Fire Safety Preparedness in Building Construction Sites in Dar-Es-Salaam, Tanzania

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Abstract

Fire, apart from being very useful, and an essential good for human being; it can be very dangerous, when it occurs where it is not needed, and unprepared. The study main objective was to assess fire safety preparedness in building construction sites in Dar-Es-Salaam, Tanzania; specifically looking into assessing awareness on fire safety preparedness among building construction site workers, examining the existing situation of the building construction sites on the provision of fire safety preparedness gears, and at the end recommending on the possible measures to improve fire safety preparedness in building construction sites.The research design adopted in this study was descriptive survey research. Questionnaire, focus group discussion and observation were used to collect data in which 48 questionnaires were distributed, and 42 of thequestionnaires returned,alongside with the focus group discussions containing 40 respondents from different construction sites. Simple, randomly and purposively sampling methods were used in selection of the study sample. The collected data were analyzed using SPSS, and Microsoft excel, presented in charts, plates, frequency table and percentage form for easy interpretations.The study findings revealed that; fire safety preparedness awareness was low among majority of site laborers in the selected construction sites, due to inadequacy of trainings to site laborers, and unawareness on the uses of firefighting gears. Moreover, the study revealed that; most of site staff are aware on the fire safety measures due to their participation in different trainings. Likewise, the provision of firefighting equipment in construction site, is still low in most of building construction sites. The study also found that; fire and safety drills were not regularly conducted, and there was lack of an assembly point in construction sites. The study recommends on; the conduction of fire safety trainings, campaigning through different media in order to raise awareness on fire safety preparedness, compliance with different statutory requirements such as Fire Rescue Acts, OSHA, and other regulatory status, so as to ensure maximum state of preparedness in case of fire outbreak in building construction sites.

Keywords - *Fire, Safety, Preparedness, Building, Construction Sites, Dar-Es-Salaam, Tanzania.*

I.INTRODUCTION

Human being always attempt to attain success in whatever they signify, and to meet the target, always depends on the levels of preparedness to absorb future shocks, and unexpected inconveniences. Being unprepared, even so, may result in endangered life and uncovered damages. UN,(2008) defines disaster preparedness as the capabilities and knowledge produced by governments, professional response organization, and individuals to be prepared and respond effectively to the impact of likely, expected or current hazard events or weather. Natural disasters sometimes occur beyond the levels of preparedness, though they can be reduced. Unlike natural disasters, the possibilities of the communities' ability to respond to damages caused man-made activities are high. Of all man-made disasters, fire outbreaks are primarily made by human activities, though they can either be forbidden or checked.

Abdusalamet al.,(2016) accounts that; fire is the one essential goods for human beings, but it becomes a danger when it occurs where it is not needed. Fire can be very useful, but it can also be very dangerous. Tharmarajan,(2007), stresses that; without fire civilization would be radically different, in fact, it would not even exist. People cause fire by their actions furnishings feed the fires and panic results in a gratuitous loss of lives and wounds. The fear of uncontrolled fires and the desire to avoid their consequences is as ancient as human civilization since it carries life and ruining property. Certainly the nature, causes and scope of such events is different, but fear and prevention have remained as the most important human reaction and as an significant human objective.

Fire is one of the many hazards that construction workers faces on site. Although fire hazards are not seen as such high risk compared to other risks like;

falling from the height and slipping, tripping and falling, fire hazards should be taken into consideration at all stages of the building construction process (HSE,2003).The research by the United State Fire Administration, about 4,800 construction site workers, faces fire every year, alongside approximately $35million in property loss. These fires are more probable to do more harm than a residential fire, because they tend to have less protection from smoke detectors or sprinklers. Hughes & Ferret (2011) adds that; construction fires can result to incomplete dislocation of the project schedule. Therefore, it's important to comply with applicable regulations related to fire safety planning during construction, and cooperation between stakeholders in building and enforcing a plan goes a long way in shortening the possible risk and impacts of fire on any construction sites.

FEMA,(2017) claims that; fire safety preparedness is a continuous cycle of planning, organizing, training, equipping, exercising, evaluating and improving strategies to insure efficient coordination and enhancement of capabilities to react to fire disasters. Furthermore, Istre&Mallonee,(2000) asserts that; fire safety preparedness is an important aspect in both environmental and occupational safety and health, and it includes availability and effective use of procedures, infrastructures, equipment as well as knowledge, and confident attitude of occupiers and workers towards implementation of fire safety preparedness guidelines. According to Proulx,(2006); factors such as character and leadership skills, decision-making style, and the amount of previous fire safety training are most important factors of how an individual would react to a fire. In addition, the buildings characteristics and nature of the fire also influence an individual's response time and evacuation. Driskell & Salas (1996), in Proulx (2001),maintains that; in the event of fire apart from knowledge, the behavior of people also needs to be modified to prevent and help them prepare to deal with a fire. It is clear that fire emergencies are stressful events as they are unexpected, are powerful, and need a fast response.

A. Problem Statement

Nature of works and activities carried out in construction site are very dangerous and may result to great accident and hazards if precaution is not taken. The existence of workshops, and stores which hold flammable substances, provide likely sources of ignition and heavy fire loads that are sources of fuel. Likewise, construction works involve the use of machines and equipment such as generators, welders, which if not used properly may cause fire. Hence; preparedness against fire occurrence plays a critical part in assuring that, workers in construction site have the required equipment, know where to go as well as keep themselves safe when the fire emergency occurs and this will aid in minimizing loss and indemnity. During the construction phase most of fire facilities, equipment, and devices for fire detection, that are designed to be part of the completed building are most not yet installed.

Therefore, this study attempts to assess the awareness on fire safety preparedness among building construction site workers, in Dar-Es-Salaam, Tanzania; by specifically assessing awareness on fire safety preparedness among building construction sites workers; examining the existing situation of the building construction site on the provision of fire safety preparedness gears; and recommending possible measures to improve fire safety preparedness in building construction sites.This is achieved by ensuring that the existing situation is addressed and worked out, through the following questions like:- are construction site workers in building construction sites aware on fire safety preparedness?, what is the existing situation regarding provision of fire safety preparedness gears in building construction sites?, and what are the possible measures that can improve the fire safety preparedness in building construction sites?.This study is essential in giving policy makers in Tanzania, Researchers, Academician, Real Estate Developers, as well as workers and stakeholder in construction; on the information useful in making, and re-defining fire safety in their construction sites hence enhancing awareness.

II. LITERATURE REVIEW

The literature review gives a clear understanding on exactly the meaning of Fire, Fire Safety, Preparedness, and Construction Sites; Classes of Fire; Causes of Fires in Building; The Concept of Fire Safety Preparedness; Fire Safety and Preparedness Awareness; Factors Having an Impact on Human Behavior in Fire, specifically on Occupant, Building and Fire Characteristics; Precautions in Case of Fire precisely on means of giving warning, escape, and firefighting; Ways of Fire Suppression or Extinction; and possible measures to improve fire safety preparedness in building construction sites.

A. Definitions of Key Words

1. Fire

Hornby &Wehmeier,(2000), accounts that; fire means the flame, light, and heat, and often smoke, that are created when something burns. For any fire to occur there must be fuel, oxygen and the source of ignition(heat). Basically, fire cannot exist without allthese elements in place and in the right proportion. Some fuel and oxygen mixes may require a catalyst, a substance that is not directly involved in any chemical reaction during combustion, but which enables the reactants to combust more readily within the building construction site.

2. Fire Safety

Fire safety means adoption of or adherence to measures intended to minimize the risk of harm from

accidental fires; safety from danger or injury in the event of fire, (Hornby & Wehmeier,2000). Ogajo,(2013), identifies fire safety as independent variables being influenced by several factors such as availability of firefighting equipment, awareness, fire protection, prevention and mitigation measures where by any changes to the variables may affect fire safety in any building.

3. Preparedness

Ogajo,(2013),defines preparedness as a state of being ready to respond to a disaster, crisis or any situation occurred due to an emergency. Additionally, Ogajo,(2013), asserts that; good preparedness involves proper planning, training, resource allocation, and simulated fire disaster response exercise. It is important to conduct exercise to ensure that skills, equipment, and other resources can be effectively coordinated when an emergency occurs. Exercises provide a good opportunity to identify organizational and departmental shortcomings and take corrective action before an actual event occur.

