

Measures to Improve Fire Hazards Handling in Dhaka City

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ABSTRACT

Fire hazard incident is very much common phenomenon in Bangladesh especially at densely populated Dhaka city. Every year many people died due to the fire hazards. They lost their lives, wealth, properties and suffer from burn injury for a long time. Being the hub of all economic activities this city compels people to live here and construct High rise buildings, Semi-structured buildings and temporary shades in slums and squatters and also build Ready-made-Garments or Industries, Shopping Malls, Educational Institutions and Hospitals or Medical Centers. We find that in this City, these structures/buildings are closely spaced, in most cases the owners or authorities do not follow the building code, most of the dwellers and owners do not have better awareness and minimum fire management knowledge and practice. In most of the cases, they cannot understand the intensity and severity of devastating fire hazards and identifying the reasons and taking effective mitigation measures are not prevalence. Moreover, most of the areas of this city are unplanned, have many unplanned chemical factories in residential areas and utility service like electricity management, gas line are not properly set-up or manage and in most cases there is no fire management systems. Most of the fire hazards occurs causing electric short circuit in Dhaka City. Due to distance location of fire station, locked and narrow emergency exit points, panicky situation, no light or insufficient light in the areas of stairways, lack of constant supply of electricity, suffocation and unawareness are main reasons of ineffectiveness of mitigation measures. The broad objectives of this study were to explore the fire hazards risk and effectiveness of the mitigation measures in Dhaka City. For this study a semi-structural questionnaire interview was conducted to assess the understanding of people regarding fire hazards and actual initiatives of mitigation measures. We also observed and discussed about different evacuation plans, existing mitigation measures and identified particular victim's locations. However, in most of the cases knowledge and mitigation measures relating to fire hazards are very much unknown to the dwellers of Dhaka city. We find that they are totally untrained and never have experienced to take part in fire drill. Though this condition is very common in entire Dhaka city but in slums and semi-structured buildings this scenario is worse. The recommendations include there is a need to have regular arrangement of drills, raising practical knowledge through education and training. Moreover the urban authority or the local government institutions should arrange regular camping to create awareness of this city's dwellers.

Introduction

Bangladesh is one of the most disaster-prone countries in the world. The country experienced several massive natural and human induced disasters. Due to its geographical location this country is very much vulnerable to disasters. Besides, huge number of population, unplanned and illegal structures as well as poor utility management and unawareness lead to occur these huge number of disasters. Fire hazards related disaster is most crucial one. The total area of Dhaka City (District) is 1468km² where the number of population is 12.04 million (2011). Here fire hazards occur more frequently and causes huge number of loss of lives and properties each year. The reported fire mishap from 2014 to 2016 in Bangladesh were 16213, 17488 and 16858 respectively whereas only in Dhaka city these number were 2397, 1977 and 2953 accordingly. The economic loss due to fire hazards mishap is very high in Dhaka City compared with other cities of Bangladesh. The average annual economic loss or damage to property worth more than Tk. 400 core. At household level especially in High Rise Buildings, Semi-structures Buildings and temporary shanty shades of slum or fire mitigation system is either absent or very inefficient. Though in High rise buildings have some fire management system but in Semi-structured and in slum houses this mitigation measures is almost absent. In commercial level they have some mitigation measures but due to proper management, this city's poor utility management and unplanned or narrow communication system made this impossible to manage fire hazards related accident. In RMG sector fire management is comparatively good now from other sector but compare with developed country or only with our adjacent country's city here is not satisfactory.

Given the importance of fire safety in the garments sector, there have been concerted efforts from the government, the industry lobby (BGMEA) and the international buyers of the apparel products, to improve the fire safety culture and this has indeed reduced the fire incidents and losses significantly. However, the overall scenario has not fully changed. Each year several instances of fire outbreak in the garment, resulting in significant losses of lives, livelihoods and properties. Another sector is Slum or Tent. Though the Disaster Management Vision of the Government of Bangladesh is to reduce the risk of people, especially the poor and the disadvantaged, from the effects of natural, environment and human induced hazards, to a manageable and acceptable humanitarian level, and to have in place an efficient emergency response system capable of handling large scale disaster (NPDM, 2010-2015). In our study, we find in these slum they have no fire mitigation measures and also have not any fire knowledge but each year in Dhaka city on average 47 fire hazards accident occur in these Slum. Accordingly, this Study has investigated a random sample of High rise buildings, Semi-structured building and Slum as well as RMG, Shopping Mall, Educational Institution and Hospital from different 6 zone (BFSCD divided into Dhaka city into 6 zone only Dhaka district) to assess their understanding and Fire mitigation system. Also this study observe different evacuation plans and existing condition of fire mitigation system and also discussed with expert in this field.

Material and Methods

Theoretical Framework

Disaster affects society as a whole, “focusing events,” or “destabilizing events,” have also had an impact on scholarly enterprises, shifting the attention of a sociologists from more traditional areas of professional inquiry to the expansion and application of innovative concepts and methods to the study of Disasters (Birkland 1997, Picou and Marshall 2007). Disaster and emergency management have gain a long-back (but at present incomplete) recognition from the general people while politicians legislators have increased funding for the profession to historic levels. In terms of emergency management, we may state that a disaster (D) will occur when a triggering agent (T) interacts with vulnerability (V). In other words, $T+V=D$. If we look at this equation in a different manner, we can say that a hazard is most likely to create a disaster when a particular area is geographically vulnerable and over populated, when urban planning and building code do not maintain, when there is no modern warning system, when there is lack of preparedness and a particular area has other risk groups.

