riskiest (Al-Kilani, 2011; Ogetii, 2019). Consistently, many individuals succumb to injury and even death brought about by accidents in building construction projects (Kadiri et al., 2014). Research conducted by Zhou et al. (2019) in China indicated that, the number of accidents each year from twenty sixteen to twenty eighteen escalated considerably. The researchers further stated that, in twenty eighteen, there were seven hundred and thirty-four production accidents and eight hundred and forty fatalities in construction undertakings. According to Vongpisal and Yodpijit (2017), in 2011, the construction industry in Thailand experienced 80 fatalities, 47 workers were permanently disabled and 9,148 were injured. In Kenya, a wall adjacent to the construction site on General Mathenge Road in Westlands, Nairobi County, crumbled due to loose soil, killing four construction workers and ten others were left injured (Wanja, 2016). Additionally, a crane caved in from a fourteen-storey building under construction in Hurlingham, Nairobi County, killing nine construction workers while one survived the crash and was rushed to the hospital for treatment (Ombati, 2021). The accident statistics as presented above make safety advancement one of the pertinent issues within the construction industry.

One way in which collaborators in the construction industry have attempted to reduce accidents and fatalities is through occupational safety regulations (Ogetii, 2019). Every country has its Act and policies that governs the aspects of occupational safety. In Malaysia, the Department of Occupational Health and Safety (DOSH) is responsible for enforcing the Occupational Safety and Health Act of 1994 and the Factories & Machinery Act of 1967. In Section 15 (1) and (2) of the 1994 Act, employers are directed to make sure that, at the job site, workers are not exposed to any perils (Awang et al., 2019). The enactment of the Occupational Safety and Health Act (OSHA) 2007 marked a new beginning in the administration of occupational safety services in Kenya, that entails all workplaces (Kemei, 2019). This Act requires all industries to formulate strategies and rules that domesticate it. The primary aim of OSHA 2007 is to promote and instil safety culture among all Kenyan workforce (Kenya Law Reports, 2010). Another supreme law that governs occupational safety in Kenya is the Work Injury Benefits Act (WIBA) enacted in 2007 (Kenya Law Reports, 2012). The purpose of WIBA 2007 is to give compensation to workers for job-related injuries and illnesses caught over the period of their employment and for associated reasons. The Directorate of Occupational Safety and Health Services (DOSHS) manages OSHA 2007 and WIBA 2007. While reviewing national occupational safety and health canons is the responsibility of the National Council for Occupational Safety and Health (NACOSH), whose structure incorporates the Federation of Kenya Employers and the Central Organization of Trade Unions-Kenya (Maina, 2014). There are other laws that touch on occupational safety in Kenya, but other government ministries and corporations manage them. For example, the Employment Act of 2007 and the National Construction Authority Act number 41 of 2011. The NCA Act incorporates provisions on safety standards of any construction undertaking (Kemei, 2019).

The safety regulations ordinarily outline fundamental risk minimization actions and minimum prerequisites that businesses or people must adhere to. For example, in Kenya, under section 99 of the OSH Act 2007, no individual ought to be engaged in whichever undertaking at a building construction site except if that individual has acquired indispensable information, guidance and training to be able to execute work efficiently and securely (Kenya Law Reports, 2010). Any individual who neglects to consent to any of the requirements set down in section 99 perpetrates a crime and will on sentencing be obligated to pay a fine not exceeding 200,000 Kenyan shillings or to imprisonment for a period not exceeding half a year or to both. Furthermore, even talented and seasoned employees need refresher instructions and training when abilities are not habitually utilized (Gul, 2014). Apart from training, safety regulations requirements also cover other fundamental aspects such as medical surveillance, reporting and investigation of accidents, and maintenance of safety records. Despite the comprehensive regulations that cover the various aspects of occupational safety, the status of safety in the construction industry has not significantly changed. Hence, the need for the paradigm shift proposed by this paper.

Scope of the Study

The scope of this paper is to appraise the causes of accidents in building construction works, evaluate the safety regulations requirements, and recommend strategies towards minimizing the accidents in Kenya.