4. Construction Sites

These are places where construction works is undertaken and also used for storage of materials or plant used or intended to be used in the construction work. A construction site is a very important place, as a considerable number of workers are involved in construction activities.

B. Classes of Fire

Grant,(2012),points that; classification of fire depends mainly upon the fuel involved. Based on this, Grant,(2012),details that; fire is classified in five classes as follows;-

CLASS "A":- These are fires caused by combustible materials, such as wood, cloth, paper, and many plastics. This type of fire burns and leaves an ash, and is best extinguished by removing the heat. Extinguishers fit for these fires is a dry chemical extinguisher. Water is also currently used in extinguishing these type of fires.

CLASS "B":- These are fires caused by flammable liquids, combustible liquids, petroleum greases, tars, oils, oil-based paints, solvents, lacquers, alcohols and flammable gases. This type of fire burns on the surface of the fuels, and is best extinguished by a blanketing or smothering action. This type of fire spread fast and over a large area in a very short time. Its extinguished mostly by dry chemical or carbon dioxide extinguishers. Flammable liquids may re-ignite after being eliminated. Water is not suitable for extinguish these fire and should not be used.

CLASS "C":- These fires occur in energized electrical equipment, where the electrical non-conductivity of the extinguishing media is of importance. Blanketing or smothering this type of fire with a non-conducting extinguishing agent is of prime importance. Water, or solutions containing water, is never to be used on a Class "C" fire. Either dry chemical or carbon dioxide extinguishers should be used to extinguish these types of fires.

CLASS "D":– These fires involve combustible metals, such as magnesium, titanium, zirconium, sodium, lithium and potassium. It is extinguished by a dry powder.

CLASS "K":–These are fires in cooking appliances that involve combustible cooking media such as vegetable or animal oils and fats. The extinguishing agent is a Wet Chemical.

C. Causes of Fires in Building

Ogajo,(2013) asserts that; many common causes of fire can be associated to open flames, electrical fires, cooking and unplanned ignition and the explosion of waste materials.Murali &Vijayalakshmi,(2014) avails more that;there are two causes of fire in the building, human error, and appliances type of fire. The human error fire is that caused due to rubbish burning, smoking, and intentional. The appliance fires are electrical appliances, gas appliances, and other fuel appliances. Different survey and research indicate that human error type of fire is the primary causal agents of fire in the building. Currently, all activities in the society depend on fuel consumption and most people utilize energy in many processes and therefore this becomes the main origin of fire outbreak in buildings.

Phoya,(2011) points that fires on the site are mostly caused by braising work carried by plumbers, gas lines for underground work, power lines, power leads and tools, machinery requiring petrol and diesel, and hazardous chemicals. According to Giwa,(2012), over 90% of fire outbreaks in Nigeria are caused by human negligence, which can be prevented through changing the values, cultures and practices of the people. "Fire outbreak has continued to be a major disaster not only in Nigeria but all over the world. Some of these fire disasters are caused due to power flows from electrical wires.

D. The Concept of Fire Safety Preparedness

Implementation of rules and fire safety strategies are very important in improving fire safety. In England, one of the first fire prevention measures was a requirement to eliminate all fires before nightfall. To date the remaining fire safety in the United Kingdom(UK), have several requirements for builders that cover all activities starting from construction site itself, the actual design of material to be used and a building can only be given permissions to operate if the structure has been certified to be proofed and compliant with the fire safety regulations (Hall,1997). In Kenya, OSHA Legal Notice No. 15 of 2017 of the laws of Kenya OSHA (2007), stipulates fire safety preparedness requirements for minimizing and controlling fire hazards. In Tanzania OHS Acts No. 50 of 2009 stipulate about fire prevention where by workplaces

should have adequate equipment, as well as a means of escape by which people could use it in the event of fire outbreak.

A study conducted by Haris,(2004) on adults living in private houses in the United States uncovered that; a great number of Americans who were interviewed had an escape plan for use in case of fire, but do not implemented the plans. He further adds that; 75% of the respondents were aware that, practicing an escape plan would reduce the time of escape of people to safe environment. In this case, knowledge did not correspond to the people's practices. Moreover, the study conducted by Francisco et al.,(2004) on the status of facilities for fire safety in hotels in Spain, it was found that; some of the defects detected were due to, absence of a technical installation project certificate or certificate of obligatory maintenance contracts for the fire safety equipment. Other defects noticed were, absence of alarm devices and smoke detectors, faulty signage as well as difficult access to firefighting equipment.

Furthermore, Oduor&Atsiaya,(2004) claims that; people who frequently visit or use the buildings or even visitors should be attentive about the existence of the exit door which should not be blocked with anything and with proper signage showing the path out. They further said that in most of the buildings in Nairobi there were locks on doors while grilled outdoors were also locked a situation that present questions on their usability for escape purpose during an emergency. They also noted that most of the buildings, especially the storey one, escape routes are a fare tales and therefore when the fire outbreaks out, people crumble in one staircase exposing them to more danger of fire. Many of the surveyed buildings, fire disaster may hardly be escaped using the emergency exists since many do not know the position of fire exits.

Afedzie&McEntire,(2010), view preparedness as the set of natural processes of formulating, testing, and exercising disaster planning; and communicating with the public and others about disasters and what to do to shorten them. They further examined preparedness from the perspective of the households, organizations, communities, states and the nations. UNESCO,(2010) state that; preparedness emphases on plans to react to a disaster occurrence. It contracts into account an estimation of emergency needs, and identifies the resources to fulfill the needs and also highlights preparedness objectives which include:-

- To minimize disaster impact through correct activities and to increase the mental capability of those who are likely to be affected most.
- To assure that ongoing development continues to improve the contents and capabilities of the system to strengthen preparedness efforts at the community level.
- To monitor reconstruction so as to safeguard reduction in exposure.

E. Fire Safety and Preparedness Awareness

Ayabei,(2016), claims that; this is the ability to acknowledge the risk of fire, ability to know what to do to prevent a fire as easily as what action to take in event of fire outbreak. All fire disaster preparedness is based on the knowledge about fire hazards, the like hood of different examples of fire outbreak and the possible effect on the built and natural environment, (Comolotti,2004). Moreover, Sime,(1990), asserts that; people with knowledge about fire disaster acquires equipment's such as fire extinguisher, fire blanket, and smoke detectors among others to support response activities. Furthermore, he insists that; they also organize their families and employees in taking prompt action to prevent death, injury and devastation of property against disaster risk which may occur. Safety regulations in United Kingdom (UK), enforce mandatory fire safety training to all employees working within a building, a construction area or any other busy area which helps provide employees with essential information, build up skills such as those employed in operating fire extinguishers and proper flight behaviors.

According to Ayabei,(2016) on a study conducted in Oshogbo in Nigeria to assess the relationship between levels of awareness and disaster preparedness found, that 73.4% of the houses studied, had burglary proofs installed on windows, doors, and sometimes the veranda. Out of those interviewed 64% said they had never thought of its implication in case of fire outbreak, they only thought of it as a security measure aimed at preventing robbers from gaining access to the house.Mfinanga,(2007) accounts that; most people are unaware of their responsibilities to prevent fire outbreak, and the first response is to call fire fighter as depicted by a shop owner in Mchikichini market in Tanzania where 80 shops were destroyed by fire.

Again, Kukali&Kabuka,(2009),claims that; lack of knowledge of fire safety issues or on how to react in the case of fire tragedy, has facilitated to the heavy number of casualties experienced. Basic fire emergency drills to teachers, supporting staffs and students are in most cases taken for granted, to the extent that in the case of fire tragedy very few staff, and scholars may know what to practice. Ronoh&Kyalo,(2009) uncovered that; most schools in Turkana district had not conducted fire drills. The survey concluded that knowledge on effective use of a fire extinguisher, and performance of fire drills, was a sign of availability of training and awareness programs in the schools. Based on the study, 87.5% of students in the schools that performed fire drills, knew how to effectively use a fire extinguisher as compared to 21.2% of the students in the schools which did not conduct fire drills.