Conceptual Framework

This framework has developed for highlighting the fire hazards and to explore the reasons and effective mitigation measures in the context of both household and commercial sectors. The study tried to explore city dwellers opinion relating to effective fire mitigation measures for Dhaka City.

Fire Hazards reasons and Mitigation system

There are various number of reasons of fire hazards in Dhaka City. These reasons make Dhaka city more vulnerable to fire hazards disaster. For most of the reasons here people are responsible. The common fire hazards reasons are following:

1. Electric short circuit
2. Cooking/ stove
3. Careless disposal of burning cigarette and match stick.
4. Chemical reaction
5. Explosion
6. Mosquito coil
7. Machine/ Engine
8. Sabotage
9. Leaked electric wire
10. Necked lamp
11. Thunder
12. Unawareness

Background of the Study

A fire hazard is any situation in which there is a greater risk than other hazardous situation. Fire hazards incident is very much common phenomenon in Bangladesh

especial at densely populated Dhaka city. Being the hub of all economic activities this city compels people to live here and construct several building both household and commercial. When they build these structures, the authorities does not follow buildings code of 1993 (BNBC-93) or plan of RAJUK. Most of the area of this city are unplanned and roads are very narrow. For these reasons fire management system has becoming unmanageable treat here for its dwellers. In this city buildings are very closely spaced that is why if any of these buildings catches fire it is obvious the adjacent building will catch fire. Short circuit is another crucial reason of fire mishap. People unawareness and electricity mismanagement are responsible for this mishap. This city also specially in the Old town in threat of chemical explosion that cause fire hazards. According to Bangladesh Fire Service and Civil Defense Authorities (BFSCDA) regulations every emergency factory has to obtain a fire safety certificate but most of them do not maintain that. So, this garments are very much vulnerable to fire hazards. Also our utility services system is not standard enough that is why gas leak and make fire hazards. Another fire hazards cause is accidental cause. Due to several mishap this city faces many fire hazards. In recent fire accident we observe that a huge number of people lost their lives and many of causalities. The main causes behind the colossal losses were inadequate fire hazards knowledge and inadequate fire mitigation equipment in both household and commercial buildings and lack of awareness. The Study will try to find out the understanding of people regarding fire hazards and effectiveness of mitigation measures for this big city.

Purposes of the Study

The broad objective of this study is to assess the existing realities of city dwellers of Dhaka city in understanding of fire hazards, assessing the possible fire mitigation measures at household level and commercial area. The specific objectives are as follows:

- a) To assess the city dweller's understanding regarding to fire hazards;
- b) To identify the actual causes of fire hazards;
- c) To assess the city dwellers initiatives in mitigating fire hazards;
- d) To suggest appropriate policy implication to fire management.

Rationale

Studying the existing literatures this study found that mostly on the issues that fire hazards and some reasons are not properly identified. There is a lack of data on fire safety in Bangladesh especially in Dhaka City. Although there are few studies in general, no comprehensive fire management system applied for household or for commercial buildings before. Also the existing mitigation measures are not more effective and we could not save the amount of death and causalities. We do not find strong recommendations for fire hazards mitigation. Overall, people are not aware of this hazards, they violating the national building code of Bangladesh. Besides they do not know the proper evacuation plans. Moreover there are many illegal structures and chemical factory in residential area, no special plan for Semi structures or Slum as well as

sector wise (male, female, disable and adult) proper suggested recommendations. So, awareness programs, implementation of building code, short circuit, and Chemical industry set up, building both households and commercial buildings, utility management and sector or group based strategy and strong recommendations should be more emphasized.

Research Methodology

(A) Process of Data Acquisition: This study has employed both qualitative and quantitative because of mixed nature of the problem with a view to achieving the best outcome of the research. The total sample size was taken 101 following the rules of thumb for sampling (Hogg & Tanis, 1996) These sample size includes both households like dwellers of High rise building, semi-structured, slum residents and the representatives of commercial like RMG owners, owners and staff of shopping malls, representatives of educational institutions and Hospital. The qualitative methodology of research has been applied for subjective assessment based on the secondary sources to investigate the loopholes in the mishap at both household and commercial sector fire accident and management or mitigation measures in Dhaka, Bangladesh. Some questionnaires are designed in such a manner so that the both the households and commercial dwellers and owners can express their opinions without any prejudice and bias finding the obstacles as to fire mitigation in consonance with ILO Conventions and standards. The findings of the study gathered through mixed approach would be categorized systematically and the common findings will be offered as recommendations to amend the present fire hazards mitigation measures in Dhaka City as well as in the country.

- Secondary Data source like previous study and publication
- Semi-structured interviews owners and dwellers to assess their knowledge and mitigation preparedness for fire hazards
- KII. We discussed with three expert from Bangladesh Fire Service and Civil Defense.
- Observations. We observe several places and talked with victim people in Karail tent, Nimtoli, Kodomtoli railway tent and alos in Boshudhora.

