# A COMPARATIVE STUDY OF FIRE SAFETY CONDITION IN THE READYMADE GARMENT SECTOR OF BANGLADESH BEFORE AND AFTER THE RANA PLAZA ACCIDENT

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## ABSTRACT

Readymade garment industry is the largest export sector of Bangladesh contributing more than 83% of the total export earnings of the country. Yet the workplace safety in this industry has always been a questionable issue due to a lot of parameters. This research mainly focuses on the fire safety condition of this industry through a comparative study of the safety condition before and after the Rana Plaza accident. A total of 15 comparable parameters comprising both structural (hard) and management related (soft) parameters have been considered. Study result reveals that the overall fire safety condition of the garment factories have improved. The average Fire Risk Index (FRI), established earlier, for the same garment factories (surveyed before and after the accident) has increased from 0.64 to 1.57 on a 2-point scale, indicating a much safer place for workers at present. For the same number of mixed garment factories, average FRI increased to 1.46 compared to 0.61, indicating a significant improvement of safety issues in terms of fire safety. Significant improvements of the management related (soft) parameters compared to structural (hard) parameters are the main factors for this notable outcome.

***Keywords**: readymade garment, fire safety, fire risk index, rana plaza accident, workplace safety.*

## Introduction

Readymade garment (RMG) industry is the largest export sector of Bangladesh, with more than 83% of the country's total foreign earnings generated from this sector. At present, the industry consists of 4,560 factories, empowering 4.4 million workers, of which 80% are women (BGMEA, 2018a). Over the last three decades, the RMG industry has thrived the economic growth throughout the country (Ansary and Barua, 2015). The government of Bangladesh is providing full support to the RMG industry by offering tariff rationalization, tax reduction on imported materials and machineries and reducing the interest rate on loans (Yunus and Yamagata, 2012). As a result, Bangladesh is now the second largest garment exporter in the world after China with a total export of US $30.61 billion in the fiscal year of 2017-18 (BGMEA, 2018b; UNICEF, 2015). Surely, this is a great achievement for all the personnel associated with this huge industry and the people of Bangladesh. But, unfortunately, the workplace safety in this highly labor-intensive industry has always been a questionable issue. In the last four years only, over 4,500 garment workers have been subjected to severe injuries of which a significant number turned into death (Chowdhury and Tanim, 2016). Out of various types of workplace accidents, fire inducing accidents are the most frequent one in RMG industry of Bangladesh. Although, the Rana Plaza accident in 2013, caused the death of 1,129 workers and another 2,515 workers were the victims of severe life-threatening injuries (ILO, 2018), Hasan et al. (2017) reported that 94.2% deadly incidents in RMG industry are still due to fire.

Rana Plaza which was a nine-storied building is the case of structural failure which has left with the highest number of fatalities and injuries ever been recorded in any single incident involved in the RMG industry of Bangladesh. This catastrophic accident triggered the initiative and commitments from both the government of Bangladesh and the international community to improve the workplace safety in RMG industry. After the incident, several action plans have been undertaken to ensure the overall safety of the RMG sector. Apart from the action plans, the international stakeholders have also formed two inspection programs, ACCORD on Fire and Building Safety in Bangladesh (The ACCORD), and ALLIANCE for Bangladesh Worker Safety (ALLIANCE) to inspect the workplace safety of the garment factories in Bangladesh and work with the factory owners and management body to improve the deficiencies where deemed necessary (Ansary and Barua, 2015). Till date, both the programs have achieved more than 85% remediation progress rate among

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the factories which have signed and collaborated with these two programs (ACCORD, 2018; ALLIANCE, 2018).

Although the Rana Plaza accident attracted a huge attention from both the stakeholders and regulatory bodies, still fire related accidents are more frequent and catastrophic ones in the RMG industry. However, there is lack of studies that attempt to understand the fire risks associated with this industry. Besides, no studies till date have attempted to quantify the fire risks in the RMG industry of Bangladesh after the Rana Plaza accident. This paper thus aims to investigate the workplace safety in terms of fire safety of the readymade garment factories of Bangladesh at current state (i.e. after the Rana Plaza accident) through a quantitative Fire Risk Index (FRI) method developed by Wadud et al. (2014). Along with this, the paper also investigates whether the fire safety condition of the garment factories have changed compared to the safety condition before the accident and if so, what is the nature of change by a comparative study of the before and after state of the fire safety condition of the garment factories. Finally, this paper also tries to figure out the parameters which possess significant importance to achieve a better workplace safety in short period of time in the RMG industry. Giving the nature of the study, it is believed that the study findings will be beneficial to a wide range of labor-intensive industries. The fire accidents in a firework factory in Indonesia which left 50 fatalities (The Straits Times, 2018) or a footwear factory in Philippines which left 72 fatalities (The Telegraph, 2018) indicates the importance of this research.