F. Factors Having an Impact on Human Behavior in Fire

On the event of fire, every person tends react different depending on the following factors;

1. Occupant Characteristics

Proulx,(2001) claims that; occupant characteristics is influenced by many factors such as Individual profile example age, gender, and ability of individual to attack the fire. He further added that, knowledge and experience is of much important since occupant, workers, who have or don't have received any training will react differently. However, the condition of a person at the time of the fire outbreak will influence the reaction of a person such as whether the person was alone or with others, alert, stressed, or under drugs- alcohol or medication. Personality and decision making style has an impact on the reaction during the fire outbreak such as some will be influenced by others, while others will act as a leader to help others to evacuate as well as to attack the fire. Lastly the occupant role such as a visitor, owner and employee can explain different responses.

2. Building Characteristics

According to Proulx,(2001); this characteristic is determined by elements like the occupancy of the building such as residential, office, factory, hospital, college and university where by all these masses will react differently in the case of fire. He too noticed that; the complexity of the space has an impingement on the movement of people and on the possibility of discovering alternative means of evasion. In addition, the activities carried out at the time of fire will have a major impact on the response and the reaction of a person example, in building construction site there are activities which result in a heavy noise such as the use of different machines like generators, welding machines, hence if a fire outbreak occurs and the alarm is sounded it will be very difficult to be heard by all people in the site. Finally, he concluded that, fire safety features such as Fire alarm signal, their location, audibility, number, fire safety plan, trained staff, and voice communication will also play a great role in notifying other about the situation.

3. Fire Characteristics

Proulx,(2001) avails that; fire characteristics can influence the people's response in the event of fire. Example, the reaction of the person who smell the fire, and the other who sees directly, they will respond differently, since people perceive different cues from the fire.

G. Precautions in Case of Fire

In case of fire outbreak, people must be able to escape from the fire. This can be achieved through the following means:-

1. Means of Giving Warning

As per HSE,(2006), site managers should set up the fire system which could alert people in event of fire incidence in the construction site. This system could either be an air horn or a whistle depending on the size and complexity of the site. The system could be temporary or permanent and should be regularly tested. Any warning should be audible above all other noises caused by different activities in site and should be recognized by all workers in site.

2. Means of Escape

The escape routes should have remained available and unobstructed. This could be achieved through good housekeeping as well as proper storage of materials in a construction site. HSE,(2006) avails that; escape route can be protected through installing permanent fire separation and the fire doors. The escape routes direct people to a safe place far from the fire where people can gather. Signs are needed if people are not conversant with the escape routes, and decent lighting is needed for enclosed escape routes, emergency lighting may be indispensable.

3. Means of Fighting Fire

HSE,(2006), insists that; the provision of firefighting equipment in construction sites and should be located in identified places around the site. Equipment provided should be appropriate to type of fire.

- Paper, cloth and wood fire – Water extinguishers
- Flammable liquids fire – Dry powder or foam extinguisher
- Electrical fire – Carbon dioxide

Workers should be trained on how to use the firefighting equipment.

H. Ways of Fire Suppression or Extinction

Writings by Cumming,(2012) reveals that; there are four methods used depending on the five classes of fire, and these include smothering or extinguishing, cooling, watering or removal of burning substance and control of flames. Cooling is the most common method. It consists of lowering the temperature of the burning substance and the environment below its ignition point. Smothering or extinguishing consists of separating the burning substance and oxygen, or reducing their concentration within the environment. Watering or removal of burning substance consists of separating the burning substance from the heat source or environment of the fire. Control of flames involves modification of the chemical reaction, changing the release of free radical products in the combustion and therefore delaying development, (Cumming,2012).

Fire extinction, in principle, consists the limitation or elimination of one or more of these factors, and according to him the methods of extinguishing fire may be classified conveniently as; Starvation (or the limitation of fuel); Smothering / Blanketing (or the limitation of oxygen); and Cooling (or the limitation of temperature. The extinction of fire by starvation is applied in three ways; by removing combustible material from the neighborhood of the fire. Examples of these are the drainage of fuel from burning oil

tanks. Starvation can also be done by removing the fire from the neighborhood of combustible material as, for instance, pulling apart a burning haystack or a thatched roof as well as by subdividing the burning material, when the smaller fires produced may be left to burn out or to be extinguished more easily by other means, (Cumming, 2012).

The method of extinction by Smothering is by preventing or impeding the access of fresh air to the seat of the fire, and allowing the combustion to reduce the oxygen content in the confined atmosphere until it extinguishes itself. If the oxygen content of the atmosphere in the immediate neighborhood of burning material can be sufficiently reduced combustion will cease. An important practical application of the smothering method is the use of foam. This forms a viscous coating over the burning material and limits, in so far as it is complete, the supply of air. It also tends to prevent the formation of flammable vapour(Cumming,2012).

I. Measures to Improve Fire Safety Preparedness in Building Construction Sites

1. Fire Safety Trainings and Drills

Cote,(2011) affirms that; fire prevention and protection activities can be easily implemented by establishing a fire safety programme that includes inspection, fire drills, training, management procedures, and communication. Fire drill is an important exercise for instilling skills on evacuation procedures and consequences of fire are completely avoidable if safety requirements are observed. Training must meet the goal of reducing the number of fires and thus reduce death and injury among workers, and the financial loss on organizations. Gold &Koigi,(2009) further adds that; well-trained firefighting team with well-defined responsibilities in case of fire should be established and on hearing the fire alarm sound, the team should assist fellow workers, visitors and customers by leading them through the fire exists. They should not allow people to come back to the building or to collect their properties unless the escape is clear and they should proceed to the assembly point for roll-call.

2. Assembly Point

All designated escape exists from the structure should give direct access to an unenclosed space in the open air at ground level. From here, there should be an unobstructed passageway from the structure to a place of safety where people can assemble and be counted for. Regard needs to be given to the size and location of these assembly points (HSE,2010).

- On small site- The pavement outside may be adequate (Provided this does not obstruct the fire service on their arrival).
- On larger sites- arrangements may have to be made to make use of an area such as car park
- On site such as chemical refineries- a safe refuge such as a plant control room may have to be used. Where the site is in operation, a responsible person from the company should be consulted regarding a safe assembly point.
- Where the construction site is surrounded by a hording or fence and the assembly point is outside this, an adequate number of gates giving access to the assembly point will be needed. There should be clear and unobstructed access to the gates, which should be unlocked and available for use at all times that people are at work on the site.

3. Emergency Warning Signs

As per HSE,(2010), signs provided need to be large enough so that they can be clearly seen and positioned where they are least likely to be obstructed or obscured by smoke. Signs need to be sufficiently durable to withstand site conditions, securely fastened and properly maintained (including kept clean). If there is any changing which make the sign to become inappropriate, then it should be removed so as not to mislead or confuse people. Training should be given to all workers (not forgetting workers who are not good at reading or for whom English is not their first language) so that they fully understand the signage in a fire emergency to ensure their safe escape.

4. Fire Alarms

HSE,(2010) asserts that; the aim of any warning system is to ensure that people on the site are alerted to make their escape before a fire becomes life-threatening. The essentials requirements of the warning signals are that it is distinctive, clearly audible above any other noise and recognized by all people on the site. False alarms and unwanted fire signals can be costly on any project and can also lead to complacency in those needing to respond. Careful selection of systems and management arrangements can reduce this nuisance (HSE,2010).The sophistication of the method of giving warning of fire will vary from site to site. For example:

- For a very small open site, or those involving small buildings and structures, word of mouth may be adequate
- For a very limited number of open-air site, or those involving buildings and structures with a very limited number of rooms, such that a shout of fire might be heard or could be misunderstood, a small self-contained proprietary fire alarm unit may well be needed.
- Consideration should be given to visual alarms systems or any other for noisy area or where there are workers who suffer from a hearing impairment.

The operation and effectiveness of the fire alarm system over the entire site should be routinely checked and tested by a competent person and periodically serviced and any necessary repair should be carried out by a competent person having the appropriate level of training and experience. Generally, means of communication should be tested daily, example portable radios or any intercom

devices should be checked at the start of shifts (HSE,2010).

