

FACTORS ASSOCIATED WITH FIRE HAZARD IN THE READYMADE GARMENT FACTORY OF DHAKA CITY, BANGLADESH

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Abstract: This paper illustrates the major factors associated with fire hazard in the garment factories such as unauthorized sub-contracting, non-compliance of rules and regulations and unplanned factory buildings are considered the important issues. Moreover, lack of maintaining compliances in the factories, negligence of occupational safety and health (OSH) issue and inadequate firefighting equipment etc. are responsible for fires in the factories. The existing worst situations can be improved by taking proper measures which can ensure a safe working environment for around 4 million of workers engaged in this sector.

Keywords: Fire Hazard, Garment Factory, Unauthorized Sub-contracting, Compliance, Dhaka City

INTRODUCTION

Bangladesh is one of the disaster prone countries in the world. Man-made disasters often become the causes of huge losses of lives and property. These disasters usually create tremendous socio-economic impacts on the affected communities. Every year thousands of young come from the country side to cities for works. Poverty compels them to receive any types of work in the garment industry. Long working hour and low wages are very common problems of this sector. International standard labour laws and regulations are often ignored in the garment sector of Bangladesh. The garment industry plays a significant role in the economic development of Bangladesh. It is the highest source of income from the export (79.63%) of the country (BGMEA, 2014). There are approximately 4 million workers engaged in this sector and among them 80% are women. About 20 million people are directly and indirectly depending on this sector for their immediate livelihoods (BGMEA, 2016). Ready Made Garment (RMG) sector is positioning a lead role to alleviate poverty through skills

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development and employment generation of a large number of people (BGMEA, 2016). The garment industry currently consists of 5600 factories of various sizes, although around 4,222 are currently operating (BGMEA, 2015). The manufacturing sector of Bangladesh contributes 18% of GDP and it is dominated by the garment sector. Bangladesh is the fifth largest garment exporter to the European Union and among the top ten apparel suppliers to the US. In the past two decades Bangladesh emerged as a successful manufacturer and exporter of RMG products in the world (BBS, 2012).

Fire hazards have become a major inevitable problem in the RMG sector of Bangladesh in the recent years. The dirty secret of the steady growing garment sector of Bangladesh is that the underpaid workers are treated as disposable objects (Claeson, 2012). The RMG sector faced a significant numbers of fire accidents between 2000 and 2013, and the numbers of accident were 1833 (BFSCD, 2014). Several factors are associated with fires in the RMG factories. The violation of fire safety rules by anyone is considered as social crime because the ultimate victims of fire hazards are not only the individuals but the society as a whole (Syduzzaman and Islam, 1992). The establishment of factories or the conversion of residential or commercial buildings into garment factories has often been done quickly and cheaply, and resulting in widespread safety problems including faulty electrical circuits, unsafe buildings, inadequate emergency exits and inadequate firefighting equipment (Clean Cloths Campaign, 2012). Although the number of inspectors increased to monitor the preparation of the factories for fire control, but the numbers remained same to check the occupation safety and health (OSH) issue over the last 26 year (ILO and ILS, 2013). Most of the accidents occurred in the factories due to the lack of maintaining adequate safety measures. The numbers of fires in the factories have increased simultaneously with the rising number of factories. Therefore, the numbers of casualties, causing significant damages of lives and property, are going up due to the fires in this sector.

OBJECTIVES OF THE STUDY

The main objective of the study to inquire into the main factors associated with fire hazards in the RMG factories of Dhaka city. The study assesses how these factors are worsening the existing situation to make the RMG factories more vulnerable for fire hazard.

STUDY AREA

Most of the RMG industries are located in the urban area or vicinity to urban area in Bangladesh. The garment industries have grown in Dhaka city remarkably in the last few years. The present study area is Mirpur Sub-district (*Thana*) which is under Dhaka city (Figure 1). There are 120 factories are located in Mirpur Thana (BBS, 2010) but the actual figures are more. There are few factories which are operating their production without permission of the concerned authority. Thus, the study area was selected based on the location of factories, presence of large number of workers, factories are located without having adequate space to take shelter during fire or any other accidents, fire risk of the garment factories, frequency of fire accidents and the mitigation measures of the factories. In order to conduct the study, Mirpur Thana area was selected based on the following considerations:

- a) There are significant numbers of garment factories are located and substantial number of garment workers are engaging in this area compare to the other parts of the capital Dhaka.
- b) The factories of the study area are affected by fires in the last few years and the numbers of casualties are mentionable also.
- c) This area is not a recognized industrial zone, but a lot of industries established in a scattered way without considering the problems of the surrounding communities and environment.
- d) The area is termed as 'Mixed Area' of Dhaka city, combining both the planned and informal types (Ahmed et al., 2014) and is considered mainly a residential area, and also simultaneously used for commercial and industrial purposes (Haq et al., 2012). Moreover, all economic classes of people are living there and their occupations are also diversified.