(B) Process of Data Analysis: Collecting data has been analyzed by applying following methods to achieve desire outcomes. Statistical analysis of collected data was done with the help of SPSS software. All variables were analyzed with the help of SPSS software and analysis to find statistical accurate data for all sectors from both households and commercials. First of all, all sample population were individually contacted to find out the ground reality and their knowledge to fire hazard management and the possible options for mitigation. After gathering of data from respondents, we analyzed those data. Also there were many observations from the field and those observations were further analyze. The nature and extent of the review of fire related documentation and the observational study of fire safety were set out and explained. I arranged special discussions

with BFSCDA's authority to find exact data and also justify the findings with their activities and opinions. Then we accumulated the whole data and analyze the field data and information. We also carried out semi-structure interviews where we different types of data which were bit different from findings of existing literatures. These field outcome helped us to a great extent to process and analysis data. Economic losses of industrial fire refer to the economic losses which reach certain amounts caused by fire. Typical losses include the decline in output in productive sectors (agriculture, livestock, fisheries, industry and commerce) and the lower revenues and higher operational costs in the provision of basic services (water and sanitation, electricity, transport), as well as the unexpected expenditures to meet humanitarian needs during the post-disaster emergency phase. The estimation of economic loss of fire accident and current mitigation measures have adopted a method of estimating by classes. That is, based on the estimation of economic loss of each class, get the total conditions and caused by each both household and commercial fire accidents.

Limitations

A significant limitation was the limited amount of time allocated by the owners, dwellers and management authorities for the undertaking of the survey and interviews in the households and commercial buildings. The main reason for this appeared that the study should cause the least impacts on the day-to-day life in household and commercial building in terms of the disruption of their life style. Enter to each houses or buildings was difficult because the authorized person and keys were not ready available. Access and availability to fire safety related documentation was also an issue as in some readymade garments and High rise buildings were claimed that these information can delivery fire service department. This could have been the case or it could have been just an excuse for the absence of documentation. The researcher would have prepared to have had more time at each buildings to observe the everyday operation in order to get a feel of how fire mitigation system worked and measure better the variables, particularly at night. For instance, in one of the buildings the survey went well into the late evening when the researcher observed a security person lock an external exist with a door. This would not have been discovered in the day time.

Findings and Analysis of Data

Overall Summary of Result for the Adequacy of Fire mitigation Measures

The objective of the study was to identity the fire hazards, its reasons and the effective mitigation measures in Dhaka city. The overall findings of survey respondents of one hundred and one both from households and commercials enterprises passed two categories of findings: first of all managing the fire events and secondly unmanageable mitigation measures. It was found that in RMG and high rise building fire mitigation measures are quite good but in slums this condition is very worst. In slums and also in semi-structured dwelling houses, there is no minimum mitigation measures and most of them have no fire hazards management knowledge. In Bangladesh, damage and losses

due to fire accident is very high. At dwelling houses and commercial buildings this loss is huge. In some garments factory fire causes huge loss every year. Mainly the damage and loss have been calculated by assessing some direct losses like loss of infrastructure, loss of machinery, loss of production, loss of materials etc. But there have several indirect losses which cannot be calculated. Psychological frightening and trauma are kinds of indirect losses which has cost in the form of mental stress, anxiety, and tension which aggravate due to loss from fire hazards. In case of fire incidence, Bangladesh RMG sector faces different obstacles and challenges. Due to lack of work place safety Bangladesh lost GSP facility from the USA. And for the fire incidents many buyers cancel their contract with the affected garments which creates deprivation to earn foreign currency. In this study we cannot calculate how much money lost in Bangladesh due to incidence of fire because of limitation of carrying assessment. The government of Bangladesh and the owners of the garment factories should take initiatives for mitigating the fire incidents. The details of the respondent's opinion and socio-economic background are given below:

Table 1 Percentage Distribution of mean age of the Respondents

Age of the respondent (N= 101)	
Mean	40.57
Median	39.00
Mode	30
Std. Deviation	11.926
Minimum	19

The respondent's mean age was 40.57 and Median is 39.00.

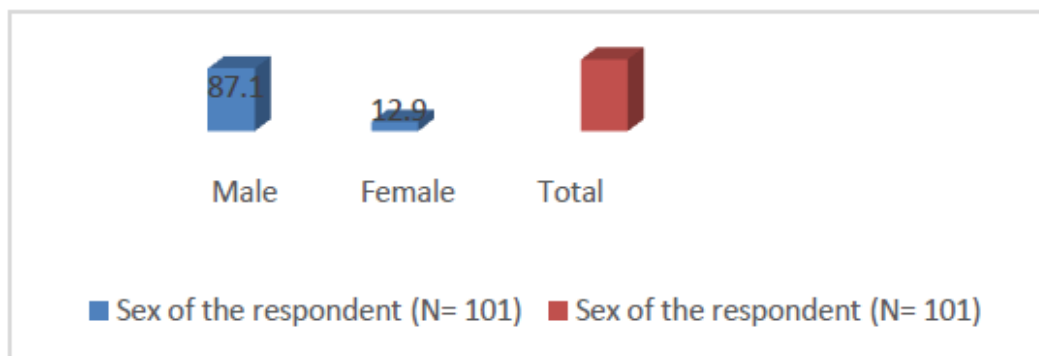


Figure 5.1: Percentage Distribution of the Sex of Respondents

We took interview both male and female respondents and it was the female investigators though whom we approached the female respondents.