5. Firefighting Equipment/Gears

Ridley,(2008) claims that; firefighting equipment are classified into two types as Installed equipment such as horse reels, sprinklers, halogen gas, carbon dioxide and hand-held extinguishers which most of these are painted red with a colour coded band to identify its contents and type of fire for which is suitable. Furthermore, Hall &Greeno,(2007), divided firefighting into sprinklers and other fixed water sprays, fixed foam, carbon dioxide, dry powder extinguisher, fixed wet or dry risers, portable extinguishers, fire doors, dampers fire resisting forms of construction. Additionally, Guyer,(2009), has classified the firefighting equipment and termed as fire extinguishing systems into automatic sprinkler systems, water spray systems, foam systems, dry chemical extinguishing systems, carbon dioxide systems, gas extinguishing systems,

Sand Buckets:-these are buckets filled with sands which are used to extinguish fire and most are placed outside the building. They are mostly used to extinguish small fires. The advantages of sand buckets are that they are cheap, easy to use and reliable.

Automatic Sprinkler System:-Hall & Greeno,(2007) affirm that; water sprinkler provide an automatic spray dedicated to the area of fire outbreak. He further added that sprinkler head has temperature sensitive components that react immediately to heat, discharging the contents of the water main to which they are bound. In addition to a rapid response which reduces and isolate fire damage, sprinklers use less water to control a fire than the firefighting service, therefore preventing further damage from extra water.Menon &Vakil,(2005) defines automatic sprinklers as devices which gives automatically water upon a fire in sufficient quantity to extinguish it altogether or to prevent its spread, by keeping the flame under control, by the water emission from the sprinklers. A sprinkler system consists of a set of installation control valves and a pipe array fitted with heads, (Saini & Chaturvedi,2009).

Portable Fire Extinguishers:-The Fire and Rescue Regulations (2015) stipulated that, every undergoing construction or demolition should have portable fire extinguishers and smoke detectors. Types of portable fire extinguishers are;

i). **Foam Extinguisher:-**Guyer,(2009) insists that; the foam to be installed must be low, medium, and high expansion, and should be applied as Foam Water Sprinkler and Foam Water Spray Systems.

ii). **Dry Powder:-**As per Guyer,(2009**),** the dry powder extinguishing system is appropriate for the protection of certain characters of special occupancies, hazards, and installations such as drop tanks, and other operations involving flammable liquids. Dry chemical extinguishing systems must conform to National Fire Protection Association (NFPA) 17, Dry Chemical Extinguishing Systems and should not be utilized to protect sensitive electronics.

iii). **Vaporizing Liquids:-**According to Guyer,(2009), the gas extinguishing systems are extremely desirable in facilities containing high value electronic equipment because the gases do not damage the equipment. Major challenge with gas extinguishing system, however, in facilities where people are present is that they rely on depleting the oxygen supply in order to smother the fire**.**

iv). **Carbon Dioxide:-**Carbon dioxide systems are normally effective against flammable (Class B) and electrical (Class C) Fires and must conform to National Fire Protection Association (NFPA) 12, Carbon Dioxide Extinguishing Systems (Guyer,2009).

The USA Fire and Rescue Regulations,(2015) stipulated that portable fire extinguisher provided should be in conformity with specifications stipulated under specification for portable extinguishes and shall be charged, tested, and maintained and properly tagged in conformity with requirements in National Fire Protection Association (NFPA) 10. Also the size, quantity and sitting shall comply with the requirements of NFPA 10.

6. Fire Blankets

According to Fire Prevention Hand Book,(2005) these are lightweight sheets of fire-resistant material which are used to cover a fire to cut off its oxygen supply or to wrap around a person whose clothes are on fire. Fire blankets are used to put out a fire or wrap a person whose clothes are on fire. They are best kept in the kitchen. Fire blankets, along with fire extinguishers, are fire safety items that can be useful in case of a fire. These non-flammable blankets are helpful in temperatures up to 900 degrees and are useful in smothering small fires by not allowing any oxygen to the fire. Due to its simplicity, a fire blanket may be more helpful for someone who is inexperienced with fire extinguishers.

7. Fire Instruction Notices

HSE,(2010) asserts that; fire instruction notices should be displayed permanently and prominently on major escape routes, place where people meet, circulation spaces etc. They should be updated and take into account changes to the building and any escape routes, clearly outlining, the action to be taken on discovering a fire, including raising the alarm and first-aid firefighting and the action to be taken on hearing the fire alarm, including evacuation, assembly and accounting for people. Site visitors also need to be made aware of what to do in case of a fire outbreak. The fire instructions notices are only intended to serve as a reminder. All people on site,

even if they are there for just few hours, should receive sufficient information to know what to do in the event of fire.

8. Training on Emergency Services in Case of Fire Occurrence

According to HSE,(2010) adequate fire safety training should be conducted to both construction site staffs and the site laborers. The training should take into account of the findings of the fire risk assessment, explain the emergency procedures, take account of the work activity and explain the duties and responsibilities of staff, take place during normal working hours and be repeated periodically where appropriate, be easily understandable by the employees and other people who may be on site, be tested by fire drills. Also the training should show what to do on discovering the fire, how to raise the alarm and what is next, what to do upon hearing the fire alarm, the procedures to alerting contractors and visitors including, where appropriate, directing them to exists, the arrangements for calling the fire rescue service, and the reporting of incidents and any near misses (HSE,2010).

9. Proper House Keeping

Garis*et al*.,(2015), housekeeping involves keeping the worksite tidy and safe, ensuring combustible materials are stored in safe designated areas, as well as spotting hazards and taking action against them. Housekeeping is an important fire-prevention practice, but it can quickly deteriorate as a result of lack of action from supervisors. Housekeeping needs to be enforced consistently, and action must be taken when rules are violated. Proper housekeeping involves:-

- Keeping the premises clear for all kinds of refuse and process waste,
- Ensuring waste, excess debris or scrap is swept up and removed from the premises at least daily,
- Ensuring all areas in and around the building site are kept free from accumulated packing materials, such as empty wooden crates, straw, plastic products, paper, etc.
- Proper disposal of combustible waste material, and keeping storage areas accessible to firefighters.

III. METHODOLOGY

A. Research Design

The objective of this research wasto assess fire safety preparedness in building construction sites in Dar-Es-Salaam, Tanzania. Through a quantitative approach, primary data were collected through questionnaire survey, focus group discussion, and observation; while secondary data relied on literature review. The methodology and research design used in this study was descriptive field survey in line with Kothari,(2004) and Kombo & Tromp,(2006) writings, in which apart from literature review; instruments like questionnaire,focus group discussion and observation were used by approaching a sample of various building contractors; covering safety officers, site engineers, site managers, site foremen, and clerk of works on site.This sample was designed using writings by Kothar,(2004) via adopting both probability and non-probability sampling, in which simple randomly was used in selecting site laborers for focus group discussion in building construction sites using Prince & Davies,(2001) and Marczak & Sewell,(2007) writings; while Judgmental sampling was used in selecting site staff such safety officers, site engineers, managers, foremen, and clerk of works.

The focus group discussion guide used was divided into three parts in which; Part I covered awareness on fire safety preparedness; Part II was on fire safety gears; and Part III looked into fire safety preparedness measures. An observation checklist covering; emergence assembly point (availability and accessibility); emergency exit; firefighting and protection gears (availability and functionality) (like fire alarms, fire extinguishers, sand buckets, hose reels, water supply, fire safety signs and notices) was also used.The study questionnaire was divided into four main parts whereby; Part I related to general information about the respondents' experience in the building construction industry; Part II covered the awareness on fire safety preparedness among building construction sites workers; while Part III was on the situational analysis of the building construction site on the provision of fire safety preparedness gears; and Part IV covered on the measures towards improving fire safety preparedness in building construction sites.

B. Population and Sample of the Study

The study population consists ofbuilding construction site workers (safety officers, site engineers, site managers, site foremen, and clerk of works on site) under Class I and Class II building construction companies.In Tanzania contractors are categorized into seven classes. Criterion set to obtain the sample from building contractors was: building contractors to be class one and two, because in Tanzania these are grouped as large contractors.An accessible totalpopulation of 143 Class I and Class II large building contractors with ongoing projects as per CRB,(2017) were selected as seen in Table #3.01. Singh,(2006), enlightens that; 10% to 20% of the accessible population can be used; thus, 10% of 143 gives the total of 15 building construction sites.

