ISSN: 0976-3376

Available Online at http://www.journalajst.com

ASIAN JOURNAL OF SCIENCE AND TECHNOLOGY

Asian Journal of Science and Technology
Vol. 08, Issue, 01, pp.4169-4175, January, 2017

RESEARCH ARTICLE

FIRE SAFETY PREPAREDNESS IN THE CENTRAL BUSINESS DISTRICT OF KUMASI, GHANA

***Kofi Agyekum, Joshua Ayarkwa and DeGraft Joe Opoku**

Department of Building Technology, Kwame Nkrumah University of Science and Technology, Kumasi-Ghana

ARTICLE INFO

Article History:
Received 17th October, 2016
Received in revised form
29th November, 2016
Accepted 24th December, 2016
Published online 31st January, 2017

Key words:

Fire safety,
Central Business District,
Kumasi, Ghana

ABSTRACT

In Ghana, the incidence of fire outbreak has become the order of the day, as there is no single day without news on fire outbreaks in some parts of the country. These fires affect different buildings. Knowing how to use installed facilities within buildings is very important in tackling fire emergencies. This study was conducted to assess the perceptions of occupants on fire safety preparedness in the Central Business District (CBD) of Kumasi. The key objectives set out were to assess fire disaster preparedness among occupants in the CBD, to assess the perceptions of the occupants on the causes of fire outbreaks and the use of firefighting equipment in the CBD, and to identify the measures which occupants feel should be put in place to control outbreak of fire in the CBD. The study adopted a case study research strategy. Empirically, the findings from the research showed that there is limitless fire safety preparedness among occupants in the CBD of Kumasi. The study recommends, that fire assembly points/emergency shelters, public education on fire safety, enforcement of fire safety policies, among others should be put in place to ensure that fire outbreaks are controlled in the CBD.

INTRODUCTION

Fire outbreaks have risen to a worldwide attention in recent years as an environmental and economic issue. Globally, fire is considered a potential threat to sustainable development because of its effects on ecosystems, its contribution to carbon emissions and its impact on biodiversity (Tacconi, 2003). The world has experienced succession of disasters such as floods, fires, storms, earthquakes volcanic eruptions and landslides. Such incidents include the worst fire that occurred in Mexico, the Mozambican floods of the year 2000 and the 2010 Chilean earthquake (Victoria, 2003). Fires have also contributed to the toll of manmade disasters in Ghana with varying loss of properties and lives (Disaster Relief Emergency Fund, 2010). Examples of these fires include fire outbreaks in 2008 at various markets, especially in Accra, Kumasi and Takoradi. Also, six (6) fire outbreaks occurred in 2009 at markets throughout the country, with fire at Kumasi Central Market being the most devastating. Ghana has also recorded numerous fire outbreaks which have been costly to the economic development of the country. Urbanization in the Central Business District (CBD) of Kumasi has exerted severe energy, environmental and human traffic pressure on the CBD making it susceptible to a widespread of disaster risks, particularly fire hazards. The main drivers behind this massive urbanization in the CBD of Kumasi are high rates of natural population increase, rural-urban migrations and the reclassification of rural areas as urban (Akrofi, 2006). However, many of the buildings and shops used for this purpose are poorly constructed and in a slummy nature, posing significant fire risks to the habitants. Additionally, water supply, sewage and drainage, paved roads, lighting and electricity supply, public transport and garbage disposal areas are often not available, which create massive hazards (Nguluma and Lupala, 2000). Above all, the rate of fire incidences in the CBD of Kumasi is quite alarming and awful. The lack of proper roads, problem of inaccessibility and perhaps the dense nature of the area (overcrowded conditions) make it easy for fire to spread between buildings in the CBD, makes populaces vulnerable and limits the ability for emergency services to reach affected areas in case of fire disasters. These and many other factors have caused the risk of fire outbreaks in the CBD. This paper is structured to provide a review of theoretical perspectives that are relevant for a proper understanding of the study's context. The methods adopted in this study are explicated in the subsequent section, followed by the presentation and discussion of results, and finally the conclusion and recommendation.

****Corresponding author: Kofi Agyekum***
Department of Building Technology, Kwame Nkrumah University of Science and Technology, Kumasi-Ghana.