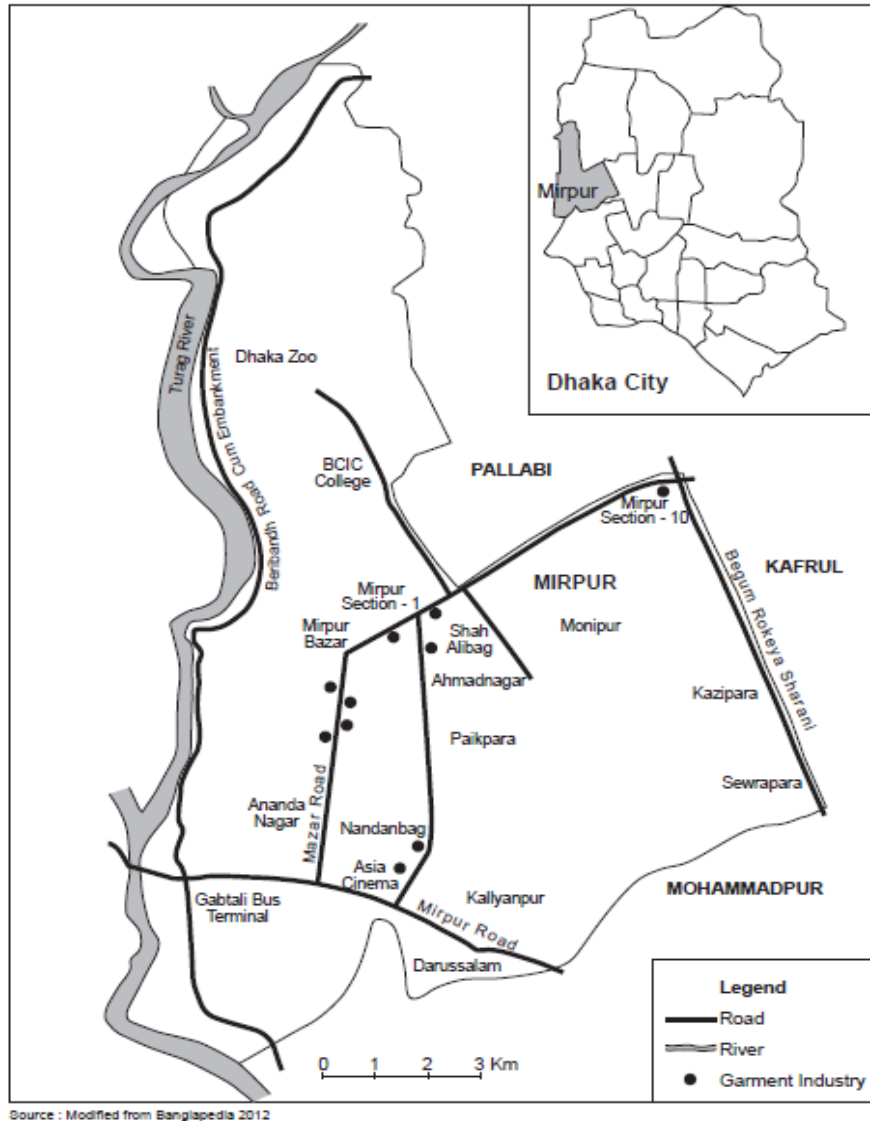


Figure 1: Location of Surveyed Garment Factories in Mirpur Sub-district (Thana)

METHODOLOGY

For this study, the required data and information were collected from both primary and secondary sources. The primary data were gathered through a survey conducted on 70 RMG workers, many of them are the victims of fire accident in the factory and

few of them have observed the accident, from 10 factories of the study area (Figure 1). In addition to this, 10 key informants (KIs) such as fire safety specialist, fire fighters, academician, researchers, NGO personnel, workers' leader etc. were interviewed to get in depth information on various issues which are related with the fire in the RMG factories. Secondary sources of information were published and unpublished research works relevant to the theme of the study. These include books, journal articles, research documents, reports of the government offices, NGO documents, conference proceedings, government laws and regulations, locally published reports and maps etc. In addition to this, several case studies were recorded from the affected workers.

RESULTS AND DISCUSSION

Factors Responsible for Fire Hazards in the RMG Factories

Various factors which were identified through the study, interviewing the workers, KIs and factory authorities, are associated with fire hazard in the readymade garment factories. Few factors play significant role to originate fire in the factories directly and few others work indirectly to develop the situations to break out fires in the factories.