Table 2: Types of fire hazards

Types of fire hazards Frequency(N= 101)		
	Frequency	Percent
High Rise building	16	15.8
Semi-structured building	17	16.8
Slum/ tent	16	15.8
RMG/ Industry	10	9.9
Shopping Mall	15	14.9
Educational Institution	16	15.8
Hospital	11	10.9
Total	101	100.0

Fire hazards occurs in both household and commercial level. At household level we found three categories of hazards, high rise buildings, semi-structured buildings and squatters and slum katcha houses. In commercial sector we divided hazards into four categories, namely, RMG/Industry, Shopping Malls, Educational institutions and Hospitals

Understanding of Fire Hazards



Figure 2: Percentage Distribution of respondents about their Understanding of Fire Hazards

The study analyzed the incidence of fire hazards from different angles. It was found that about 47% respondents told the incident of fire even was an accident, followed by about 24% who the incidence was manmade, while about 5.0% said it was spread and caught naturally. On the other hand about 24% respondents who usually live in slums don't know the causes of fire hazards. In table 1, we have shown the percentage distribution of the respondents according to building types about their understanding to hazards. Here most of the building's owners and dwellers said it was an accident followed by 47.5% who said it was manmade. Fire accident seen frequency yes 18.8% and no 81.2% in the table 1 and in Table 2 shows the Period of catching fire response.

Table 3: Percentage distribution of the respondent s according to building types category and understanding about fire hazards

Percentage distribution of the respondents according to building types category and understanding about fire hazards								
	High Rise building	Semi-structured building	Slum/ tent	RMG/ Industry	Shopping Mall	Educational Institution	Hospital	Total (N= 101)
Accident	56.2	17.6	31.2	70.0	46.7	62.5	63.6	47.5
Man made	18.8	23.5	0.0	30.0	26.7	37.5	36.4	23.8
Caught naturally	12.5	5.9	6.2	0.0	6.7	0.0	0.0	5.0
Don't know	12.5	52.9	62.5	0.0	20.0	0.0	0.0	23.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 4: Ever seen the fire hazard in this institutions

Ever seen the fire hazard in this institutions (N= 101)		
	Frequency	Percent
Yes	19	18.8
No	82	81.2
Total	101	100.0

Main reasons of fire hazards

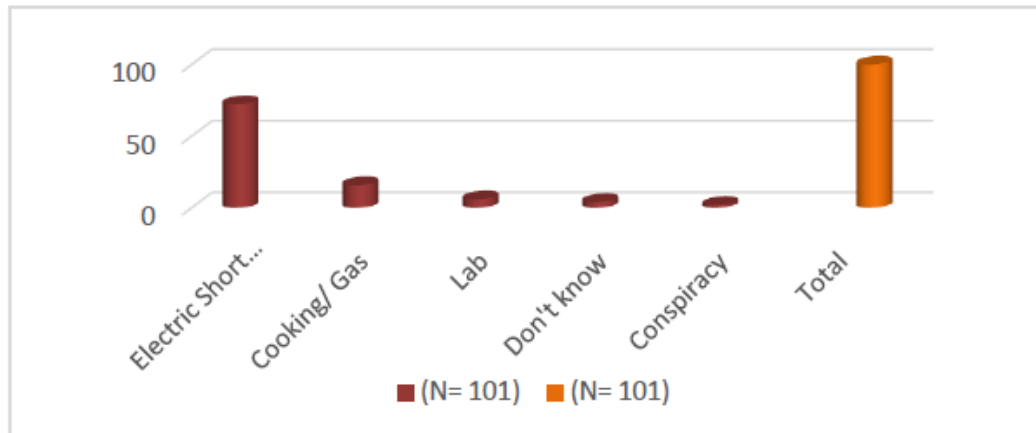


Figure 3: Main reasons of fire hazards

Table 5: Main reasons of fire hazards

Percentage distribution of the respondents according to building types and main reasons of fire hazards								
	High Rise building	Semi-structured building	Slum/ tent	RMG/ Industry	Shopping Mall	Educational Institution	Hospital	Total (N= 101)
Electric Short circuit	87.5	58.8	25.0	100.0	86.7	93.8	63.5	72.3
Cooking/gas	6.2	29.4	56.2	0.0	6.7	0.0	0.0	15.8
Lab	0.0	5.9	0.0	0.0	0.0	6.2	36.4	5.9
Don't know	6.2	5.9	12.5	0.0	0.0	0.0	0.0	4.0
Conspiracy	0.0	0.0	6.2	0.0	6.7	0.0	0.0	2.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

There are many reasons of fire hazards which we stated before. Here in the table 5 and 6 show the respondent described fire hazards reasons. The study found the main cause as electric short circuit 72.3% Cooking/gas reason is 15.8% for the reason of lab and conspiracy are 5.9% and 2% respectively. There are 4% respondent don't know the main reason. Electric short circuit as a main reason respondent told in High rise building, semi-structured building, shopping mall, Educational institution and Hospital. In RMG sector 100% respondent told as main reason is electric short circuit where in Slum number one reason was cooking/gas. In Shopping mall and Slum also find another main reason of fire hazards that is Conspiracy. In Slum 12.5% respondent also do not know the main reason of fire hazards.