Literature review

Causes of Fire in Buildings

Fire is the rapid oxidation of a material in the exothermic chemical process of combustion (Wahab, 2015). It involves the emission of heat, light and reactive products (Pyne, 1982).

According to Wahab (2015), fire starts in different ways and serves as a potentially destructive force in the lives of people. Many major markets and office buildings located within the central business districts of many countries have been gutted by fire, destroying lives and properties which are worth millions of dollars (Wahab, 2015). Fire is a rapid, self-sustaining oxidation process accompanied by the evolution of heat and light in varying intensities (Addai *et al.,* 2016). For fire to be present in a building, four key elements should be present: fuel; ignition source; oxidizing agent; and mechanism of the reaction (Addai *et al.,* 2016). In most cases, the root cause of the fire is as a result of negligence, ranging from direct acts such as lighted cigarettes left burning to more indirect causes such as poor installation, overloading of electrical appliances and maintenance of electrical wiring (Rubaratuka, 2013). It is not practically possible to eliminate completely these causes (Rubaratuka, 2013). Power fluctuations locally known as 'dumsor' in Ghana can also cause fire outbreaks (Twum-Barima, 2014). When electricity goes off, people forget to turn off the electrical gadgets they use. When the power comes back and they are not around, the high voltage that comes with it tends to set fire to the electrical gadgets which might probably be on. Also, overloading of electrical appliances can cause fire outbreaks in the markets, especially, in the wrongful use of extension sockets as the market women tend to overload them without knowing its consequences. Improper and old electrical wirings pose a big threat to fire outbreak because once they get very close to any dry combustible material, fire can easily ignite and set the whole market place ablaze (Twum-Barima, 2014). Cooking in the home and workplace with naked fire also causes fire disaster. Improper disposal of waste materials susceptible to spontaneous combustion, such as oily rags from wood finishing or polishing; accumulation of organic materials, such as green hay, grain or woodchips; and accumulation of waste combustible materials near potential sources of ignition all cause fire outbreaks (Pyne, 1982). Anaglatey (2013) in his study observed that one of the major causes of fire outbreaks in buildings in Ghana has been electrical problems that result from faulty wiring and misuse of electrical gadgets. Other studies conducted in Ghana have further identified the causes of fire in buildings to include poorly designed and constructed electrical circuits, improper electrical fittings, use of substandard electrical materials, defective generators, power fluctuations and illegal tapping from the national grid (Boateng, 2013; Simpson, 2010). Boateng (2013) further reports that the rise in fire outbreaks in buildings can be traced to overloading of electrical appliances on the same fuse, improper electrical installations in homes and workplaces, intense harmattan, amongst others. With the ever increasing outbreaks of fire in building infrastructure in Ghana, with the most recent occurring in state buildings and the central business districts in major towns in Ghana, the issue still keeps escalating with no definite ways to control it.

Fire safety preparedness in CBDs

Fire safety preparedness is defined as pre-fire disaster activities designed to increase the level of readiness or improve operational capability, for responding to a fire emergency (Murage, 2012). Brewerton (1999) also defined it as planning, equipping, training and exercising in order to create or sustain capabilities in order to prevent, protect against, mitigate and respond to any fire emergency. The purpose of being prepared is to enable effective response when a disaster occurs (Corrall and Brewerton, 1999). According to Colonna (2001), one of the universally followed guidelines in fire disaster preparedness is that, fire extinguishers and other firefighting equipment which include fire extinguisher hose reel, dry riser, wet risers, sprinklers, fire detectors and sensors should be kept wherever necessary.