Unauthorized sub-contracting

Unauthorized sub-contracting is a significant challenge and very common in the garment sector of Bangladesh. According to the KIs, one-third of the factories are involved in sub-contracting basis production in Bangladesh. The sub-contracted factories usually receive work orders from the famous compliant factories which can produce more products than maintain good working environment. It has been observed during the field survey that the working environments in the compliant factories are better than the non-compliant factories. However, the sub-contracting factories usually remain outside monitoring since the buyers keep contract with the order receiving factories only (Kormojibi Nari, 2003). Moreover, the sub-contracted factories are comparatively financially less solvent to ensure the compliances in their factories. These factories are less efficient to solve the workers issues and most of the workers are changed due to the frequent movement of workers from their jobs. These factories often experience the worker shortage of workers. The workers avoid working in these factories when they face difficulties regarding their wages and other facilities. Furthermore, the safety issues of the factories are ignored due to poor and irregular inspection by the authorities. The awareness levels of the workers are comparatively less in these factories. The factory authorities keep the fire equipments for display only which are not workable and these factories run on sub-contract basis. Therefore, these factories become more vulnerable for fire accidents and other problems.

The factory owners also sub-contract to unknown factories that operate in the shadows of garment factory of Bangladesh. These unauthorized factories are often the most dangerous in terms of workers' safety and reported as violators of workers' rights. It also deprives the country from the due share of production. Many sub-contractors are in small size factories and do not have enough capital to meet the buyers' code of conduct for fire safety and other issues. According to BGMEA, at least 500 factories out of 5400 run totally on a sub-contract basis. Moreover there are several hundred factories which are not the members of BGMEA and engaged in sub-contract operations. However, the buyers do not want to know where their products are being produced and the working conditions of those factories. Moreover, factory authority sub-contracts part of the orders or even provides the whole orders to other factories due to meet tight deadlines or to be able to finish more orders within short time. The sub-contracted factories and workplaces are not part of the buyer's business and buyers do not consider the issue seriously, and that is why inspections do not take place in these factories (SOMO, 2013). Therefore, the sub-contracted factories remain in vulnerable condition for fire as well as building collapse. These factories have inadequate safety measures for fire control. The government authority or BGMEA do not handle the issue properly and do not take strict steps to control this issue. In addition to this, there are no specific regulations regarding the sub-contracting issue. The unplanned management strategy of government and other agencies is giving legality of sub-contracting in the garment sector and consequently making the sector more vulnerable for unexpected fire and other problems.

Rules and Regulations

The regulatory frameworks (RFs) of the RMG industries are associated with the Labour Laws, Building Code, Fire Code, buyers' conditions etc. The inspections of the factories are conducted to ensure the various laws and regulations in the factories. Usually the regulations to control fire are followed by all the stakeholders. When there are no bindings to follow the regulations, many of them do not want to follow. RFs are considered important to control the fires of RMG factories in Bangladesh. The number of factories has increased with time and the nature of problems has been changed also. When the number of factories was less, accident occurred at that time also but only few of them are reported or recorded. This issue became a matter of great concern to all the stakeholders after the Tazreen Fashions fire and Rana Plaza collapse. The implementing mechanisms of RFs are really weak and that is why the damages could not be reduced. The main issues regarding the RFs are the role of factory inspection department, manpower shortage, inadequate logistic support, e.g. vehicles, corruption of the officials of the concerned directorate, people's mentality of not following the rules, lack of implementation of labour laws, bureaucratic problems etc.

Bangladesh National Building Code (BNBC)-1993 is an important aspect to control fire in the garment factories and this specified that all building owners have to follow the building code. The number of staircases in a building depends on the volume of traffic of that particular building. A wholesale law regulating the number of stairs for every type of building is illogical as it is meant to differ according to that particular building's use. This type of law cannot support to place hospitals, residential buildings and industrial complexes under the same guidelines. All have to take the approval from RAJUK (*Rajdhani Unnon Kotripokkhho/* Capital Development Authority) to construct building in the city. Many garment factories are operating their production in residential and commercial buildings which indicate the serious violation of such laws. Bangladesh government cannot enforce the building code properly due to various reasons such as inadequate manpower, lack of capital and technologies and logistic capacities.

Fire exits in few buildings are constructed in such a way that the narrow steel staircases on the outside of the building with low railings can lead to a sure fall of the workers during the emergency evacuation time. The safety issues during the emergency time are not considered by the factory authorities. BNBC-1993 has specified different widths of the stairs for the commercial, industrial and residential buildings. In the RMG factories, exit stairs are not separated from work areas by fire protected materials. Sometimes the stairs open directly into areas where warehouse is located. In many factories, the main exit staircases meet on the ground floors inside the building which makes the situation more vulnerable for the workers. Moreover, emergency evacuation plan of whole building and each floor are not displayed in proper place of the building. The workers often do not follow the rules and regulations properly for their safety (Table 1) but are supposed to follow by some rules to avoid fire accident in the factories.