Other reasons of fire hazards

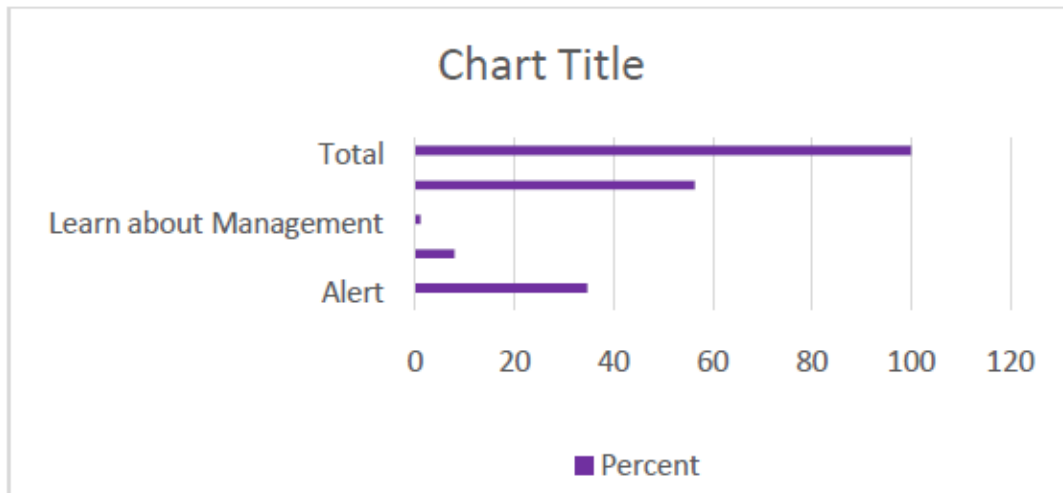


Figure 4: Other reasons of fire hazards

Table 6: Overall Condition of mitigation measures

measures before fire hazard (N= 101)		
Measures	Frequency	Percent
Alert	35	34.7
Take Preparation	8	7.9
Learn about Management	1	1.0
Don't know	57	56.4
Total	101	100.0

Table 7: Measures during fire hazard

measures during fire hazard (N= 101)		
Measures	Frequency	Percent
Call Fire Service	53	52.5
Work management team	7	6.9
Water	23	22.8
Use fire equipment	2	2.0
Don't know	16	15.8
Total	101	100.0

Table 8: Steps after fire hazard

Steps after fire hazard (N= 101)		
Steps	Frequency	Percent
Take preparation	19	18.8
Build Management Team	9	8.9
Discussed	13	12.9
Don't know	60	59.4
Total	101	100.0

Fire protection system

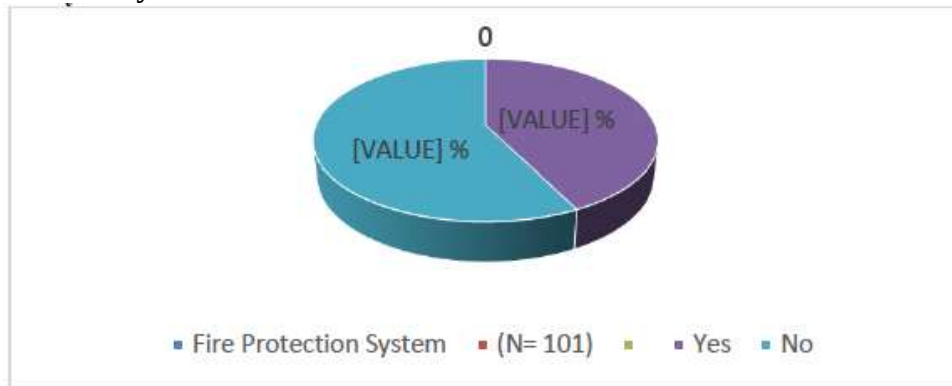


Figure 5: Fire protection system

Table 9: Emergency exit point condition

emergency exit point unlocked an un-obstacle (N= 101)		
	Frequency	Percent
Yes	67	66.3
No	34	33.7

Fire Equipment Condition

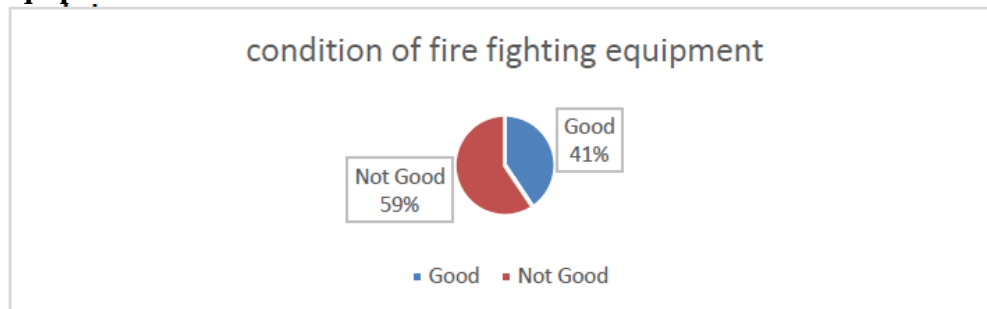


Figure 6: condition of fire-fighting equipment

Table 10: Percentage distribution of the respondent s according to building types and condition of firefighting equipment