In the workplace standards, it is also important that the equipment in each of these facilities is maintained on a regular basis and any faults, when detected, must be rectified immediately (Murage, 2012). A record of such maintenance must also be maintained (Colonna, 2001). However, a survey which was conducted in South Kolkata Dhakuria, India to assess fire disaster preparedness in hospitals in both private and public buildings found that fire pumps had stopped working in several hospitals. In addition, fire and smoke alarms in many hospitals were not functioning properly. The study revealed the risk exposed to patients in case of fire outbreak (Reuters, 2004). All workplaces must have clearly identified means of escape which are kept clear at all times to ensure that everyone can exit the workplace in the event of a fire or other emergency (Mfinanga, 2007). If an escape route or emergency exit must be blocked for any reason, then alternative arrangements must be made, and these arrangements must be conveyed to all those occupying the building (Mfinanga, 2007). A research conducted in London to assess peoples' behaviour in fire revealed that as long as an exit is not seriously obstructed, people have a tendency to move in a familiar direction, even if further away, rather than to use a conventional unfamiliar fire escape route. The study recommended proper fire signs to be posted in every building for easy access in case of fire outbreaks (National Fire Protection Association, 1995). Bowker (1999) noted that in order to have effective fire preparedness in high-rise buildings, it is important to teach people about the fire safety methods and procedures. Educational and training programs pertaining to the fire safety measures help in providing knowledge to the people about the various aspects of a fire disaster (Bowker, 1999). Safety regulations in U.K impose mandatory fire safety training to all employees working within a building, a construction area or any other busy area which helps provide employees with crucial information, develop skills such as those used in operating fire extinguishers and proper escape behaviours (Proulx, 1999).

Also, Ouellette (1997) noted that there is a huge difference between acquiring fire protection in theory and implementing the same in practice. Fire drills enable people to escape from the scenes without being hurt (Ouellette, 1997). It is necessary to conduct a fire drill at least once a year. This will help employees practice how to get out of a building as fast as they can, in case there is fire outbreak (Ouellette, 1997). To conclude, the Occupational Safety and Health Administration, OSHA, requires a written emergency action plan for all businesses that employ more than ten people. However, for those with fewer than ten employees, the plan may be communicated orally. It is important that the evacuation plan is evaluated and practiced to ensure its efficiency (National Fire Protection Association, 1995).

MATERIALS AND METHODS

This study adopted a case study research strategy. The Central Business District (CBD) of Kumasi was selected as the case study area, owing among other factors to its richness in terms of information relevant to fire outbreaks. Also, choosing the CBD was founded on the basis that it comprises of many buildings that are subject to sections 4(b) and 26(1) of the Ghana National Fire Service (GNFS) Act of 1997 (Act 537). This circumstance provides an extensive scope for selection as linked to areas outside the CBD. A quantitative research method was chosen to examine the assessment, since it was investigative in nature. A questionnaire survey was adopted so as to facilitate the collection of information from the Central Business District. The target respondents included property managers, occupants, tenants and other key informants such as the care takers and managing directors of all public buildings in the CBD of Kumasi. To maximize the number of potential survey respondents, a number of office buildings, commercial buildings, commercial residential buildings within the CBD were considered. In the end, 20 public buildings were conveniently sampled and agreed on for responses. This is because the occupants in those buildings showed higher interests to participate in the study. This approach to sampling the buildings were founded on a study by Mfinanga (2007), who grouped the buildings into three classes, based on land use as purely office buildings, purely commercial buildings, and office and commercial buildings. Within these buildings, 100 respondents (made up of property managers, occupants, tenants, managing directors and care takers) were conveniently invited and agreed to participate in this survey. Hard copies of the questionnaire were distributed by hand to the respondents in the CBD within the selected public buildings. In identifying the groups of buildings, Kachenje et al. (2010) defines purely office buildings as the buildings with 100% of their respective occupied areas used as offices, without any other activities while purely commercial buildings are the ones that accommodate only commercial activities. They further distinguish commercial residential buildings as those being used for both commercial purposes and for residential accommodation, whether for families or students and workers.

Figure 1. Aerial view of the Kumasi Central Business District (www.en.wikipedia.org)

The questionnaire was divided into five major sections (i.e. A to E). Section A sought information on the demographics of the respondents. Section B sought information on fire disaster preparedness among occupants in the CBD of Kumasi. Section C sought the views of the respondents on the causes of fire outbreaks in the CBD of Kumasi. In this section, the respondents were asked to score on the Likert of 1 to 5 (where 1 = Highly Insignificant and 5= Highly Significant) the significance of some factors as causes of fire outbreaks in the CBD. Section D further sought the views of the respondents on firefighting equipment which are used to control fire in the CBD. In this section also, the respondents were asked to score on the Likert scale of 1 to 5 (where 1= Highly Unused and 5= Highly Used) the level of usage of some firefighting equipment to control fire. In Section E, the respondents were asked to indicate the importance of some key measures used to mitigate fire outbreaks in the CBD.