Table 1: Workers' perception regarding rules and regulations to control fire

Rules	% of total Respondents (N. 70)
Always should be careful about fire rules	88.57
All have to know how to operate the fire alarm	57.14
All have to know the use of fire extinguishers	50.00
Not to bring combustible materials	38.29
No smoking inside the factory	32.86

Source: Field Survey, 2014

Note: Multiple responses have been considered

Unplanned factory building

Recent accidents of fires in garment sector happened mainly due to establish of unplanned factory building. Many factory buildings have been developed in the mixed areas of Dhaka city. Actually these were built for residential or commercial purposes and used as garment factory building. Therefore, this more often confronts with design for residential building but they are not actually suitable for industries or plant. When a building constructed for specific purposes and used for other purposes, then it is difficult to convert the existing building to meet the requirements of industries. In fact, the staircases may be small for residential purposes, but if these turned in to factories with several hundreds of workers, staircases may be too small and there are shortages of safe exit ways (Table 2). The building owners want to get more rents and signed deals with the factory owners. Hence, they modify the internal structure of the building without following the rules. In many buildings, multiple garment factories are conducting their operation by using different floors. These factories do not follow the rules and regulations properly to control fire. These factories often located in the commercial complex and lower floors of the building are used for business purposes. Therefore, the factories located in these types of buildings, remain always in vulnerable conditions for fires.

Table 2: Factory condition on the basis of stair numbers and widths

Indicator	Justification	Values	Number of factory	Percentage
Staircases	Staircases are used to get down from the upper floors of the factory building. It depends on the size of the building and fire resistant stairs save the workers from fires.	Adequate number and width	2	20.0
		Either number or width inadequate	3	30.0
		Inadequate number and width	5	50.0

Source: Field Survey, 2014

Compartmentalization relates to the physical barriers to the spread of fire and smoke. It is a system by which fire-resistance wall or slab between two buildings or two spaces to protect spread of smokes or fire vertically and horizontally (GoB, 1993). Most of the garment factories in the city are using buildings that are built primarily either for residential or commercial purposes. The factory owners break down inside walls on the floor of a particular building to convert it into a garment factory. The

factory authorities do not maintain compartmentalization of the floors where a lot of people are working together. Thus, this becomes a case of danger rather than ensuring safety of workers during the emergency period. When fire breaks out, it is easy to put out fire, as it does not get the chance to spread out inside the factory. The agency which is involved to control unplanned building in the city area is RAJUK is not playing satisfactory role to overcome the situation.

Lack of compliances in the factories

Compliance ensures all the issues of labour rights and services according to the buyers' code of conduct (Baral, 2010). Compliances are related with the development and standardization of various issues of the factories and these are closely related with the investment or funding. These types of factories need supports from government and other agencies to upgrade the existing safety measures for fire and good working environment. Many factories cannot pay the workers' salary regularly and often become difficult for them to invest huge amount of money to maintain compliances. Compliance is considered the prime requirement for all global buyers. The big and renowned brands are more concerned about the compliance issue of their contracted factories. The major brands such as Inditex, H & M, Wal-Mart, GAP, Levis, Nike, Marks & Spencer etc. emphasized on the compliances followed by factories. The factory owners are discouraged to be a full-complaint factory because of huge initial investment and running cost. Rented factory building, narrow staircases, low roofs, unsafe working environment, absence of lunch rooms, unavailability of clean drinking water and absence of separate toilets or common rooms for female workers are serious concerns in the garment factories of Bangladesh also. Fire accidents may be happened in the factories in the future also. When these factories follow the compliance issues properly then less casualties and damages will be observed. Around one-thirds (31.4%) of the respondents mentioned that compliances are followed properly and 40% of the workers told that compliances are followed partially in their factories. Among the interviewed respondents, 17.1% opined that compliances are absent in their factories (Table 3).