Causes of Construction Accidents

The initial step for finding probable solutions to the safety issues experienced during execution of construction undertakings is to appraise the most significant causes of accidents requiring intervention. Many researchers have investigated the main causes (direct and underlying causes) of accidents in diverse construction industries. For instance, if a construction site operative is harmed by objects tumbling off racking, the objects dropping and striking the worker is an immediate/direct cause while poor maintenance of the racking could be a hidden/underlying cause. Research by Zhang (2014) indicated that, in the United States of America, a substantial fraction (35%) of the overall fatalities was due to falls, followed by transportation (26%), collision with objects and paraphernalia (18%), subjection to dangerous materials (15%) and others (6%). A study by Mordue (2020) in the United Kingdom also revealed that the stake of falling accidents was the largest, representing 59%. Ahmed (2019) links the direct causes of accident with the following top five underlying factors: unawareness of welfare-related issues, failure to utilize personal protective and safety equipment, lack of information and training on apparatus, failure to design for safety and ill-suited tools. Besides, the fundamental contributing/underlying components for most construction deaths and injuries incorporate: unsuitable task planning and management, inadequate correspondence among site workers and administrators and absence of safety training and conventions (Behringer, 2013). According to Dangoriya (2020), inadequate supervision of laborers with health conditions such as respiratory issues and phobia from heights might also lead to construction accidents.

In the Egyptian construction industry, absence of housekeeping and absence of administrative assessment for safety were positioned as the most elevated reasons for site accidents while shortcoming of old safety gear/no safety gear at all and hesitance to put resources into safety were positioned as the least drivers of site accidents (Elsebaei et al., 2020). The findings by Elsebaei et al. (ibid) contradicts those of Kiconco et al.

(2019) who argued that the main reasons for construction accidents are defective apparatus, absence of appropriate workers' safety training, overcrowding in building construction sites, deficient oversight, low-quality materials, mental issues and insufficient lighting for night shift laborers. According to Kibe (2016), the leading root causes of accidents in construction projects include: tumbling from stature, slips, plummeting objects, handling and physical attacks. These results are in line with those of Zhang (2014) and Mordue (2020) who identified falling from height (direct cause) as the top most contributor to construction accidents. Kibe (ibid) also identified absence of workers' safety training as the prime component that influenced the implementation of safety measures at job sites. A recent study by Kagai (2020) acknowledged that construction accidents are brought about by numerous variables among them being the crumbling of structures under development, plummeting rubble, subjection to high voltage wires, laborers inability to utilize defensive gear, tumbles from stepping stools, defective apparatus, blasts, absence of appropriate workers' safety training and inconsiderateness when utilizing heavy equipment, for example, cranes.

The following direct causes of accidents have been observed to be the most significant and therefore, will be adapted by this study: fall from height, collapse of structure or machine (inadequate structure), the failure of support (unsafe formwork erection), struck by moving vehicle (improper planning of layout), trip and fall (due to obstacles and uneven surfaces), crane colliding with building structure/other cranes, being hit by falling objects, electrical hazard and fire outbreak (due to unsafe means of access and egress). At the same time, the study will adapt the following underlying causes of construction accidents: lack of workers' safety training, inadequate personal and protective equipment, unsafe condition of equipment for operation, lack of effective communication, workers disregarding safe work practices, acquiring staff from previous building construction projects, absence of a site supervisor to ensure that construction workers are observing safety measures, lack of effective site planning, lack of safety reporting culture, closeness of workers to the operation of construction plant and equipment, job site becoming congested, worker health condition, lack of consideration of safety in planning and design stages, absence of stocked emergency treatment kits at building sites and lastly, absence of top management aid in the administration of safety in job sites.

Accidents Causation Theories

With regard to safety management in construction, various paradigms have been formulated in the past to give a theoretical establishment for identifying the main causes of accidents. The domino theory and the Swiss Cheese model concur that the physical environment is always a possible cause of accidents. Based on the updated domino model by the British Safety Services (2011), the cycle of occurrences starts with "External Factors", for example, acquiring staff from previous building construction projects. James Reason's Swiss cheese model indicate that, the openings in a slice of Swiss Cheese are not fixed; they shift randomly, may unlatch, or seal and transform in magnitude constantly relying upon the circumstances and the environment of the system. The enhanced variant of the Swiss Cheese model is not restricted to explicit number of protective shields (Forestell, 2019). An assortment of defence guards can be adjusted to this paradigm from various organizational conditions relying upon the outlay of the danger involved. Thus, the contemporary way of accident modelling has shifted towards perceiving that, accidents come about because of interacting factors that happen in certifiable conditions and it is only through the

network relationship that they can genuinely be understood and forestalled/mitigated. Kibe (2016), Kemei (2019) and Ogetii (2019) have conducted research on construction safety in Kenya. Despite their extensive research, the versions of accident causation models that underpinned their studies are now antiquated as there exists enhanced versions of the models that offer different perspectives and can be used in identifying the main causes of accidents that require intervention. Nonetheless, the accident causation theories require unearthing of direct and underlying causes of accidents as the first step for finding probable solutions to the safety issues since construction activities are performed in a continuously transforming environment.