Data from the study was analyzed using the IBM SPSS (International Business Machines Statistical Package for the Social Sciences) version 23 offering mainly descriptive statistics. Unless otherwise stated, percentages given below relate to the responses to individual questions. Descriptives also provide information concerning the mean, standard deviation, and distribution of scores on continuous variables (skewness and kurtosis). This information may be needed if these variables are to be used in parametric statistical techniques. The skewness value provides an indication of the symmetry of the distribution. Kurtosis, on the other hand, provides information about the 'peakedness' of the distribution (Pallant, 2005). Wrong inferences might be reached when normality hypothesis is not valid (Glass *et al.,* 1972). According to Kline (2005), hypothesis of univariate normality is not violated when the skewness index is between -3.0 to 3.0 and the kurtosis index is between -8.0 to 8.0. The element of standard deviation measures consistency in responses by obtaining the difference between the highest and lowest values of the standard deviation. If the difference between them is low, i.e. being close to zero (0), the consistency is high as far as the responses are concerned and vice versa. Moreover, standard deviations greater than 1.0 indicate that there is a great variability in data provided by the respondents and differences in how respondents interpreted the variables.

RESULTS AND DISCUSSION

Sample Characteristics

From the information provided, it can be deduced that, respondents who dominated the study are tenants below the age of 39 years with less than 3 years of occupying purely commercial buildings.

Fire disaster preparedness among occupants in the CBD of Kumasi

Generally, preparedness is defined as the process of ensuring that an organization has complied with the preventive measures, is in a state of readiness to contain the effects of a forecasted disastrous event to minimize loss of life, injury, and damage to property, can provide rescue, relief, rehabilitation, and other services in the aftermath of the disaster, and has the capability and resources to continue to sustain its essential functions without being overwhelmed by the demand placed on them. Preparedness for the first and immediate response is called emergency preparedness. However, in this study, the disaster tackled is fire disasters in the CBD of Kumasi.

Table 1. Demographic profile of the respondents (N=83)

Characteristic	Frequency	Percentage
Nature of occupation		
Occupant	23	27.7
Property Manager	18	21.7
Tenant	27	32.5
Others (Managing Director, Care Taker)	15	18.1
Age		
Below 30 years	39	47.0
31-40	21	25.3
41-50	15	18.1
Above 50	8	9.6
Length of time occupying premise		
Less than 3 years	39	47.0
4-6 years	14	16.9
7-9 years	10	12.0
More than 9 years	20	24.1
Type of building operated		
Purely Office building	19	22.9
Purely commercial building	37	44.6
Commercial residential building	27	32.5

Table 2. Fire safety preparedness (N=83)

Characteristic	Frequency	Percentage
Experience of fire outbreak in the CBD		
Not often	36	43.4
Less often	25	30.1
Neither	18	21.7
Often	2	2.4
Very often	2	2.4
Number of escape routes provided in building		
None	31	37.3
One	23	27.7
Two	17	20.5
Three	12	14.5
Custodian of key to escape route		
Owner	9	10.8
Occupants	23	27.7
Security man	18	21.7
Unknown	33	39.8
Configuration of escape route door		
Inward	22	26.5
Outward	27	32.5
Sliding	8	9.6
Both inward and outward	26	31.3
Usage frequency of escape route		
Not Often	28	33.7
Less often	13	15.7
Rarely	24	28.9
Often	6	7.2
Very often	12	14.5
Existence of signage for fire escape routes in the building		
Yes	33	39.8
No	50	60.2
Safety of the building in case of fire outbreak		
Yes	38	45.8
No	45	54.2
Compliance with fire bylaws in the building		
Yes	38	45.8
No	45	54.2