Table 3: Workers' perception regarding the compliances in the factories

Level of compliances	Frequency	Percentage
Compliances are followed accordingly	22	31.4
Compliances are followed partially	28	40.0
Compliances are not followed	12	17.1
Do not know about compliances	8	11.5
Total	70	100.0

Source: Field Survey, 2014

Ignorance of occupational safety and health (OSH) issue

Many factories receive low making charges for the products to attract buyers and take more orders in order to make maximum profits. These low cost suppliers often avoid safety issues and reduce workers expected wage through increasing working hour, cutting their benefits, without investing money for safety purposes. This cost reducing behavior of the factories develop the ways of deprivation and proliferation the vulnerability of workers. OSH issue are neglected in the all spheres of works and less awareness observed on this issue. The KIs opined that the RMG sector is following OSH issue from the buyers' pressure but not for the industries. In most of the cases, the factories grow without considering the basic building safety issues such as the shops and business outlets in the lower floors and the upper floors are used for factory production. The workers cannot maintain the OSH issue due to the limited knowledge regarding this. Moreover, the factory authorities do not ensure required measures for safety. As a result, the OSH issues get less prioritized by the factory management and law enforcement agencies. It has been observed from the study that more than half of the workers (52.9%) know about OSH issue of the factory (Table 4). However, many respondents (47.1%) reported that they are not aware of OSH issue. They focused that ignorance of OSH issue often becomes the cause of fires in the factories.

Table 4: Whether the workers know OSH issue

OSH issue	Frequency	Percentage
Know about OSH issue	37	52.9
Do not know about OSH issue	33	47.1
Total	70	100.0

Source: Field Survey, 2014

Faulty Electric System

The electric wire connections are not safe in many factories. The cables are exposed unprotected on the floors, ceiling and walls. Cables and wiring often run through the rooms and stairways. Electric wirings in boiler room are not protected from the external heat. Generator rooms are small in size in compare to the need to avoid the probable accident. The buildings which were constructed for the residential purposes are now used for garment factories and as a result more electric appliances are used in a de-compartmentalized open space, which develops more vulnerable conditions for the garment factories. It has been observed from the study that over uses of electricity and overload in the electric lines often caused many accidents in these factories.

According to majority of the respondents (100%), the main cause of fire in the RMG factory is electric short circuit (Table 5). Low quality electric apparatus and improper checking of electric apparatus are propagating this problem.

Table 5: Causes of fires in the garment industry

Causes of fire	Frequency	% of respondents (n = 70)
Electric short circuit	70	100.0
Boiler explosion	31	44.29
Storage of flammable materials	26	37.14
Transformer explosion	20	28.57
Canteen kitchen	17	24.29
Overheating	8	8.57
Others	15	21.43

Source: Field Survey, 2014

Note: Multiple choices have been considered

Inadequate firefighting equipment

There are shortages of adequate modern firefighting equipment in the national level in Bangladesh. Actually, government became pressurized to purchase a lot of essential equipment from the outside of the country after the occurrence of a sheer number of accidents in the RMG sector. In contrast, still these are inadequate to fight against major fires properly. According to the field survey, there are few factories who arrange fire drills regular basis in their factories and many of them do not arrange fire drill regularly. There are no fire safety plans in every floor and no coordination observed also. There are limited practices of the workers to use the fire extinguishers and others equipment which are presence in the factories. Many factories even do not have adequate fire alarm system (Table 6). Most of the factories did not set fire sprinkler in their factories which should be followed according to the building code. These instruments are costly to set up but there are no bindings from the authority. Many factory authorities even do not care about maintaining the records of the equipment and fire drills in their factory.

Table 6: Sufficiency of fire extinguisher numbers in factories

Indicator	Justification	Sufficiency level	Number of factory	Percentage
Number of fire extinguisher per factory	Fire extinguishers are used to control fire inside the factory. Factory workers or management can drowse the small scale fire by using these.	inadequate	6	60.0
		adequate	4	40.0

Source: Field Survey, 2014

Locked and Inadequate Exits

Adequate numbers of exits are the pre-requisite to establish a factory building. It has been noticed in the surveyed factories that these have exits ways but these are either inadequate or remain locked (Table 7). The factory owners want to ensure of security and make confirm of not stealing of properties. Hence, they strictly control the exits and keep lock the exit ways most of the time. When fires occur in the factory, the workers and factory authority become scared and could not find the exit ways accordingly. Inadequate and locked exits often become the major cause of casualties in the factories due to fires or other unexpected events.

Table 7: Emergency floor exits of the surveyed factories

Indicator	Justification	Level	Number of factory	Percentage
Emergency floor exit	Emergency floor exit is separated from the main exit or gate. It is important because the workers can be evacuated from each floor of the building directly.	adequate	2	20.0
		inadequate	6	60.0
		absent	2	20.0

Source: Field Survey, 2014

The majority respondents (61.43%) expressed their concern regarding the number of exit gates because the numbers of evacuees become much higher during the emergency period (Table 8). The workers are not aware enough how to come out during fire which was reported by 42.86% respondents and this factor attributed in face of disastrous stampede in the rapid evacuation process. According to 38.57%

respondents, the negligence of the factory management became a major problem during the evacuation. Long travel distances usually create panic and risk of the casualties of the workers, and it was mentioned by 25.71% of the respondents.