Percentage distribution of the respondent s according to building types and condition of firefighting equipment								
	High Rise building	Semi-structured building	Slum/ tent	RMG/ Industry	Shopping Mall	Educational Institution	Hospital	Total (N= 101)
Good	80.0	10.0	0.0	100.0	86.7	56.2	81.8	40.6
Not good	20.0	90.5	100.0	0.0	13.3	19.8	18.2	59.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Condition of available space to enter fire brigade vehicle

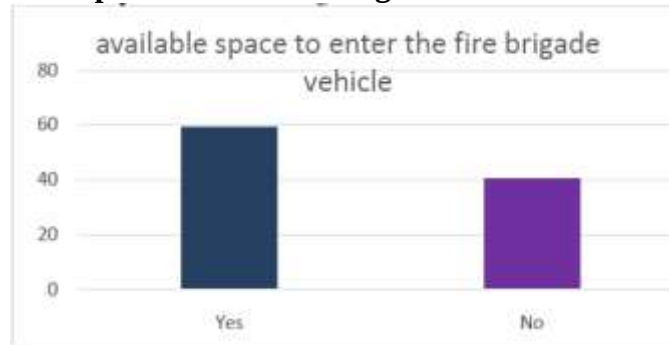


Figure 7: Available space to enter the fire brigade vehicle

Table 11: Percentage distribution of the respondents according to building types and available space to enter the fire brigade vehicle

Percentage distribution of the respondents according to building types and available space to enter the fire brigade vehicle								
	High Rise building	Semi-structured building	Shum/tent	RMG/Industry	Shopping Mall	Educational Institution	Hospital	Total (N= 101)
Yes	62.5	58.8	62.5	50.0	60.0	68.8	45.5	59.4
No	37.5	41.2	37.5	50.0	40.0	31.2	54.5	40.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

In Dhaka City there roads are very narrow and most of owner do not follow the building code. So, available access to each building is difficult especially in old city of Dhaka. Fire brigade vehicle access is 59.4% and not available access is 40.6%. There are some semi-structured buildings and some slums this space is totally absent. During fire accident to go in this place with fire brigade vehicle is impossible.

Table 12: Insurance Policy

Insurance policy (N= 101)		
	Frequency	Percent
Yes	33	32.7
No	52	51.5
Not Applicable	16	15.8
Total	101	100.0

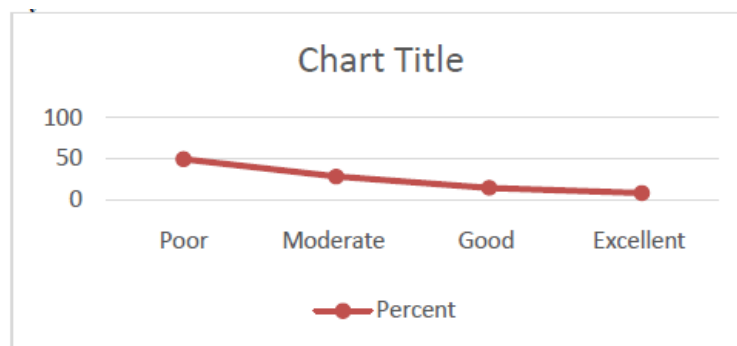


Figure 8: Condition of Utility services

Understanding of Fire Hazards

Fire hazard is a very dangerous and devastating event. It can be happened both naturally and manually. When it occur, it destroy every things. We need verse knowledge on this hazard for effective mitigation and save the life as well as properties. Only for fire hazards we lost each year thousands of life and properties also injured huge people. In our study we find general people have very less knowledge on this crucial event. When we asked them, most of them answer were not satisfactory and even many of them do not know the event. We observe that in affected area's people know the hazard and also know the danger of the hazard. Many of them told us that when someone fall in danger or in any accident he or she losses some things but if fire catch there is no way to protect their goods even avoid injury. During our study we went many places of the Dhaka city and talked to the people and also observed the real situations. First of all we divided our sample into two part in household and Commercial. In household portion there were High Rise Building, Semi-Structured Building, and Slum or Tent. In High Rise Building and also in Semi-Structured Building the understanding of fire hazard were comparatively in good condition but in Slum they have little knowledge on it. Even they haven't realization that they should know about this terrific hazard.

In commercial portion there were Ready-Made-Garments or Industry, Shopping Mall, Educational Institution and Hospital or Medical Center. We found different data on fire hazard understands in this section. Ready-Made-Garments or Industry's condition are quite good. In Hospital or in Medical center they told they have well understanding on fire hazards but most of doctor, nurse or the staff are do not know it welly and also don not know what should they do before, during and after fire hazard. They told us that they have particular division to manage it. We know fire mitigation is a holistic approach. So, if the dwellers or the staff of one particular household or in any institution don not have proper understanding on fire hazard then mitigation would be unmanaged. Every individual should have proper knowledge of fire hazards as well as proper fire mitigation measures. In Educational institutions they have some knowledge but most of the institute do not teach their student or do not discuss on fire hazards among their teacher or staff. In primary school they have never taken fire drill. From our study we found 47.5% people told it as an accident. 23.8% and 5% told it is a man-made and natural hazard respectively. A big number of people about 23.8% could not clarify the fire hazard. According to Fire Service they are trying to increase their camping and awareness building among general people not only Dhaka city but also entire country. This study found that there are many gaps about fire knowledge among general people or the dwellers of the Dhaka city.