This part of the survey sought to examine the level of fire disaster preparedness among occupants in buildings within the CBD. Table 2 shows that 36 out of the 83 respondents reported that fire outbreaks are not often experienced in the CBD. This represents the bulk of the respondents and stands at a percentage of 43.4. Also, 25, representing 30.1% of the respondents reported that fire outbreaks occur less often in the CBD, followed by 18, representing 21.7% of the respondents providing a neutral response to this question. Only a small percentage (4.8%) of the respondents reported that fire outbreaks occur often and very often in the CBD. Majority (31, 37.3%) of the buildings surveyed in this study do not have escape routes. This will make escape from these buildings very difficult in the event of fire. However, 27.7% of the buildings have one escape route, followed by 20.5% having two escape routes. Very few (14.5%) of these buildings have up to three escape routes. Table 2 further shows that majority (39.8%) of the respondents do not even know where or with whom the keys to the doors of the escape routes are kept. This is an indication that even in the event of fire, occupants of the buildings in the CBD will find it very difficult to access the escape routes. However, in some of the buildings, the key of the doors of the escape routes is kept by occupants (27.7%), a security man (21.7%) or the owner of the building (10.8%). Most of the doors of the escape routes swing outward (32.5%). This is followed by doors that open both inward and outward (31.3%), inward (26.5%) and sliding (9.6%). The results also show that majority of the respondents do not often use the escape routes. As much as 78.3% of the respondents fall under this category. The reason for this finding may be related to the fact that fire outbreaks are not often experienced in the CBD as previously indicated in the 'number of escape routes provided in buildings'. Consequently, this does not require occupants to often use the escape routes. However, the remaining 21.7% of the respondents reported that they use the escape routes often and more often. Sixty percent (60%) representing the majority of the respondents reported that their operated buildings in the CBD do not have signage for fire escape routes. Only 40% of the buildings have signage for fire escape routes. This makes the location of escape routes in the event of fire very difficult. Fifty-four (54%) of the respondents also reported that their operated buildings in the CBD are not safe in case of fire outbreaks. However, 46% of the respondents reported that their buildings are safe in case of fire. The implication of this is that in the event of fire, the safety of occupants and properties cannot be assured. Meanwhile, 62%, representing the majority of the respondents reported that there is no compliance with fire bylaws in their operated buildings. Only 38% indicated that there is compliance with fire bylaws in their operated buildings.

Causes of fire outbreaks in the Central Business District of Kumasi

There are a number of factors leading to the outbreak of fires in any facility. Respondents were asked to indicate the causes of fire outbreaks in the CBD and the results are shown in Table 3. It can be observed that skewness values for the independent variables ranged between -1.130 to 0.018 (-3.0 to 3.0), while values for the kurtosis ranged between -1.563 to -0.388 (-8.0 to 8.0). This is an agreement with the common rule of thumb in testing normality, both the skewness and the kurtosis should be within the ±3 and ±8 respectively. Hence the data set for the causes can be considered normal for further parametric tests. The mean statistics revealed that *Power fluctuations* (Dumsor) came first with 3.92. Power fluctuations which are defined as frequent power outages have recently become a common issue of national attention in Ghana. This has led to the terming of this power outage situation as "Dumsor" in Ghanaian localities which means power going on and off frequently.

Table 3. Descriptive statistics of the causes of fire outbreak (N=83)

Causes of fire outbreak	Mean	Std. Deviation	Skewness	Kurtosis	Rank
Power fluctuations (Dumsor)	3.92	1.548	-1.130	-.388	1
Improper electrical wiring systems	3.54	1.434	-.646	-.906	2
Overloading of electrical appliances	3.46	1.382	-.564	-.913	3
Illegal tapping of electrical power from the national grid	3.04	1.557	.018	-1.550	4
Cooking with naked fire in the market	2.93	1.496	-.053	-1.463	5
Use of defective operators	2.90	1.503	-.163	-1.563	6

Table 4. Descriptive Statistics of equipment used in the CBD (N=83)

Equipment	Mean	Std. Deviation	Skewness	Kurtosis	Rank
Carbon dioxide extinguishers	3.71	1.164	-.647	-.257	1
Dry chemical extinguishers	3.23	1.243	-.332	-.838	2
Smoke detectors and alarms	2.60	1.249	.531	-.560	4
Wet chemicals	2.33	1.474	.726	-.917	5
Sprinklers/hose reels	2.14	1.138	.776	-.256	6
Fire fighter's outfit	1.99	1.042	.688	-.485	7
Fire pumps	1.92	1.171	.961	-.307	8
Fire blankets	1.88	1.253	1.185	.103	9
Remote shut and stop system	1.81	1.224	1.564	1.510	10
Fire main piping and valves	1.80	1.009	1.228	1.043	11
Fire doors	1.76	.995	1.571	2.467	12
Fire dumpers	1.63	1.056	1.505	1.032	13
Emergency escape breathing device	1.61	1.046	2.016	3.655	14
Fire retardant bulkhead	1.43	.719	1.549	1.566	15