Table 8: Exit gates and evacuation systems in the factories

Problems	Frequency	% of total respondents (n = 70)
Inadequate exit gates	43	61.43
Congested escape routes	38	54.29
Do not have emergency evacuation plan	30	42.86
Do not follow emergency evacuation plan	27	38.57
Long traveling distance	18	25.71

Source: Field Survey, 2014

Note: Multiple choices have been considered

Negligence of the Factory Authority

It has been reported from the workers that the factory authorities usually arrange evacuation and fire drill from the pressures of concerned department, rather ensuring the workers' safety issues. There are gaps persist among the workers, owners and the government authority. The factory authorities do not consider that investment for safety is one kind of investment for the factory also. Fire issue is a matter of concern for 24 hours and 365 days in the garment factories. The owners perceive that the enforcement of laws regarding the fire and safety is the condition of buyers. The interviewed workers reported that the main negligence of the factory authority remain in the enforcement processes of existing rules and regulations.

Box 1: Case 1 Workers' perception regarding factory owner

'It is very difficult to understand the mentality of the owners regarding the fire issue of the factory'- Shariful, a 25-years old worker engaged in this sector for last 6 years, mentioned these words with dissatisfaction. He reported that the owners of the factories are not so serious regarding the fire of the RMG factory. More often, the factory owners formulate a loyal group of management in their factory and they are busy to work for the interest of the owners not for the workers. The factory owners consider that they are above laws and they do not want to follow the existing RFs . In addition, the punishments for the factories are negligible for not following the laws, the fine ranging from 5,000 to 10,000 Tk. which are really negligible amount for the factory owners. Therefore, the workers become the victims by the greediness of the owners.

According to the KIs, the previous mistakes of RMG sector were not considered at all by its concerned agencies. When any fire accidents happened in this sector, the concerned authority pledged to take stern actions against the rules violators. Afterwards, no actions were taken for the accidents. Thus, the culprits remained in safe and continue their practices and these kinds of accident are happening frequently. It is like the practice of 'blame game', but in most cases no conspiracy found, just blaming the third party for the accidents to avoid the responsibility. Government, BGMEA, union leaders are patronized by the factory owners, and they develop such a fake stories that the main reasons of fire remain uncovered. The investigation authorities prepare an investigation report as usual regarding the accident, which could not publish to the people and no effective measures were taken on the basis of the recommendations provided in the report. The capacity and volume of the Directorate of Inspector for Factories and Establishments did not increase even 10% in the last 20 years (Ahmed, 2009).

Conflicts Among the Various Stakeholders

Political instability is considered as the highest risk of sourcing from Bangladesh, just after the infrastructure (Berg, 2011) and it assists to create chaos among the factory management and the concerned stakeholders. For instance, political turmoil in Sri Lanka in the late seventies compelled many buyers left Sri Lanka and invested Bangladesh. Political anarchy disturbs in the normal operation of the RMG factories. The buyers are warning Bangladeshi garment producers about shifting their orders from Bangladesh to other countries such as Cambodia, Vietnam and even India if political violence continues in the same way. The safety issue of this sector remains unchanged mainly due to the conflicts among various stakeholders. Conflicts between factory management and parties are important issue and these are evolved more during the political unrest conditions. The recent fire in the Standard Group factory of Konabari, Gazipur is an example how a country's renowned factory destroyed by the vested quarters for their own interest. Besides, there are businesses which are associated with the byproducts of the factories, controlled by the local powerful people. These garment byproducts businessmen remain in conflicting situations often with the factory management. They use local terrorists (*mastans*) to shut down the production of the factories and often assign people to set fire or destroy the property of the factories.

Box 2: Case 2 Mahfuz's doubt on the safety of the RMG factories

“Once I asked the factory manager, how can we get out if there is a fire in factory? The manager ensured me that they would build stairs outside, but they didn't take any measures afterwards. This was 2 years ago.”- Mahfuz, a Tazreen survivor who injured his back, arm and foot and was hospitalized for weeks. He was only 22-years old and could not complete his Higher Secondary School (HSC) education due to poverty of his family. He left the school and found the job in Tazreen Fashions Ltd. as an operator. He was working in the fourth floor. When he noticed that the fire alarm rang for a while and stopped. He observed later that fire broke out in the 3rd floor; he could not reach the ground floor. He immediately planned to jump from the fourth floor and did that. He fell on a tree that is why he was saved. He is fully recovered from the injuries and planned to work in other places, no more work in the garment factories. He told that the garment factories are the death trap for the workers. The factory authority does not care the safety issue of the workers. The management of the factory is so strict that the workers could not address their legal issue to the management of the factory. If the authorities get any problems or allegation against a worker, they just terminate the job of the workers. These kinds of incidents are happening always in the factories. The workers have no ways without to continue the work. These workers are contributing to the economy of the country but no measures are taken for them. More than 1200 workers were working in the Tazreen Fashions building; there were no emergency floor exit. So when fire occurred, all the workers tried to come down by using the stairs, but the main gate was locked and smoke covered the whole area. Therefore, 111 people died miserably and more than 300 people were injured.