Safety Regulations Requirements

a) Safety Training

In spite of the fact that a large portion of an employee's skills can be acquired at work, safety is one of the abilities that is best cultivated before site workers commence construction activities (Hojati, 2018). The International Labour Organization (ILO) lays prominence on training construction workers by embracing the 1988 Safety and Health in Construction Convention Number 167 and Recommendation Number 175 (Mahmoud et al., 2020). Section 99 of the OSH Act 2007 requires employees from other establishment to receive appropriate instructions regarding safety risks at the workplace (Kenya Law Reports, 2010). Acquiring staff from previous building construction projects has been identified as an external factor that contributes to construction accidents hence, adherence to Section 99 of the OSH Act. Furthermore, Muiruri and Mulinge (2014) acknowledged that, site workers should be furnished with instructions when they start work (fundamentals such as emergency treatment and fire safety), guidance on explicit tasks, education when hazards change and refresher instructions when abilities are not habitually utilized. Nonetheless, safety guidance truly has included a bigger number of preachments than genuine training of abilities to accomplish results (Mwangi, 2016). Henceforth, there is a need to survey the safety training programs in construction undertakings to find out their adequacy for decreasing occupational accidents.

b) Medical Surveillance

33% of all accidents that happen in building construction projects are drug or liquor-connected (Associated Builders and Contractors, 2019). Not only are compromised laborers bound to harm themselves (being reckless and perpetrating safety mistakes) but also, they can jeopardize people close to them (being vicious and assaulting fellow laborers), including the general public (Lipsig, 2019). Organizations with substance abuse arrangements and strategies that incorporate caveats for "drug and alcohol testing" where allowed are 60% more secure than those without a scheme. The importance of medical surveillance is clearly stated in paragraph 11 of ILO Recommendation No. 171, which provides for medical examination of the workers before the job placement, during their employment (at appropriate intervals), on resumption to work after a prolonged absence for health reasons and after the termination of assignments. Section 103 of the OSH Act 2007 highlights that, any individual who neglects to consent to any of the arrangements set down in section 103 (medical surveillance) perpetrates a crime and will on sentencing be obligated to pay a fine not surpassing 100,000 Kenyan shillings or to incarceration for a period not exceeding 3 months or to both (Kenya Law Reports, 2010). Nevertheless, an adequate assessment regimen is regularly not cost-friendly, particularly for little businesses, making it difficult to identify laborers with substance misuse or medical issues.

c) Reporting and Investigation of Accidents

Promoting accident reporting and supporting employees in pushing for their own safety and the safety of everyone around them can have an effect on construction safety performance (Forestell, 2019). However, De Silva et al. (2018) unearthed that 80% of construction accidents are under-reported. The Occupational Safety and Health Act of 2007, Section 122 demands that all accidents be recorded in a prescribed booklet called the general register and the information must be retained for 3 years from the date of the last entry into the register (Kenya Law Reports, 2010). All accidents recorded should be notified by means of DOSH 1 forms for the purposes of compensation. Section 21 of WIBA 2007 instructs workers to report any accident that happens in the course of work either in written format or verbally to their manager and forward a duplicate of the written notification to the Director of Occupational Safety and Health Services within 24 hours in the case of a fatal accident (Kenya Law Reports, 2012).

According to Mahmoud et al. (2020), distinguishing and mitigating construction site accidents is not often conceivable without recognizing the causal agents through accident investigations. Section 128 of OSHA 2007 highlights the prerequisites on accident investigations in order to discover facts that can culminate to remedial actions (Kenya Law Reports, 2010). Ideally, an accident investigation is carried out by somebody or a group of individuals who are knowledgeable about accident causation theories and investigative methods, learned in any legal or organizational requisites, well informed in OSH essentials, proficient in the job systems, capable of employing data collection and dispute resolution strategies fruitfully, experienced in prerequisites for records and information assortment; and capable of analysing collected information to deduce findings and arrive at recommendations (Canadian Centre for Occupational Health and Safety, 2022). Members of an accident investigation team can include employees with knowledge of the work, supervisor of the area or work/ safety officer, safety committee, representative from local government or police' among others. When collecting facts about what happened, the following aspects need to be investigated: the events leading up to the accident (for example, the materials in use or being handled), the facts of the accident itself (for instance, the people directly and indirectly involved) and the facts regarding what occurred immediately after the accident (for example, any injuries resulting directly from the accident). Sometimes, parties involved directly or indirectly in an accident such as contractors may provide false information to avoid being responsible for the accident. Hence, investigators are urged to be careful with preconceived notions of what transpired. An investigation should be approached with an open mind (Canadian Centre for Occupational Health and Safety, 2022). Consequently, the most basic information in a typical accident report should incorporate the following items: Type of incident; location; names of affected people; immediate supervisor; statement of the affected people; witnesses; context of the event; the motion of the affected people during the incident; injuries, severity, and treatment; photos; hazards identified and the root cause of the event (Fleming, 2019).