It was not surprising when respondents ranked this factor, first, as the most significant factor that causes fire outbreaks in the Central Business District (CBD) of Kumasi. This factor obtained the highest mean score of 3.92. This finding is in support of the studies by Boateng (2013), Addai et al. (2016) and Simpson (2010) where it was posited that power fluctuations resulting in power outages is a major cause of fire outbreaks in Ghana. Similarly, Twum-Barima (2014) also found power fluctuations as the major cause of fire outbreaks in the Kumasi central Market. This is a serious problem when electric power goes off during the day and occupants leave their electrical appliances and go out without putting them off. When the power comes on with a high voltage, this can easily ignite fire in the appliances that were not put off when the power went off. Anaglatey (2013) stated that *improper electrical wiring systems* is one of the major causes of frequent fire outbreaks in Ghana. The findings of this study also revealed this factor as a significant cause of fire outbreaks in the Central Business District (CBD) of Kumasi. This factor was ranked second by the respondents, with a mean score of 3.54. The finding from this study corroborates literature (Twum-Barima, 2014; Boateng, 2013; Simpson, 2010). Electrical faults originate from poorly designed and constructed electrical circuits, and the electrical wiring found in many domestic buildings in Ghana is designed not by an electrical engineer, but by an artisan with scanty knowledge in the design of electrical circuit. Electrical cables are commonly found strewn haphazardly on the ceiling of most domestic buildings, and when the cables' insulation deteriorates with time, short circuitry occurs, resulting in fire outbreaks (Simpson, 2010). *Overloading of electrical appliances* was ranked as the third significant cause of fire outbreaks in the CBD with a mean score of 3.46. This finding is also in consistence with literature (Twum-Barima, 2014; Boateng, 2013; Simpson, 2010). Extension sockets have maximum capacities they can hold. As a result, when their limits are exceeded they explode and cause fire outbreaks. From one socket, a number of appliances exceeding the capacity of the socket may be connected and when the socket can no longer support the distribution of the electricity, it explodes by igniting fire in the building. *Illegal tapping of electrical power from the national grid* was ranked as the fourth significant cause of fire outbreaks in the CBD. This factor obtained a mean score of 3.04. The high charges of electricity tariffs compel many building occupants in the CBD to resort to illegal connections of electricity power in order to beat down the high cost of monthly electricity bills. However, most of the occupants do not use competent electrical engineers for this illegal tapping. This practice often leads to careless work in laying out the wires and tapping the power from the electricity poles. The end results are often fire outbreaks in the CBD. Boateng (2013) warns that it is a bad practice so occupants should abstain from it. A naked fire is very vulnerable in terms of causing fire outbreaks. A naked fire when it gets in contact with a combustible material, will easily cause a disaster which will be dangerous to occupants and properties. Respondents ranked *cooking with naked fire in the market* as the fifth significant cause of fire outbreaks in the CBD. This factor obtained a mean score of 2.93. Boateng (2013) highlighted that cooking with naked fire in homes and at the workplace is a major cause of fire outbreaks in Ghana. Causes of naked flames are defined by Simpson (2010) to include cooking (e.g., kerosene stoves, electric cookers, gas cookers, coal pots), lighting devices (e.g., candles lanterns), cigarettes, and lighted mosquito coils.

Firefighting equipment used in the CBD to control fire

Respondents were asked to indicate which firefighting equipment are highly used in the CBD to control fire. The response data was analysed descriptively. Any equipment that obtained a mean score of 3.00 or more was deemed used and vice versa. From the results in Table 4, it is generally established that firefighting equipment such as smoke