Limited Capacity of Fire Department

The capacity of fire department is considered an important to fight against fire. The numbers of fire stations in Dhaka City were 12 in the year 1991, which have increased to 13 in 2004 and the present number is 14. The number of population of the city has increased substantially by this time. In 2001, there were only an average of 35 fire fighters and two vehicles for each station of the city (BFSCD, 2007). Hence, each fire station has to serve almost 1 million people of the city where the ratio of the citizen and vehicle is 470,833: 1. Fire department cannot conduct regular inspections in the factories due to lack of manpower (such as instructors, inspectors for monitoring, evaluation and supervision) and resources (e.g. vehicles, modern firefighting equipment).

Table 9: Population per fire station of various cities

City name	Area (sq. km.)	Population	Number of fire stations	Population per fire station
Dhaka (Bangladesh)	797	7,001000	14	5,00,071.4
Kolkata (India)	1480	4,580679	95	48,217.7
Delhi (India)	1500	9,817439	53	1,85,234.7
New York (USA)	1214	8,475500	221	38,350.7
London (UK)	1580	8,308369	102	81,454.6

Source: US Census Bureau, 2014, World Population Statistics, New Delhi City Census, 2011. 2013 and Islam, 2008

According Carter and Stein (2013), in USA the number of total fire stations are 30,100 and each station serves on average 6,097 persons whereas in Bangladesh the number of population is 156,140,847 (BBS, 2014) and fire station numbers are 267 (Newaz, 2013), so each station can serve on average 584,797 persons. In Dhaka city the capacity of fire department is little bit better, the population of Dhaka city is 7,001,000 (World Population Statistics, 2013) and the number of total fire stations are 14, so the numbers of population per station are 500,071.4 (Table 9). The number of total fire fighters in Bangladesh are 7,500 (BFSCD, 2013) and the numbers of staff in each station are on average 28 and each fire fighter can serve on average 20,819 persons. Therefore, the limited capacity of fire department often reduces to fight against fire accidents.

CONCLUSIONS AND RECOMMENDATIONS

Fires in the RMG sector have become an important issue for the factory workers and owners. The owners presume that they follow all the compliances for the reduction of fire hazards in the factories. The owners do not agree to invest adequate money to ensure the safety of the workers and they try to make maximum profit from this sector by exploiting the workers and without following the rules and regulations. As a result, there are huge gaps persisting in the present and expected fire safety conditions of the factories. The probability of occurrence of fire in many garment factories still remains high. Tazreen Fashions Ltd. is considered a good example where all the fire safety issues of the workers were violated by the factory owners and the management. Sub-contracted factories are less monitored by the authority, but these types of factories are more vulnerable for fires. There are less uses of firefighting equipment in the factory level; rather the authority prefers to display the equipment for the buyers and inspection authorities. Electric short circuit is a major cause of fire in RMG factories. The problem associated with the electric products which are used for the industries as well as residential purposes, their qualities are low. These products often could not support to avoid the fire accidents in the factories. The OSH issue is often ignored by the factory authorities. The unrest political condition of the country often endures to create sabotage in the RMG factories. Consequently, miscreants take the opportunity to set fire in the factories. In many factories, conflicts persist among the concerned stakeholders of the factories which ultimately enhance to set fire in the factories to destroy the properties and make the workers jobless. Various measures can be taken to reduce the occurrence of fires in the factories.

1. The laws and codes to prevent fires in the factories should be enforced properly to avoid further accidents in this sector.

2. Unauthorized sub-contracting should be controlled and adequate safety measures should be ensured in the factory level.
3. Unplanned factory building conversion should be stopped without making any delay and the required measures should be ensured to control fires in these factories.
4. Compliances should be maintained to avoid hazardous situation in the factories.
5. The factory authorities and the workers should be more aware regarding the OSH issue in the factories.
6. The factory authorities should avoid the low quality electric products to keep the factory safe from fires.
7. There should be adequate number of fire fighting equipments in the factory premises to fight against fires.
8. Adequate number of exit ways and open gates should be ensured in the factories to reduce the number of casualties of fires.
9. The factory authorities should be more aware about fires and they should arrange fire drill on the regular basis in the factories.
10. Conflicts among the concerned stakeholders should be minimized to keep the factory safe from unwanted fires.
11. The fire department should be more dynamic with trained personnel and modern equipment to fight against factory fire.