## Methodology and Data Analysis

The fire safety condition of the garment factories is assessed through a quantitative method, Fire Risk Index (FRI) that has been developed by Wadud et al. (2014). Data of the garment factories before the Rana Plaza incident has been considered from the earlier studies of Wadud et al. (2014) and Wadud and Huda (2017). The current status of the garment factories has been collected from the inspection report provided by the ACCORD and ALIANCE which have been retrieved from their website from 11$^{th}$ to 17$^{th}$ June 2018. The inspection report provides information of the current state of various parameters of the garment factories under three broad categories namely, structural, electrical and fire safety.

In FRI method, a number of parameters which are assessed is first weighted through a panel of fire safety experts. In this study the weight value of the parameters is adopted from the earlier studies of Wadud et al. (2014) and Wadud and Huda (2017) and is based on a 5.0 scale. Individual garment factories are then checked against those parameters and graded for their current state. For this study, a 2.0 scale grading scheme has been considered to rationalize the data between the earlier studies of Wadud et al. (2014), Wadud and Huda (2017) and data extracted from the ACCORD and ALLIANCE inspection reports. Table 1 depicts the modified grading scheme adopted in this study for both the earlier studies and the ACCORD and ALLIANCE reports.

*Table 1. Grading scheme for different parameters.*

| Grade | For the ACCORD and ALLIANCE data | For 'hard' parameters (grade point extracted from Wadud and Huda (2017)*) | For 'soft' parameters (grade point extracted from Wadud et al. (2014)*) |
|---|---|---|---|
| 0 | No improvement / no changes | 0 to 2 | 1 to 3 |
| 1 | Under construction / in progress | 3 | 4 |
| 2 | Fully complete / comply | 4 | 5 |

* The subjective description and quantifiable parameter of the grade points from their ideal case can be found from the earlier studies of respective hard and soft parameter.

Finally, considering the weight value and grade points of each parameter, the FRI for a garment factory is than calculated in a linear additive model of the following form:

$$FRI = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i} \quad (1)$$

where, $w_i$ is the weight value provided by the safety experts to determine the importance of various parameters relative to each other, $x_i$ is a dimensionless grade point for parameter i and n is the total number of parameters.

For this research, total 15 parameters comprising both 'hard' (structural) and 'soft' (management) parameters, have been considered to be comparable with the earlier studies. It should be reminded here that the 'hard' parameters refer to the structural factors affecting the fire safety which cannot be changed or improved overnight while the 'soft' parameters refer to the management practices affecting the fire safety and can be implemented or improved over a short period of notice. Table 2 depicts the list of the parameters, their nature and weight values.

*Table 2. List of parameters and associated weight values.*

| Ser. no | Type of parameter | Parameters | Parameters description | Weight average |
|---|---|---|---|---|
| 1 | Hard | Fire pump | Availability and function ability of fire pump | 4.38 |
| 2 | | Boiler room | Segregation of boiler room | 4.13 |
| 3 | | Door width | Width of doorway | 4.00 |
| 4 | | Exit sign & illumination type | Availability of exit sign and illumination type | 4.00 |
| 5 | | Corridor width | Clear width of the corridor | 3.88 |
| 6 | | Exit door rating | Fire rating of exit door | 3.63 |
| 7 | | Emergency light | Presence of emergency light | 3.63 |
| 8 | | Door height | Height of doorway | 3.25 |
| 9 | | Exit sign letter size | Letter size of exit sign | 2.88 |
| 10 | Soft | Locked exit | Locked/unlocked condition of exit door | 5.00 |
| 11 | | Chemicals | Existence of chemical material inside | 4.75 |
| 12 | | Block furniture | Blockade of exit corridor by furniture/other material | 4.75 |
| 13 | | Combustible | Presence of combustible item (cotton, cloth) inside | 4.00 |
| 14 | | Emergency light | Serviceability/working condition of emergency lights | 3.75 |
| 15 | | Door swing | Outward/inward swinging of door | 3.63 |

Source: Wadud et al. (2014), Wadud and Huda (2017).