Table 5. Descriptive statistics of measures for mitigating fire outbreaks

Measures	Mean	Std. Deviation	Rank
Existence of fire assembly points/emergency shelters for buildings	4.04	.862	1
Public education on fire safety	3.99	1.330	2
Enforcement of fire safety policies	3.98	1.121	3
Provision of fire Insurance policies	3.97	1.225	4
Accessibility to fire hydrants	3.93	1.091	5
Regular inspection and maintenance firefighting equipment	3.88	1.392	6
Provision of emergency communication systems	3.81	1.374	7
Sanctions against those who go against fire regulations	3.73	1.083	8
Fire evacuation plans	3.71	1.185	9
Provision of emergency disaster kits	3.67	1.250	10
Regular Fire drills	3.61	1.351	11

detectors and alarms, wet chemicals, sprinklers/hose reels, fire fighter's outfit, fire pumps, fire blankets, remote shut and stop system, fire main piping and valves, fire doors, fire dumpers, emergency escape breathing device and fire retardant bulkhead are highly unused. These responses were obtained because the occupants in the CBD may not have the knowledge of how to use these firefighting equipment or the equipment themselves do not exist in the CBD. Despite the fact that majority of these equipment is not in use, respondents indicated that carbon dioxide extinguishers and dry chemical extinguishers are normally used in the CBD to fight fire.

Measures to mitigate fire outbreaks in the Central Business District of Kumasi

The views of respondents were further sought on the measures to mitigate the outbreak of fire in the CBD. For this part of the study, a success variable was deemed important if it obtained a mean value of equal to or greater than 3.5 since the scale adopted highest ratings as 4 and 5 for important and highly important respectively. The findings of the study revealed that all the identified fire mitigation measures are important since all the mean scores are greater than 3.5. From Table 5, *existence of fire assembly points/emergency shelters for buildings* in the CBD was identified as the most significant fire mitigation measure in the CBD. This factor was ranked as the highest as it had a mean value of 4.04 with a corresponding standard deviation of 0.862. Emergency shelters are those areas of the facility that may be used to provide shelter in an emergency. These may include areas where people are dropped off by a bus, van or car; the parking areas; the entrance to the shelter; pedestrian routes (both interior and exterior); sleeping, eating, information and recreational areas; and toilet rooms. Such areas if provided at vantage points within the CBD can control the casualty rate in case of an outbreak of fire. *Public education on fire safety was ranked as the second* fire mitigation measure that can be put in place in the CBD. Based on the nature of the fire situation in Ghana, Addai et al. (2016) suggested that the issue of public education should be intensified within the country. Both the Ghana National Fire Service and the National Disaster Management Organization should embark on an intensive educational campaign among the occupants with regards to fire prevention and safety measures, because studies have shown that most fires actually occur out of ignorance and negligence on the part of the occupants. *Enforcement of fire safety policies* was identified by the respondents as one of the most significant fire safety measures that should be put in place in the CBD to control the outbreak of fire.

According to Addai *et al.* (2016), this can be carried out by ensuring that fire safety regulations are consistently followed throughout the country. This also includes the rehabilitation of the electrical wiring system (one that follows standard regulations during installation), proper use and handling of combustible materials, installation of fire hydrants, and widening of roads for easy access to fire services. Households should also be provided with fire extinguishers.

Conclusion

It is a common knowledge that disasters may happen anytime and cause loss of lives and properties. This study was conducted to assess the perceptions of occupants on fire safety preparedness in the Central Business District of Kumasi. Key among the objectives were assessing fire disaster preparedness among occupants in the CBD, assessing the perceptions of the occupants on the causes of fire outbreaks in the CBD, assessing the perception of the occupants on the use of firefighting equipment in the CBD, and identifying the measures which the occupants feel should be put in place to control the outbreak of fire in the CBD. In the case of dealing with fire disasters in the Central Business District of Kumasi, the trend is that there are inadequate escape routes in the buildings, no signage for fire escape routes, no compliance with fire bylaws in the operated buildings, only few firefighting equipment available and other conditions that make dealing with fire disasters a challenging task in the CBD. Empirically, this research has shown that there is limitless fire safety preparedness among occupants in the CBD of Kumasi. Generally, the issue of fire preparedness in the CBD lies on the hands of the occupants and the government which has the responsibility of putting law and order to safeguard its citizens. It is therefore very important that as indicated by the respondents, fire assembly points/emergency shelters, public education on fire safety, enforcement of fire safety policies, among others are put in place to ensure a fire free environment to operate in.

REFERENCES

Addai, E. K., Tulashie, S. K., Annan, T. K. and Yeboah, I. 2016. Trends of fire outbreaks in Ghana and ways to prevent these incidents. *Safety and Health at Work*, 1-9. In press.