REFERENCES

- Ahmed, B., Hasan, R. and Maniruzzaman, K. M. (2014). Urban Morphological Change Analysis of Dhaka City, Bangladesh, Using Space Syntax, *ISPRS International Journal of Geo- Information*, Vol. 3, pp. 1412-1444.
- Ahmed, N. (2009). *Designing for Fore Safety: Case Study Dhaka*, The Daily Star, March 28, Dhaka, Bangladesh.
- Baral, L. M. (2010). Comparative Study of Compliant and Non- Compliant RMG Factories in Bangladesh, *International Journal of Engineering & Technology*, Vol. 10, No. 2, pp. 93-100.
- BBS (2013). *Statistical Pocketbook Bangladesh 2012*, Bangladesh Bureau of Statistics (BBS), Statistical and Information Division, Dhaka, Ministry of Planning, Government of the People's Republic of Bangladesh.
- BBS (2012). *Statistical Year Book of Bangladesh-2011*, 31st Edition, Bangladesh Bureau of Statistics (BBS), Statistics and Informatics Division, Ministry of Planning, Government of the People Republic of Bangladesh, Dhaka, Bangladesh.

- BBS (2010). *Register of Establishment*, Size: 10+, (Updated Up to December 2009), Bangladesh Bureau of Statistics (BBS), Statistics and Informatics Division, Ministry of Planning, Government of the People Republic of Bangladesh, Dhaka, Bangladesh.
- Berg, A. (2011). *Bangladesh's Ready-made Garments Landscape: The Challenge of Growth*. Apparel, Fashion and Luxury Practice, McKinsey & Company, Inc.
- BGMEA (2015). About Garment Industry of Bangladesh, [http://www.bgmea.com.bd/home/about/About Garments Industry](http://www.bgmea.com.bd/home/about/About%20Garments%20Industry),
- BGMEA (2014). Industry Strengths. [http://www.bgmea.com.bd/home/pages/ Strengths](http://www.bgmea.com.bd/home/pages/Strengths). Accessed on September 2015.
- Carter, M. J. and Stein, G. P. (2013). *US Fire Department Profile 2012*, National Fire Protection Association (NFPA), Fire Analysis and Research Division, Quincy, Massachusetts.
- Claeson, B. (2012). *Deadly Secrets*, International Labour Right Forum, Washington DC, www.laborrights.org/sites/default/files/publications-and-resources/DeadlySecrets.pdf
- Clean Cloths Campaign (2012). *Hazardous Workplaces: Making the Bangladesh Garment Industry Safe*. [www.cleanclothes.org/resources/ccp/working conditions/hazardous workplaces-making-the-bangladesh-garment-industry-safe](http://www.cleanclothes.org/resources/ccp/working%20conditions/hazardous%20workplaces-making-the-bangladesh-garment-industry-safe).
- GoB (1993). *Bangladesh National Building Code 1993*, Ministry of Public Works, Government of the People's Republic of Bangladesh.
- Haq, M. F., Islam, M. M., Ali, M. S., Haque, M. F. and Akhand, M. M. R. (2012). Status of Noise Pollution in Mixed Areas of Dhaka City: A GIS Approach, *Journal of Environmental Sciences and Natural Resources*, Vol. 5, No. 1. pp. 9-17.
- ILO and ILS (2013). *Bangladesh: Seeking Better Employment Conditions for Better Socio-economic Outcomes*, International Labour Organization (ILO) and The International Institute for Labour Studies (IILS), Geneva.
- Islam, N. (2008). *Dhaka Now: Contemporary Urban Development*, Bangladesh Geographical Society (BGS), Dhaka University, Dhaka, Bangladesh.
- Kormojibi Nari. (2003). *Sub-contracting Chain in the Garment Sector of Bangladesh and State of Labour Standards*, in Hale, Angela (ed.) *The Rights of Workers in Garment Industry Sub- contracting Chains: A Research, Education and Action Project with Workers Organization in Asia and Eastern Europe*, Women Working Worldwide.
- Newaz, A. K. M. S. (2013). *Presentation on Fire Safety on Readymade Garments*, Paper Presented in Export Processing Zone (EPZ), Dhaka, Bangladesh.
- SOMO (2013). *Fact Sheet Unsafe Garment Factory Buildings: Zooming in on the Role of Buying Companies*, Centre for Research on Multinational Corporations (SOMO), Amsterdam, The Netherlands. www.somo.nl/publications-en/Publication_3979/at_download/fullfile.
- Syduzzaman, M. and Islam, M. A. (1992). A Fire Hazard Assessment Model and Fire Hazard Zones in Dhaka SMA, *Oriental Geographer*, Vol. 36, No. 1, pp. 3-23.