Table #3.01; Classification of Building Contractors Ongoing Projects

SN.	Class of Registration	Population
01.	Class I	96
02.	Class II	47
	TOTAL	**143**

Source: CRB,(2018).

Therefore, the targeted population was 90 building construction site workers as seen in Table #3.01, which included site foremen, site engineers, site managers, safety officer and clerk of works, in 15 building construction sites, selected using Judgmental sampling.Sample size was selected from 90 targeted building construction site workers from 15 building construction sites, using Yamen,(1967) formula as shown below;-

$$N = \frac{n}{1 + n(e)^2}$$

Where;- ***N*** = Total Population Size

n = The Sample Size i.e. 90

e = Level of Precision = 10%

$$N = \frac{90}{1 + 90\ (0.1)^2} = 47.36842105$$

Total Population Size, (N)= 48.

percentage and frequencyusing charts and tables where necessary to draw conclusion. Besides, the data collected through focus group discussion and observation, was analyzed by using descriptive method for easy interpretation.

A.Questionnaire Response

The targeted sample was 48 respondents, in which 42 completely filled questionnaires were returned as seen in Table #4.01, which make a response rate of 87.5%, above Mugenda,(2003), writings which claims that; a rate of 50% or higher is satisfactory for data analysis.

Table #4.01: Respondents status from questionnaires

SN.	Respondents	Distributed Questionnaires	Returned Questionnaires
01.	Site Managers	09	09
02.	Site Engineers	10	10
03.	Safety Officers	12	12
04.	Clerk of Works	05	03
05.	Site Foremen	12	08
	TOTAL	**48**	**42**

Source: Author,(2018).

Table #3.02: Targeted Population

SN.	Site Staff	Safety Officers	Site Engineers	Site Managers	Site Foremen	Clerk of Works	TOTAL
01.	Targeted Population	30	15	15	15	15	90

Source: Author, (2018).

The division of the sample size of the respondents obtained is as seen in Table #3.03 below

Table #3.03: Targeted Sample Size

SN.	Respondents	Sample Size
01.	Safety Officers	12
02.	Site Engineers	10
03.	Site Managers	09
04.	Site Foremen	12
05.	Clerks of Work	05
	TOTAL	**48**

Source: Author,(2018).

IV. ANALYSIS, RESULTS AND DISCUSSION

The collected data from building construction site workers (safety officers, site engineers, site managers, site foremen, and clerk of works on site), was analysed using both quantitative and qualitative tools, i.e. Statistical Package for Social Sciences (SPSS) and Microsoft excel; and presented in

B. Focus Group Discussion

The sample size for building construction site workers was obtained by using random sampling, for a focus group discussion consisting of selected 40 building construction site workers (i.e. 4 site workers each from 10 building construction sites).

C. Characteristics of the Respondents

In order to have a wide range of respondent, characteristics like; education level, occupation and experience were of paramount important to consider during data collection so as to ensure maximum validity and reliability of the study findings.

1. Education Level of the Respondents for Intelligible and Concise Information.

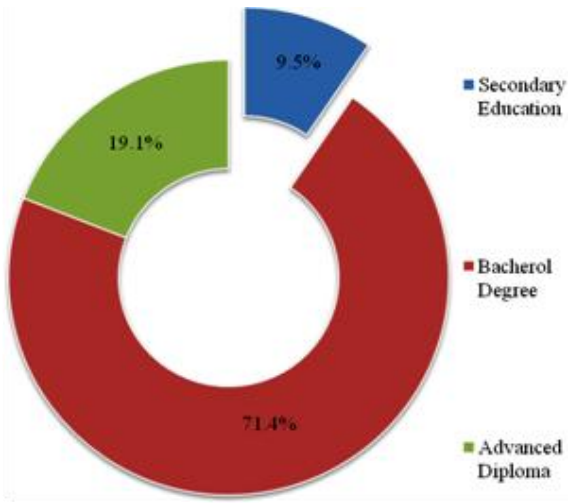
The results in figure #4.01, indicates majority of respondents are bachelor degree holders (71.4%) indicating their possibility in understanding several issue related to fire safety preparedness in construction site. Followed by (19.1%) advance

Table #4.02: Job Position of Building Construction Site Workers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Site Managers	09	21.4	21.4	21.4
	Site Engineers	10	23.8	24.0	45.4
	Site foremen	08	19.0	19.0	64.4
	Safety officers	12	28.5	28.5	92.9
	Clerk of work	03	7.1	7.1	100.0
	TOTAL	**42**	**100.0**	**100.0**	

Source: Author, (2018).

diploma and (9.5%) had secondary education. These findings differ from the focus group discussion respondents where by a large proportional has low education level which could bring challenges on understanding issue related to fire safety preparedness in construction sites, which required more clarification so as to make the discussion easy and understandable.



Fig#4.01: The respondent's education level, **Source:** Author,(2018).

2. Job Position

From Table #4.02, the site job position of the construction staff (28.54%) of the respondents were managers, (23.84%) site engineers, (19.05%) were site foremen and clerk of works (7.14%).

3. Working Experience

The working experience in this study as seen Table #4.03, was a paramount important in order to obtain concise answers from respondents; due to the fact that; experience enables a person to have more knowledge about particular phenomena.

The findings show that (47.6%) of building construction site workers had experience of 5-10 years; (31%) with experience of less than 5 years; (19%) construction site management team personnel with 11-15 years of experience; and (2.4%) with experience of above 15 years. This implies that building construction site workers had enough knowledge, and they were in a better position on being aware on the fire safety preparedness issues, their respective sites.

E. Awareness of Respondents on Fire Safety Preparedness Measures

1. Communication System

The study revealed that; 35.8% were aware of the emergency communication system in the building construction, but they have never used any; while 57.1% respondents were aware, and used mobile phones as one of communication system in the building construction site. 7.1% of the respondents were not aware of any emergency communication system.Furthermore, via observation in one of the building construction site, a notice of the emergencynumber to call in case of fire was displayed in the temporary lift. The numbers were for an ambulance, police, and other personnel who in one way or another are in charge of safety within the site.

Table #4.03: Working Experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 5 years	13	31.0	31.0	31.0
	05-10 years	20	47.6	47.6	78.6
	11-15 years	08	19.0	19.0	97.6
	Above 15 years	01	02.4	02.4	100.0
	TOTAL	**42**	**100.0**	**100.0**	

Source: Author, (2018).

Table #4.04; Response on awareness on fire safety preparedness measures

SN.	Awareness on Fire Safety Preparedness Measures	Aware and Practice	Percent (%)	Aware But Don't Practice	Percent (%)	Not Aware	Percent (%)
01.	Communication system (alarm, telephone, mobile phones)	15	35.8	24	57.1	3	7.1
02.	Frequent regular inspection and maintenance of firefighting equipment	16	38.1	26	61.9	0	0
03.	Availability of an emergency fire disaster kit/ first aid kit	30	71.5	12	28.5	0	0
04.	Existence of fire assembly point	16	38.2	22	52.3	4	9.5
05.	Provision of clear signage indicating exit routes and location of firefighting equipment	24	57.2	17	40.4	1	2.4

Source: Author, (2018).

the safety officer with the main responsibility of ensuring the whole aspect of safety in the building construction site, followed by (21.43%) site

2. Frequent Regular Inspection and Maintenance of Firefighting Equipment

In the case of regular inspection and maintenance of firefighting, the study revealed that; showed that; 61.9% were aware of the inspection and maintenance of firefighting equipment,although they do not practice it, due to unavailability of firefighting equipment in construction site. Meanwhile, 38.1% respondents were aware of the inspection and they do inspect and maintain the firefighting equipment. Viaobservation, most of the building construction site conducted inspection and maintenance of fire extinguishers after every6 months.

3. Availability of an Emergency First Aid Kit

71.5% of the respondents were aware of the availability of emergency kit in their building construction sites, against 28.5% who were not aware. Moreover, it was observed that; most of the building construction site had first aid room facility.

4. Existence of Fire Assembly Point

The study revealed that; 61.8% of the respondents, were aware on the existence of fire assembly point, although it was not allocated within the building construction site. Likewise, 38.2% of the respondents were aware of the existence of fire assembly point, and it was allocated within the building construction site. It was also observed that; in some of the building construction sites, the allocated assembly point space were not enough to accommodate all workers in case of fire outbreak.