Understanding on main reasons

There are many reasons of fire hazards both human and natural. When we worked around the city, we found people opinions on fire hazard's reasons. Due to lack of fire related knowledge many of the dwellers could not clarify the main and other reasons. They told Electric short circuit, Cocking or gas, lab and conspiracy as a main cause. In

some Slum and commercial places the owner said conspiracy is main reason and also we found its certification when we were discussing with fire service experts. Also 10% people did not clarify the main reason. So, we understand people knowledge on fire hazards main reason not good enough. In RMG, Educational Institution and High rise building owners remarked electric short circuit as a main reason than others owner or dwellers. In slum and semi-structured building there were 56.2% and 29.4% said cooking is main reason of fire hazards. People understanding on fire hazard main reason is not well though they mentioned some utility services accident as main reason. There are many reasons of fire hazards in Dhaka city. During our study we found those causes from owners or from dwellers. We found various number of reasons of fire hazards in Dhaka City. These reasons make Dhaka city more vulnerable to fire hazards disaster. For most of the reasons here people are responsible. The common fire hazards reasons are electric short circuit, cooking/ stove, Careless disposal of burning cigarette and match stick, chemical reaction, explosion, mosquito coil, machine/ engine, sabotage, leaked electric wire, necked lamp and general people unawareness etc. When they addressing the reasons we observe they have not proper knowledge. Here also almost 19% people don't know the exact reasons of fire hazards. For better fire management we need organized fire related knowledge as well as the reasons.

Fire Hazards Mitigation Measures

Fire hazards accident are very frequent in Dhaka city. Each year we lost lot of life and injured thousands of people in our country especially in Dhaka city. Though BFSCD and NFPA trying to manage it. In BFSCD there are nearly 9000 people working. They have strong management team along with one DG having the equality of Brig. General, three Director, nine DD, more than twenty AD and eighty DADs. Also they are increasing their Volunteers through-out the country. In spite of these manpower the fire mitigation measures in Dhaka city are not good at all. For proper mitigation we need a holistic approach along with house owners, dwellers as well as general people. In our study we found unsatisfactory condition of fire mitigation measures. People even don't know what they should do before, during and after fire hazards occur. Though they try to do something during accident but due to lack of before preparation and after discussion their effort are not effective. They are not trained most of them never took part in fire drill. Before a fire hazards 34.7% keep them alert, 7.9% take preparation and 1.0% try to learn fire management system. But very alarming point is there were 56.4% people they have no minimum fire mitigation measures before the accident occur.

During fire hazards there were 52.5% people call fire service and 22.8% water in affected building or houses. Only 7% told us they try to work with fire management team whereas 15.8% respondents even don't know what they should do in that period. The scenario of mitigation measures after fire hazards are very pathetic. Here 59.4% respondents don't know their duties. In high rise building, Hospital and Shopping mall they have some activities in this period. In household and commercial building there are 57.4% have fire protection system but another 42.6% have not this system. In Semi-

structured and Slum there were no fire protection system. Though These Semi-structured building and the Slum are very much vulnerable to fire hazards. Especially in slum each and every year fire hazards occur frequently. From our study we found that most of the case fire hazards occur due to mismanagement of utility services. In Dhaka city the utility services condition are very dangerous. Here electric, water and gas service condition are very poor. Also people are not much aware of using these utility services. For proper fire management power supply is very important. There were 60.4% power supply have visual isolator. In high rise building, Semi-structured building and RMG sectors, the power supply condition and the visual isolator are good condition. In Educational institution, hospital and slum this condition are very wroth. Though 78.2% respondent said that main power supply is clearly identified but the dwellers of these building don't know the exact location and condition of main point of power. Fire mitigation measure depends on good condition of fire-fighting equipment. Here most of the respondent told us they have no fire-fighting equipment and who have this equipment they don't know how to use it. 41% fire-fighting equipment is good condition and another 59% is not well condition. In slum there are no fire-fighting equipment. So, they are very much vulnerable to fire hazards.

When fire hazards occur, knowing fire service emergency number is very important. 69% respondent told that they and their dwellers know the fire service emergency number but we also found some school's authority and staff don't have the number. Some of they said we have this number in written. Available space to enter fire brigade vehicle is essential for effective fire mitigation measures. In Slum, Educational Institution and hospital this condition is not good. Some Slum has no space to enter fire brigade vehicle. Event there is no well road. When we visited Mirpur area's slum we found there were no good communication system not only for fire brigade vehicle but also for entering the slum. Also there are some educational institutions in Dhaka city they haven't the essential space. In slum, educational institution and hospital there were no available space for fire brigade vehicles. We found 81.2% slum, 3.8% educational institution and 54.5% hospital haven't this space. For fire hazards recovery fire insurance policy is another significant step. There are 32.7% have the insurance policy but another 51.5% haven't this policy. We found in slum, hospitals even in educational institution haven't this policy. For better Fire mitigation measures utility service is very significant. Most of the fire accident occurs due to utility service disruption. The we conducted interview most of fire cause we found that electricity or gas were responsible. In Dhaka city electricity line is not well managed and gas line specially when dweller cook something they are not aware of using this. As a result fire accident occurs.