## Results and Discussion

In FRI grading policy, a higher FRI indicates less fire risks. Thus, our study reveals that for a total of 60 garment factories, the mean FRI after the rana plaza incident is 1.46 on a 2.0 scale while before the incident, mean FRI was 0.61. It should be noted here that the 60 factories which have been surveyed after the incident is not the same factories which were surveyed before the incident. We have found 15 similar factories which have been surveyed by the ACCORD and ALLIANCE and in the previous studies. The rest of the factories, we assume did not sign with either these two bodies or shut down their business. Thus, to compare the before and after scenario, we have considered the same number of factories where the rest 45 factories have been selected based on the similar characteristics (i.e. factory location and size of the factory) of the previous ones.

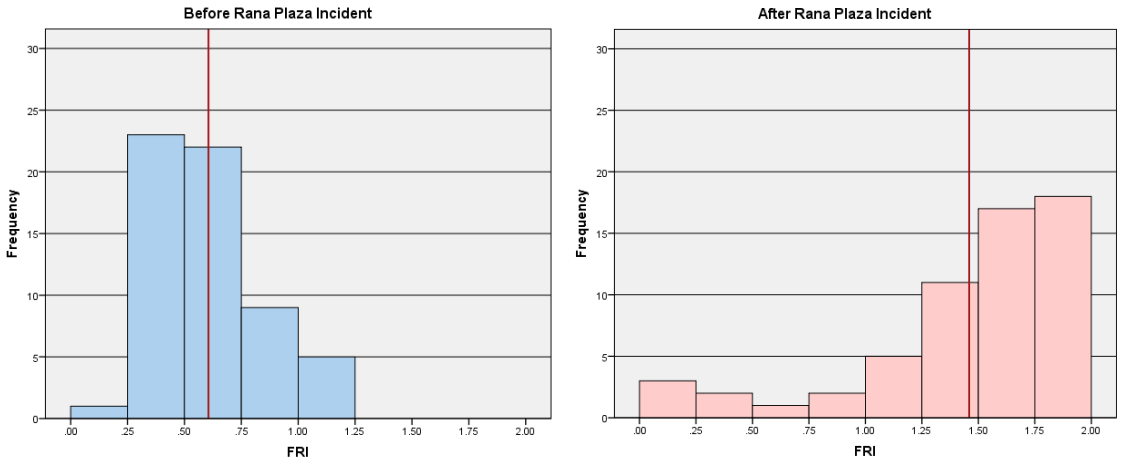


*Figure 1. Distribution of FRI's for 60 garment factories before and after the rana plaza incident. Red vertical line indicates the mean FRI.*

Figure 1 shows the frequency distribution of FRI of the 60 garment factories for both the scenarios. While no garment factory has achieved FRI more than 1.25 before the incident, after the incident, more than 76% garment factories have achieved FRI 1.25 and above. While 75% garment factories achieved FRI between 0.25 and 0.75 before the incident, after the incident, the percentage is below 10% which indicate that the overall fire safety of the garment factories have improved significantly. Though there are still 8 factories in the sample size which possess 50% deficiency from the ideal case of FRI 2.0.

Comparing the FRI for the same 15 factories which were surveyed by the earlier studies and also by the ACCORD and ALLIANCE, the mean FRI before the incident is 0.64 which increased to 1.57 after the incident. Figure 2 depicts the distribution of the 15 factories where all the factories except factory no 12 shows an increment of FRI at the present context compared to the previous scenario of rana plaza incident. This also depicts a favorable workplace in terms of fire safety at the present context compared to the previous condition. A closer insight of the inspection report for factory no 12 depicts that for many of the parameters, performance of this factory didn't change, even performed worse for some parameters i.e. exit sign and illumination type, corridor width, etc. at the present context than it was before the rana plaza incident. In terms of five most important parameters (denoted by their weight value), i.e. locked exit (w=5), chemicals (w=4.75), block furniture (w=4.75), fire pump (w=4.38), and boiler room (w=4.13), this factory performance didn't change at all after warning them for several times by the ACCORD.