5.Fire Safety Training

69% of the respondents had received training on fire safety measures and were aware of the procedures on the fire safety and response action in case of fire outbreak; while 31% had not received any training on fire safety issues, hence showing that; majority of building construction site workers were aware on the fire safety issues.Lack of fire safety drills, and fire training programs on basic fire safety, downgrades the usefulness of measures put in place to respond to fires, thus increasing the risks of fire outbreak, due to poor response in case of emergency. The NFPA reports of 2000, 2002 revealed that, fire safety trainings enable individuals to take more precautions to prevent fire spread.

Table #4.05: Response on Conduction of Fire Training in Building Construction Sites

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	13	31.0	31.0	31.0
	No	29	69.0	69.0	100.0
TOTAL		**42**	**100.0**	**100.0**	

Source: Author,(2018).

6. Conduct of Fire Safety Drill in Building Construction Sites

Most of the respondents from both questionnaire and focus group discussion stated overwhelmingly that drills were not regularly conducted, in which 66.7% of the respondents indicated that; fire drills were not conducted, while 33.3% of the respondents indicated that fire drills were regularly conducted in building construction sites.

Table #4.06: Response on Conduct of Fire and Safety Drills in Building Construction Sites

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	14	33.3	33.3	33.3
	No	28	66.7	66.7	100.0
TOTAL		**42**	**100.0**	**100.0**	

Source: Author,(2018).

These results indicate that; most of construction sites do not conduct evacuation and fire drills, thus workers are unaware of different evacuation means, as well as the response and precaution to opt for during the fire outbreak.

Plate #4.01; Fire drills conducted in one of the building construction site visited, **Source:** Author, (2018).

7. Awareness on Action to Take During Fire Incidences

The study revealed that; in case of fire outbreak, most building construction site workers may opt to inform others workers by shouting fire, using radio calls, whistle, or mobile phone, running towards a safe place such as assembly point through escape routes, to call for emergency services such as fire brigades, to identify the type of fire, and extinguish the fire by using the nearby fire extinguisher, sand or water, helping others to evacuate, running out of the site.Gold &Koigi,(2009), insists that; awell-trained firefighting team with well-defined responsibilities in case of fire should be established, and on hearing the fire alarm sound, the team should assist fellow workers, visitors and customers by leading them through the fire exists, and they should not allow people to come back to the building, or to collect their properties, unless the escape is clear, and they should proceed to the assembly point for roll-call.

Awareness on a particular issue can be increased through difference means such as trainings, education, and seminars. During the focus group discussion, on participation of any fire safety training or fire drills, most respondents revealed that; they had not, while others confused about normal weekly meetings and fire drills and training. They further said that; in weekly meeting most hazards discussed are working at height, slips and trips, manual work

handling issues, hygiene and the use of PPE. This result indicated that; most respondents were not aware on fire safety issues such as causes of fire, type of fire, different extinguishing agents, hence indicating the high risks they are exposed to, for not knowing what to do, in case of fire outbreak.Most respondents claimed that; they don't know how to use, and operate fire extinguishers in case of fire incidence. In case of fire outbreak, the respondents revealed that they will opt for running away from the fire.

…….."Moto unapotokeanikukimbia tu, sigeukinyuma, naokoa maisha yangu kwanza, cha kufianini, wakati maisha ni mafupi?" (Meaning; when the fire breaks, i can only run, I cannot turn back, I will save my life first, why should I die, while life is too short?"……..……

From their response it can be concluded that the level of awareness on issue of fire safety preparedness to site laborers is very low.

F. Existing Situation of the Building Construction Site on the Provision of Fire Safety Preparedness Gears.

1. Availability of Firefighting Equipment in Building Construction Sites

On the availability, functionality and location of firefighting equipment and extinguishing agents within the building construction site, the results revealed that; 69% of respondents had firefighting equipment and extinguishing agents in their building construction sites, while 31% did not. Some respondents claimed that; fire extinguishers were mostly placed in construction site offices and not within the constructed building where the risk is at large, a situation which was also observed, as it makes it difficult to attack fire easily in case of a fire outbreak.

Table #4.06: Response on Availability of Firefighting Equipment in Building Construction Sites

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	29	69.0	69.0	69.0
	No	13	31.0	31.0	100.0
TOTAL		**42**	**100.0**	**100.0**	

Source: Author,(2018).

Thus, the study revealed that; 66.7% water is main extinguishing agent available in building construction site, while 33.3% had no water available on building construction site. Moreover, 64.3% respondents revealed that; their building construction sites had portable fire extinguisher, as the firefighting equipment while, 35.7% respondents who indicated their building construction sites had portable fire extinguisher. Furthermore, 76.2% and 69.1% respondents revealed that most existing building construction sites had no hose reels and sand buckets respectively.In all the building construction sites studied, none of the respondents confirmed existence of Fire hydrant and fire blanket. The study observed that; foam (suitable for use on Class A fire (solid combustible fire) and Class B (Flammable liquid fires)), and carbon dioxide type of fire extinguisher were the most type of fire extinguisher used.

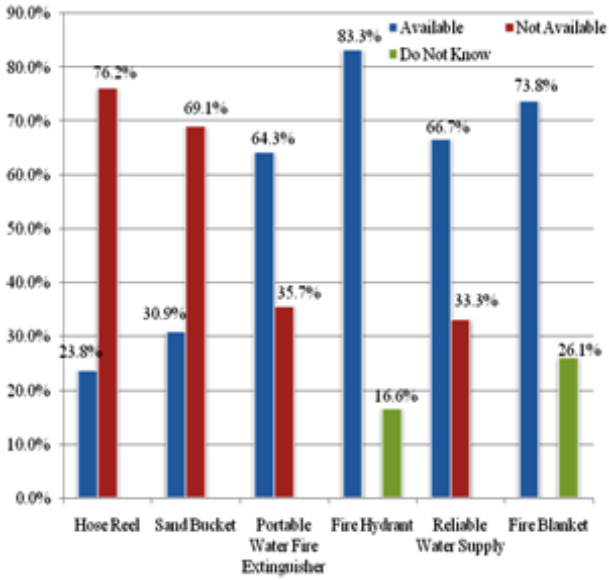


Fig #4.02; Response on the availability of firefighting equipment and extinguishing agents available in building construction sites, **Source:** Author, (2018).

Plate #4.02; Fire extinguisher provided in a temporary lift and one of the floor of the constructed building, **Source:**Author,(2018).

2. Ability to Use Firefighting Equipment

the study revealed that;only 23.8% of all building construction site workers had ability to use and operate the firefighting equipment, provided in their construction site against 76.2% who could not,as seen in Table #4.08.

Table #4.08: Response on ability to use firefighting equipment by construction site management team

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Yes	10	23.8	23.8	23.8
	No	32	76.2	76.2	100.0
TOTAL		**42**	**100.0**	**100.0**	

Source: Author,(2018).

3. Functioning of Firefighting Gears towards Fire Outbreak Response

the study revealed the availability of fire safety gears, although their availability might or might not guarantee their functioning states. Besides, the Fire Rescue Act (2007) insists that; safety gears inspections must be undertaken by the Fire Force Unit to ensure functioning states. In finding out whether the respondents were aware of functioning of the safety gears or not, 71.4% revealed that; all the equipment provided were functional and were inspected as well as checked by competent personnel, while 28.6% indicated that they were not functioning properly and had not been inspected and checked.

Table #4.09: Functioning of firefighting equipment towards fire outbreak response

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	30	71.4	71.4	71.4
	No	12	28.6	28.6	100.0
TOTAL		**42**	**100.0**	**100.0**	

Source: Author,(2018).

4. Availability of Fire Safety Notice and Signs in Building Construction Sites

signs and notices providesan escape direction routes and other exists, locate different firefighting equipment. 73.8% of the respondents revealed that; fire safety notices and signs within the building construction sites were provided, against 26.1% who revealed that, the fire safety notices and signs were not provided. Respondents pointed out exit signs; operating area; caution electrical shocks and appliance; no-smoking signsand assembly point; as fire safety notice and signs provided within the building construction site, which were also observed. Furthermore, they added that; most of notices were written in English language, hence making it difficult for most building construction site workers to understand and interpret them.