Recommendations and Conclusion

Recommendations

The Fire mitigation measures in the 101 household and commercial buildings are not satisfactory. There are many causes of fire accident and the dwellers are different ages and also there are many disable person and older person. For these people there is no

specific mitigation measures. Overall slum, semi-structured building are very much vulnerable to fire hazard but there is no sector wise plan. Unfortunately, it is clear that this condition will not be resolved significant reform plan and initiatives. We need plan and initiatives considering our economic and real scenario condition. Considering the situation this study recommend following recommendations in three specific part:

Institutional Strengthening: Most of the people have no minimum knowledge on Fire hazards and its mitigation measures. We should increase academic knowledge on this issue. BFSCDA and NFPA work on fire management. We need an integrated approach. For it along with BFSCDA and NFPA other institution should work altogether. Fire stations are not enough in Dhaka City. For proper mitigation it is important to increase the number of fire station in each area or zone basis. Dhaka is an over populated city in the world. For this huge population we need more manpower and equipment in this sector. So, authorities and BFSCDA should increase manpower and fire-fighting equipment gradually. Regular Training should be increased to build trained people and for awareness building. Most of dwellers don't know the does and don't and also don't know the fire service number. For this people or better mitigation authorities should increase camping. This camping may be physically going each household and also using the electronic and print media as well as arranging seminar or workshop in this issue. Properly implement of Building Code and Labor Law in RMG or other sectors and other relevant rules and regulations.

City Planning: Our roads are very narrow. Roads should be built more wide structure. Authority should increase water reservoir. Utility service especially the gas and electric supply management should be improved.

Individual Level: Awareness building using electronic and print media. Door to door camping by increasing manpower or volunteer. Increasing active participation in fire drill on regular basis.

Conclusion

Dhaka City is growing unfortunately as an unplanned and a hazardous city. To build a secure and peaceful City for it dwellers we have to ensure the all level security. Fire safety issue should be given priority at first. It would be so difficult for one or two organization to control fire issue and provide all support for it citizens. So, integrated approach should be implemented. There are many reasons of fire hazards that we found in this study. If authority take step to eradicate or reduce the causes the city will build as an ideal city for its people. Distance of fire station, Locked emergency exits, panic, electricity supply, gas line or other utility service are not good. Also fire mitigation measures including fire equipment have to standard and increase. Especial attention should give on RMG sector, Slum, semi-structured as well as all levels. For safe city we have to work each sector and fire issue should be address all individuals. This study find no integrated approach for fire management and also find in slum and semi-structured building they have no knowledge regarding fire management. So, there need to give

special care for better fire mitigation for this densely populated city. It is the duty of all of us to build a secure and healthy city if we want to live in peace here to increase awareness and improve our fire mitigation condition and also give more emphasis on vulnerable groups especially in slum and semi-structured building's people as they are given priority in NPDM.

References

- Arthur, K. (2007). The Costs of Financial Distress Across Industries, <https://www.gsb.stanford.edu>.
- Chen, C.J. and Rodi, W. (1980). Vertical Turbulent Buoyant Jets - A Review of Experimental Data, HMT. *The Science Applications of Heat and Mass Transfer*. Volume 4, Pergamon Press.
- CPD's Rapid Assessment of Flood 2004 (2005). Options for Self-reliant Resurgence, ISBN 984 05 1709 0.
- Eisenberg, N.A. Lynch, C.J. and Breeding, R.J (1975) "Vulnerable Model. A Simulation System for Assessing Damage Resulting from Marine Spills". Nat. Tech. Inf. Service Rep. AD-A015-245.
- Emergency Management Australia (2002). "Disaster Loss Assessment Guidelines, Part III". *Emergency Management Practice*. Vol. 3, Guidelines, Guide 11.
- Hall, J.R. (2014) The Total Cost of Fire in the United States. *National Fire Protection Association (NAPA)*. U.S.A: Fire Analysis and Research Division.
- Harris, R.J. (1983) *The Investigation and Control of Gas Explosions in Buildings and Heating Plant*. British Gas.
- Hartzell G.E. (2001). Engineering analysis of hazards to life in fires: the fire effluence toxicity component Safety Science 38(2001) 147-155
- Kevin Cassidy A, (1953). Fire Safety and Loss Prevention, ISBN 0-7506-9039-9.
- Moinul Haque (2012). Over 5000 RMG workers die in factory fires in 22 years, New Age, Dhaka, November 28, 2012.
- National population policy (2012). Ministry of Health and Family Welfare, Government of the People's Republic of Bangladesh.
- NFPA (2000). National Fire Codes, National Fire Protection Association, Quincy, MA.
- Petra, A. (1997). Evaluation and Mitigation of Industrial Fire Hazards, Report TVBB-1015. ISSN 1102-8246.
- Sudhir, A. and Kara, H. (1997). Disability Adjust Life Years: A Critical Review.

Thomas, P.H. (1963). “The Size of Flame from Natural Fires”. 9th Int. Combustion Symposium. Comb. Inst., Pittsburgh, PA, 844-859.

Wadud, Z. Huda, F.Y. and Ahmed, N. (2015). *Assessment of Fire Risk in the Readymade Garment Industry in Dhaka, Bangladesh*. Accessed 30 August 2015
<<http://link.springer.com/article/10.1007/s10694-013-0349-2>>