d) Maintenance of Safety Records

Since construction is time bound, often of short duration (typically less than three years) and as a good safety practice, such workplaces should maintain safety records (Ogetii, 2019). Example of documents to be kept include: employees acclimatization documents; documents of labourer/manager training indicating the date,

names of participants and points tackled; assessment reports and documents of restorative activities taken to tackle issues; accidents examination documents and reports of remedial activities exercised to take care of issues; statement of gatherings and team talks where safety matters were examined; manager's jottings and logs of safety talks with site workers; records demonstrating utilization of reformist order to implement safety rules and composed safe work methods; collaborative occupational safety board of trustees meeting minutes demonstrating measures taken to solve safety matters; first aid records and medical declarations; paraphernalia logbooks and service documents; forms and listicles indicating that the organization expects laborers to follow secure work techniques (for example, cramped area ingress licenses); crisis reaction plan, records of safety drills and any subsequent enhancements; occupational safety financial estimates and procurement orders; lastly, the insights on the frequency and seriousness of accidents (Kenya Law Reports, 2010, 2012).

Most of the listed documents above have been clearly stated in the Employment Act of 2007 under section 74 (1), OSHA 2007 under section 122 and in WIBA 2007 under section 9. If a person is charged under OSH legislation, the defendant may be found not guilty if he or she can use the records to demonstrate that due diligence was brought to bear. As such, the respondent should show that all reasonable safeguards, considering the present situation, were taken to fortify the safety of employees. A construction contractor's cost of insurance is largely determined by the construction company's accident experience (Canadian Centre for Occupational Health and Safety, 2022; Fleming, 2019). One of the critical factors considered when evaluating the risk involved in providing insurance coverage include the company's record of accidents and safety violations.

Findings and Discussion

Ogetii (2019) revealed that, the construction line of work is one of the adequately regulated field but still perceived to be the riskiest. Notwithstanding the fact that numerous accidents stay unreported, the observed accident statistics are a clear indication that the construction industry around the world is a long way from arriving at the aim of zero injuries. Various implications can be derived from the paradigms discussed in this study. First, the Heinrich's Domino theory and the Swiss Cheese model concur that human blunder is consistently a potential reason for accidents. For example, working without wearing defensive gear has been identified as an active error under the Swiss Cheese model and this contributes immensely to the stake of falling accidents.

Studies by Kibe (2016) and Ahmed (2019) have revealed that lack of constant worker safety training was the top-most underlying cause behind most fatalities and injuries in building construction sites. It is not so unexpected to discover that safety training gets very little attention and yet according to the updated Maslow's hierarchy of needs, it forms part of the physiological needs (food, water, **education**, reproduction, and shelter). The needs, according to Maslow, are satisfied in a specified order, from bottom to top, as illustrated in Figure I. Besides, the law in Kenya is clear under section 99 of the OSH Act, 2007 that no individual ought to be engaged in any assignments at a building site except if that individual has acquired the required training to be able to execute the job ably and securely. It is with this regard that the study is considering regular and adequate safety training as one of the most significant factors in effectuating the safety regulations in building construction works