Akrofi, O. E. 2006. Urbanization and the Urban Poor in Africa. Promoting Law Administration and Good Governance. *5th FIG Regional Conference*, Accra Ghana March 8-11, 2006.

Anaglatey, P. B. 2013. Accra continues to record fire outbreaks. *The Chronicle*, Monday, 30th July.

Boateng, W. 2013. Electricity Company of Ghana explains causes of fire outbreaks. Ghanaian Times, Thursday, 24th January.

Bowker, L. 1999. Lead hazards and abatement technologies in construction. *Journal of Risk Management*, 43(1), 35-38.

Colonna, J. 2001. Crain's New York Business. Retrieved April 26, 2014.

Corrall, S. and Brewerton, A., 1999. The new professional's handbook. United Kingdom. *Library Association*.

Daily Graphic and Joy News. 2009. News on Kumasi Central Market, fire outbreak. Saturday May 30, 2009.

Disaster Relief Emergency Fund, DREF, 2010. Mid-year report. *International Federation of Red Cross and Red Crescent societies.*

Glass, G. V., Peckham, P. D., and Sanders, J. R. 1972. Consequences of failure to meet the assumptions underlying the use of analysis of variance and covariance. *Review of Educational Research,* 42, 237–288.

Kachenje, Y., Kihila, J. and Nguluma, H., 2010. Assessing urban fire risk in the central business district of Dar es Salaam, Tanzania. *Journal of Disaster Risk Studies*, 3(1), 321-334.

Kline, R. B. 2005. Principles and Practice of Structural Equation Modeling (2nd edn). New York: *Guilford*.

Mfinanga, D. A. 2007. Parking generation by facilities in the CBD of Dar-es-Salaam City. *Journal of Building and Land Development*, 14(2), 83-99.

Murage, J. G. 2012. Factors influencing fire disaster preparedness in the Central Business district of Nyeri town, Nyeri County, Kenya. Unpublished thesis, *University of Nairobi*, Kenya.

National Fire Protection Association. 1995. National Fire Codes. Quincy, MA: *NFPA*.

Nguluma, H. and Lupala, J. 2000. Role of Design and Planning Professionals for Solving the Global Housing Problems, in Vestbro, D. (ed), *The Report from a Workshop at the Conference*- Challenges for Science and Engineering in the 21st Century, INES, Stockholm, Sweden.

Ouellette, M. J. 1997. Visibility of exit signs. *Progressive Architecture*, 39-42.

Pallant .2005. SPSS Survival Manual: A step by step guide to data analysis SPSS for Windows. *Open University Press*. United Kingdom.

Proulx, G. 1999. How to initiate evacuation movement in public buildings Facilities. 17, 331-335.

Pyne, S. 1982. Fire in America: 'A cultural History of Wildland and Rural Fire' (paperback edition Ed.). Washington: *University of Washington press*.

Reuters. 2004. Indian school fire kills 90 children. Available at: http:// www.Reuters.com/reports Accessed April 6, 2014

Rubaratuka, I.A., 2013. Investigation of Provisions of Fire Safety Measures in Buildings in Dar es Salaam. International Journal of Engineering and Applied Sciences, Vol. 4, No. 4, pp. 40-45.

Simpson, D. E. 2010. Fire protection and safety. A presentation of Ghana National Fire Service, Ashanti Regional Office at a symposium of Building Technology Students Society Week Celebration, KNUST, Kumasi, 24-27 March, 2010.

Tacconi, L. 2003. Fires in Indonesia: Causes, Costs and Policy Implications. *Center for International Forestry Research*.

Twum-Barima, L. M. 2014. An Assessment of the Awareness of Fire Insurance in the Informal Sector: A Case Study of Kumasi Central Market in Ghana. *International Journal of Humanities Social Sciences and Education (IJHSSE)*, 1(8), 41-47.

Victoria, L. W. 2003. Community Based Approaches to Disaster Mitigation. Philippines.

Wahab, A. B. 2015. Evaluation of fire management practices in selected restaurant buildings in Osogbo, Nigeria. *Journal of Multidisciplinary Engineering Science and Technology*, 2(9), 2391-2396.

****