Table #4.10: Provision of fire safety notices and signs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	31	73.8	73.8	73.8
	No	11	26.1	26.1	100.0
TOTAL		**42**	**100.0**	**100.0**	

Source: Author,(2018).

5. Availability of Alarm System/Warning System

alarm system/warning systems are the means of communication system used on informing occupants in case of any emergency. In this study, 76.2% respondents revealed that; no fire safety warning systems were provided within the building construction site, against 23.8% who revealed that they were available. The use of radio call as the main means of communication system on informing others in case of any emergency was also stated by some respondents.

Table #4.11: Provision of fire safety alarm system/warning system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	10	23.8	23.8	23.8
	No	32	76.2	76.2	100.0
TOTAL		**42**	**100.0**	**100.0**	

Source: Author,(2018).

6. Availability of Fire Assembly Point in Building Construction Sites

69% of the respondents revealed the availability of fire assembly point within their building construction sites, against 31% said no, due to limited space within their confined building construction site, especially areas like Kariakoo.

Table #4.12: Availability of assembly point

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	29	69.0	69.0	69.0
	No	13	31.0	31.0	100.0
TOTAL		**42**	**100.0**	**100.0**	

Source: Author,(2018).

The Ability of Fire Assembly Point to Accommodate All Building Construction Site Workers in Case of an Emergency:-64.3% of the respondents revealed that; their assembly point cannot accommodate all building construction site workers in case of emergency, against 35.7% who said no, due to limited space within their confined building construction site.

Table #4.13: Ability of assembly point to accommodate building construction site workers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	27	64.3	64.3	64.3
	No	15	35.7	35.7	100.0
TOTAL		**42**	**100.0**	**100.0**	

Source: Author,(2018).

G. Measures to Improve Fire Safety Preparedness in Building Construction Sites.

The measures to improve the state of fire safety preparedness in building construction sites listed by respondents, includes:-

- Frequency toolbox meetings, induction course, training, fire drills to workers on the issue of fire so as to raise awareness and state of preparedness in case of fire incidence and generally the issue of fire safety in building construction site.
- Training the building construction safety officers on fire safety issues. The Fire and Rescue

Regulations,(2015) stipulates that; the owners or occupiers of the building, should let the fire safety manager to attend courses of instructions and receive different training regarding the issue of fire safety

- Exit routes should be kept clean all the time, to facilitate the evacuation process in case of fire incidence.
- Provision of safety gears to all building construction site workers and visitors. The Fire and Rescue Regulations,(2015) stipulates that; every building undergoing construction or demolition operations shall have portable extinguishers and smoke detectors,
- Fire hydrant points should be checked frequently. According to The Fire and Rescue Regulations (2015), where fire hydrants are to be provided, they should be installed, completed and serviced prior to combustible materials, being brought into the building construction work,
- Regular inspection of electrical equipment to ensure safety and security to building construction site workers,
- Provision of fire warning signs in Swahili and English, to facilitate easy communication to all building construction site workers in case of fire incidence in building construction sites,
- Ensuring that the building construction site is clean, uncongested and the on-site building materials are properly stored. The Fire and Rescue Regulations,(2015) stipulated that; storage of flammable and combustible liquids should not exceed 200 Litres, and combustible waste material should not be burned within the building construction sites unless approved by authority, and should be removed from the building construction site so as to minimized the hazards,
- Good building construction site layout, designed to provide ease during evacuation,
- Government initiative in creating awareness on fire safety issues within a building construction site,
- Provision of first aid kit in case of any accidents,
- Healthy and safety authority should make regular checks in all building construction sites, in order to make sure that; all building construction workers are well trained and the site is well equipped.
- Proper storage of on-site building materials, so as to maintain and unobstructed means of escape and passageway. Also to keep all sources of fire away from the building materials which can catch fire easily,
- Provision of alarm system within the building construction site in case of any emergency as the means of alert all workers in case of fire outbreak in building construction sites,
- Fire department should extend their awareness creation programs to all building construction stakeholders,
- Education to all building construction site workers on how to use fire equipment,
- Provision of fire safety notices and signs,
- Compliance with OSHA and Fire Authority requirements on the issue of fire safety in workplaces,
- Clients have to allow provisional budget for the fire safety issue in building construction project so as to ensure maximum safety in building construction site.

V. CONCLUSION AND RECCOMENDATIONS

A. Conclusion

The study assessed fire safety preparedness in building construction sites in Tanzania, in which it established that most of the construction site workers areaware on fire safety preparedness issues via having education background, experience and trainings on safety issues.Likewise, findings from construction site laborers shows that; majority of site laborers were not aware on fire safety preparedness, due to low level of education or being non educated, lack of experience in construction industry, and lack of trainings on fire safety issues as well as fire drills. Again, the study revealed that; water is the main extinguishing agent available in building construction sites followed by fire extinguishers, as well as foam and carbon dioxide extinguishers.

Basically, different types of fire are fought using, different extinguishing agents; hence, it is important to make sure that, an adequate number of other types of fire extinguishers are provided on building construction sites, so as to ensure maximum preparedness in relation to the number of construction workers on site, and size of the projectsimultaneously to being placed on a visible and reachable area. Again, preparedness gears, fire safety signs and notices such as exit sign, electrical shock, no smoking and assembly point signs, were available hence indicating the level of awareness at management level. Lastly, the provision of firefighting equipment is moderate; hence a need for more provision of fire safety preparedness gears in order to ensure maximum state of preparedness in case of fire outbreak, in building construction sites.

B. Recommendations

In the case on how to improve fire safety preparedness in building construction sites, given the study fact that; fire safety is not understood clearly by site laborers and workers in the building construction sites in Dar-Es-Salaam, Tanzania, several recommendations are proposed, these includes:-

- To conduct and implement fire emergency drills on site. Most of construction sites do not have fire drills and on-going trainings on site on the

safety due to cost reason, so to ensure this before undertaking the project enough budget should be allocated particularly for the safety issue.

- To make sure all fire safety signs are available on sites, and are in such a way that can be understood and interpreted by all site workers, e.g. the use of symbols and different languages.
- To ensure safe working practices in construction sites, means well-defined procedures and instructions to carry out task properly.
- The site layout and should be considered during design stage since the site layout determine the position of different fire safety gears in a construction site.
- To ensure there are enough number of safety officers so as to ensure the issue of safety in construction is implemented effectively
- Campaign through media (TV, radio, newspaper), are the most effective means which people can see and learn. As majority of site laborers in this study were unaware of what needed to be done during fire, then this approach could be applied.
- Review of acts and regulations regarding fire control and safety to be given a priority so as to create the disaster response habit to save life's of people.

Thus, it is identified that; lack of awareness and understanding contribute to the low state of fire safety preparedness at the building construction sites. Therefore, the management should focus more in providing more adequate information about the importance of being safe from fire disaster at their construction sites.

REFERENCES

[1] Abdullah, J. (2001);Fire in Tall Buildings: Occupants Safety and Owner's Liability.Kuala Lumpur: International Law Book Services.

[2] Abdusalam, A, Kabir, R. & Arafat, S. (2016);Assessment of Fire Safety Preparedness in Selected Health Institutions in Niger State, In the International Journal of Perception in Public Health, Volume#01, Issue (01), Page 50 to 58.

[3] Afedzie, R&McEntire, D. (2010);Rethinking Disasters by Design. In the International Journal, DisasterPrevention and Management, Volume #19, Issue(01), Page 48 to 58. Published By Emerald Group Publishing Limited, 0965-3562, DOI 10.1108/09653561011022135, (https://www.researchgate.net/publication/249359280_Rethinking_Disasters_by_Design).

[4] Ayabei, J. (2016); Level of Fire Disaster Awareness in Buildings within the Nairobi Central Business District, In the International Journal of Scientific and Research Publications, Vol. 06, Page 188 to 193. ISSN 2250-3153.

[5] Burberry, P. (1998); Environment and Science, Fire Fighting Equipment. 4th Edition, London: Mitchell Publishing Company Limited.

[6] Comolotti, J. (2004);The Importance of School Fire Drills,http://www.fa.com, (Retrieved on 02nd May, 2018).