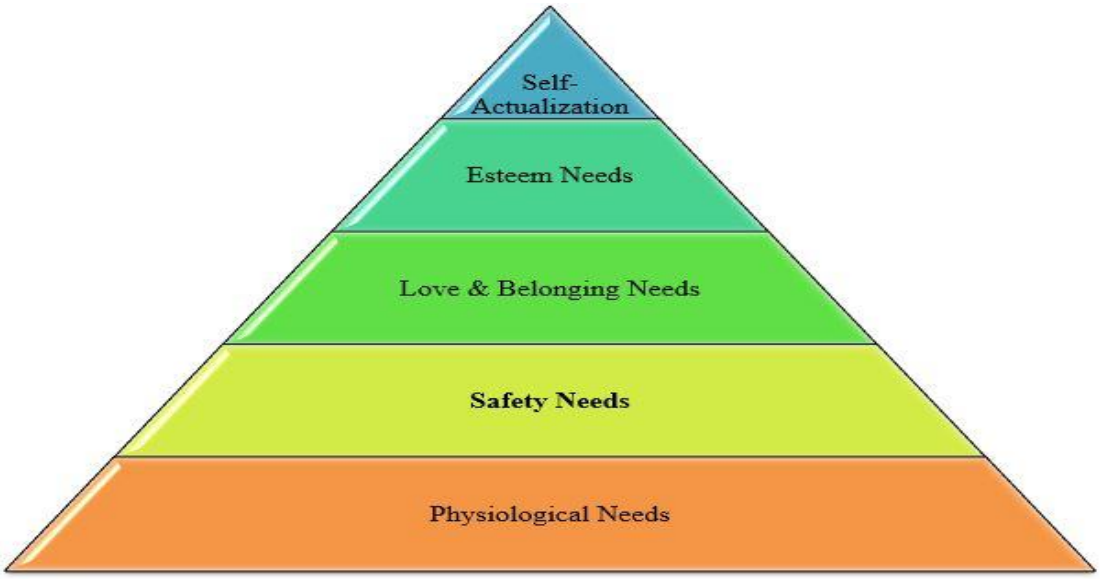

Figure 1: Maslow's Hierarchy of Needs

Source: Adapted from Balgheeth (2016)

The reviewed works has indicated that, majority of construction accidents are under-reported. Besides, it is not unusual to find some contractors running building construction projects without instigating and effecting courses of action that guarantee safety of the site operatives. Hence, reporting of unscrupulous contractors not only promotes the safety of the site operatives but also the success of the undertaking. When an accident is reported, it leads to the investigation of the causal agents. Consequently, while collecting facts about what happened, some contractors may tend to provide misleading information when they realize that reasonable precautions were not taken to fortify the safety of employees. The findings also indicate that, a general register in which all accidents are recorded should be maintained in a construction site. A written documentation is crucial especially when it comes to matters of due diligence and can as well be used to determine a contractor's cost of insurance (higher risks attracts increased premiums).

Conclusion and Recommendations

Lack of up to date, regular and adequate safety training implies that, workers are left to gain safety knowledge from their own insight and the fallacies they commit. At the same time, high turnover of the construction labour force makes it strenuous to train laborers. Accordingly, providing commendatory training resources to laborers would assist with retaining the skilled labour force in construction sites. Besides top management should attempt to make work more pleasant for their employees by incorporating participative methods in safety decision making to endorse a safety cognizant culture among construction workers. Safety Managers should always let their workers know that observing the safety rules is to their greatest advantage since being harmed would diminish their quality of life. At the same time, something as straightforward as daily huddles with the site operatives can begin to fortify the Swiss Cheese slices and seal the holes. Reconnaissance of laborers' health is also key in

guaranteeing that their condition of health is congruent with their work tasks.

National authorities tasked with the implementation of safety regulations such as the Directorate of Occupational Safety and Health Services (DOSHS) should come up with mechanisms that will promote reporting and investigation of accidents. For example, the aspect of whistle blowing is evident in diverse sectors of the National economy. Some of the most notable Kenyan whistle-blowers are John Githongo who blew the whistle on the Anglo-leasing scandal in 2002 and Spencer Sankale who exposed the massive looting at the Masai Mara University in 2019. Hence, the same concept may be adopted to get rid of unscrupulous contractors. Safety records should be maintained, either in paper or electronic format (with appropriate backups to safeguard the documents in case the computer crashes or the system fails). The government should direct all contractors to post a summary of accidents and safety violations recorded the previous year on their websites. This may trigger a safety cognizant culture among the contractors since none of them will want the image of their organization to be tarnished and its character harmed before the customers. The 'new normal' will continue to transform construction praxis with concepts such as designing for safety. For instance, building designs can be integrated with safety regulations to check models for safety compliance before they are executed. Therefore, this study also recommends employment of innovations in effectuating the safety regulations requirements in building construction works.

Future Research Directions

This being work in progress, the inquiry will extend this research by taking into consideration the viewpoints of Architects, Quantity Surveyors, Services Engineers, Structural Engineers, and Construction Project Managers regarding the strategies that can be employed to effectuate the safety regulations requirements in building construction works in Nairobi City County, Kenya. Moreover, this study is delimited to construction safety management, one of the additional knowledge areas included in the construction extension to the PMBOK Guide. The other additional knowledge areas in the construction extension include: all project resources (rather than just human resources), project financial management (in addition to cost) and management of claims in construction. Nonetheless, these three additional knowledge areas will not form part of this inquiry as they are beyond the scope of this investigation and the study proposes their incorporation as an area for further research.

Disclosure Statement

No potential conflict of interest was reported by the authors.

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