[7] Driskell, J.E, & Salas, E (1996); Stress and Human Performance, Publishedby Lawrence Erlbaum Associates, Mahwah, New Jersey, U.S.A, ISBN: 0805811826.

[8] Easterby-Smith, M, Thorpe, R, & Lowe, A, (2004); Management Research: Introduction.02nd Edition, London, United Kingdom (U.K.), Published bySage Publications, ISBN-13: 978-0761972853; ISBN-10: 0761972854.

[9] Federal Emergency Management Agency (FEMA), (2007); National Preparedness Guidelines.Washington, DC: Department of Homeland Security, U.S.A.

[10] Fransisco J, Juan, C &Rubio, G. (2004), Status for the Fire Safety in Hotels, Spain.

[11] Garis, L, Maxim, P & Mark, K. (2015); Construction Site Fire Safety: A Guide forConstruction of Large Buildings, Canada: CWC

[12] Giwa, A. (2012); The National Emergency Management Agency (NEMA) Seminar on Fire Prevention and Outbreak.

[13] Gold, D, &Koigi, K. (2009); Fire Protection Checklist. FINNIDA-ILO.

[14] Guyer, P. (2009);An Introduction to Fire Protection Engineering for Buildings, (Live Webinar), (https://pdhonline.com/courses/g258w/g258w-handout.pdf), (Retrieved on 08th May, 2018).

[15] Haddow, G, & Bullock, J. (2006); Introduction to Emergence Management. 2nd Edition, Boston, U.S.A. Published byElsevier LTD.

[16] Hall, F, &Greeno, R. (2007); Building Services Handbook. 1st Edition. Great Britain:Reed Educational and Professional Publishing.

[17] Hall, R. (1997);The Lowdown on High-rise Fires. In the Journal of National Fire Protection Association (NFPA), Page 84 to 90.

[18] Harris, (2004); Fire Prevention Week Survey, Boston: National Fire Prevention Association.

[19] Health &Safety Executive, (2003); Causal Factors in Construction Accident: Research Report 156. London: Health and Safety Executive.

[20] Health & Safety Executive (2006);Health and Safety in Construction. 3rd Edition., Norwich: The Stationery Office.

[21] Health & Safety Executive, (2010); Fire Safety in Construction, Guidance for Clients, Designers, and those Managing and Carrying Out Construction Work Involving Significant Fire Risks, 2ndEd London: The Stationery Office

[22] Hornby A.S. &Wehmeier, S (2000);Oxford Advanced Learner's Dictionary: International Student's Edition. Published By Oxford University Press, 6th Edition, ISBN-13-978-0-19-400116-8.

[23] Hughes, P &Ferrett, E, (2007);Introduction to Health and Safety in Construction, 2ndEdition, Oxford: Published by ElsevierLTD.

[24] Istre, R.I, &Mallonee, S, (2000); Smoke Alarms and Prevention of House-Related Deaths and Injuries. In the Western Journal of Medicine,Volume #173, Issue (02), Page 92 to 93, (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1071009/).

[25] Kihila, J.M. (2017); Fire Disaster Preparedness and Situational Analysis in Higher Learning Institutions of Tanzania, In the Journal Disaster Risk Studies,Volume #09, Issue(01), Page 311.

[26] Kitumbo, H. &Kirenga, A.P, (2001); Construction Industry in Tanzania. In the African Newsletter on Occupational Health and Safety, Volume #01, Issue(11), Page 08 to 09.

[27] Kombo, D.K, &Trompo, D. (2006); Proposal and Thesis Writing; Introduction.Nairobi-Kenya, Published byPaulines Publication Africa.

[28] Kothari, C. (2004), Research Methodology: Method and Techniques. 2nd Edition, New Delhi: Published by New Age International (P) LTD Publishers.

[29] Krishnaswami, O.P, &Ranganatham, M, (2006);Methodology of Research in Social Sciences. 2nd Edition, Mumbai, India, Himalaya Publishing House.

[30] Kyle, S. (2016); ConstructionSiteFires:ReduceYourRisk. (https://solutions.borderstates.com/construction-site-fires-reduce-your-risk/), Published By Border State, (Retrieved on17th March 2018).

[31] Marczak, M, & Sewell, M. (2017); Using Focus Groups for Evaluation, (http://ag.arizona.edu/fcs/cyfernet/cyfar/focus.htm), (Retrieved on15th April 2018).

[32] Menon, G.B, &Vakil, J.N, (2005); Handbook on Building Fire Codes.Kampur:Bureau of Indian Standards.
[33] Mfinanga, J.A. (2007); "Parking Generation by Facilities in the CBD of Dar-Es-Salaam City". In the Journal of Building and Land Development, Vol.14(2), 83-89.
[34] Murali, L.G. & Vijayalakshmi, M.M. (2014); Fire Accidents in Building, International. In the Journal of Engineering Trends and Technology, Vol.11(4), 178-184.
[35] Oduor, A. &Atsiaya, P. (2004); Two Fire Attacks Fail to Break Schools Spirit,Nairobi: East African Standard.
[36] Orodho, J.A. (2003); Essentials of Education and Social Science Research Methods.Published byMasola, Nairobi, Kenya.
[37] Occupational Safety and Health Act, Legal notice 15 of 2007 of the laws of Kenya.
[38] Phoya, S. (2012); Health and Safety Risk Management in Building Construction Sites in Tanzania; The Practice of Risk Assessment, Communication and Control. Ph.D. Thesis, Department of Architecture, Gothenburg, Sweden: Chalmers University of Technology.
[39] Prince, M. & Davies, M. (2001); Moderator Teams; An Extension to Focus Group Methodology, In an International Journal of Qualitative Market Research, Volume #04, Issue(04), Page 207 to 216.
[40] Proulx, G.(2001); Occupant Behaviour and Evacuation. Munich, National Research Council Canada.
[41] Proulx, G. (2003), Playing with Fire: Understanding Human Behaviour in Burning Buildings, In the ASHRAE Journal, Volume #45, Issue (07), Page 33 to 35.
[42] Ridley, J. (2008); Health and Safety in Brief. 4thEdition,Published by Elsevier, Great Britain, United Kingdom(U.K.).
[43] Ridley, J.& Channing, J. (1999); Workplace Safety. 1st Edition., Published by Elsevier, Great Britain, United Kingdom(U.K.).
[44] Ronoh, R.K. &Kyalo, W.B. (2009); Safety Awareness and Preparedness in Secondary Schools Kenya; A case of Turkana District,In the Journal of Educational Research and Reviews, Volume #04, Issue (08), Page 379 to 384.
[45] Saini, A.K. & Chaturvedi, S. (2009); National Seminar on Fire Safety in TallBuildings: Development of Fire Safety Infrastructure, Safety Principles and Policies, (https://share.ansi.org/Shared%20Documents/Standards%20Activities/International%20Standardization/Regional/Staff/LMM/SCCP%20Materials/SCCPWorkshop_Saini_20091104.pdf)(Retrieved on 25th March, 2018).
[46] Singh, Y.K, (2006);Fundamental of Research Methodology and Statistics, Published byNew Age International Publishers, New Delhi, India.
[47] Tan, C.W. &Hiew, B.K, (2004);Effective Management of Fire Safety in a High-RiseBuilding, In the Bulletin Ingenieur, Page 12 to 19.
[48] Tharmarajan, P. (2007); The Essential Aspects of Fire Safety Management in High-RiseBuilding, (http://www.efka.utm.my/thesis/IMAGES/2007/2JSBP/prashantma0501 1d07ttt.pdf, (Retrieved on 25th March, 2018).
[49] United Nations (UN), (2008);Disaster Preparedness for Effective Response Guidance and IndicatorPackages for Implementing Priority Five of the Hyogo Framework: United NationsSecretariat: Switzerland.
[50] United Republic of Tanzania, (URT), (2007); National Fire and Rescue Act, Published by Government Printers, Dar-Es-Salaam, Tanzania.
[51] United Republic of Tanzania, (URT), (2015); National Fire and Rescue Force Regulations,Published by Government Printers, Dar-Es-Salaam, Tanzania.
[52] United Republic of Tanzania, (URT), (2003); The Occupational Health and Safety Act 2003 of Tanzania,Published By Government Printers, Dar-Es-Salaam, Tanzani