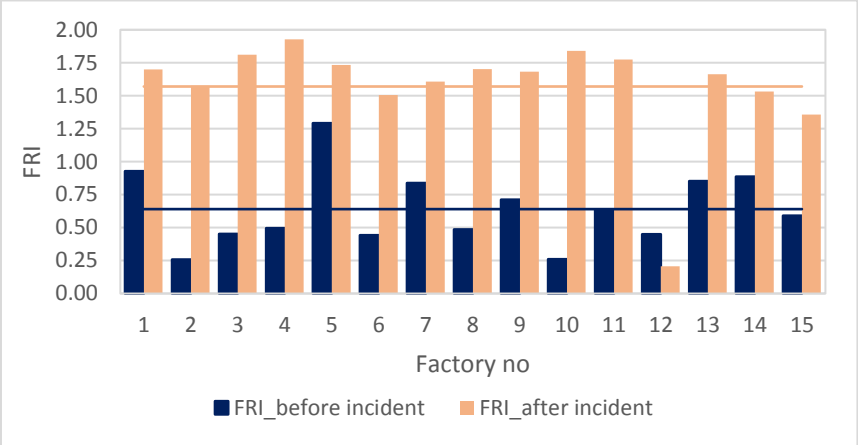


*Figure 2. Distribution of FRI's for 15 factories before and after the rana plaza incident. Horizontal line indicates the mean FRI.*

To check whether our detailed result for the 60 mixed factories (where 15 same factories are also included) are comparable for the comparison study of the before and after state of the rana plaza incident, a two sample t-test has been performed and found to be statistically significant ($t = 0.687$, $p < 0.01$ for before incident and $t = 0.359$, $p < 0.01$ for after incident). To check the performance of the hard and soft parameters separately, $FRI_{hard}$ and $FRI_{soft}$ has been assessed for the before and after scenario. $FRI_{hard}$ increased from 0.85 to 1.37 while $FRI_{soft}$ for the before state is 0.29 and the after state is 1.57. As hard parameters are related to the structural factors of a factory building which requires significant amount of time and budget from the management body to improve the safety condition thus the increment of 61% $FRI_{hard}$ is reasonable compared to the huge significant change in $FRI_{soft}$ (more than 400%).

Comparing the average grade for 60 factories for individual parameters, it is found that average grade also increased in the after state scenario from the before state scenario. For the hard parameters the difference ranges from 1% for door height to a maximum of 130% for corridor width. For soft parameters, the minimum difference is 134% for block furniture while the maximum difference is recorded for chemicals (from 0.02 for before state to 1.43 for after state). It should be noted here that corridor width which is a hard parameter can be affected due to block furniture which is a soft parameter as often seen from the surprise factory visit that empty boxes, cloths and combustibles are piled up in the exit corridor which in case of an emergency can prove to be highly vulnerable for fire safety. Comparing the average grade for five most important parameters (denoted by their weight values) which include three from soft side (locked exit, chemicals, and block furniture) and two from hard side (fire pump and boiler room), the study result shows that all three soft

parameters have performed significantly well in their after state scenario compared to the before state scenario. Locked exit got an average grade point of 1.73 in the after state scenario compared to 0.10 in the before state scenario. Chemicals got an average grade point of 1.43 compared to 0.02 and block furniture got 1.25 compared to 0.53. For the two hard parameters, fire pump got an average grade point 0.55 in the after state scenario compared to 0.52 for the before state scenario and boiler room got 1.28 compared to 0.98. This depicts that garment factories which have achieved higher FRI (safer in context to fire safety), have performed significantly well in the soft parameters compared to their hard parameters. Soft parameters which are related to management practices are relatively easy to improve or upgrade than hard parameters and thus, a better workplace can be ensured in context of fire safety.

## Conclusions

This research had three objectives: (i) to assess the fire safety of the readymade garment sector of Bangladesh after the rana plaza accident in a quantitative method, (ii) compare the fire safety condition of the RMG industry through a comparative study of before and after state scenario of the rana plaza accident, and (iii) to identify the parameters which possess important contribution towards the change of the fire safety condition in the present context (after rana plaza incident). Among the 60 factories surveyed, study result shows a mean FRI of 1.46 in a scale of 2.0 which depicts a relatively satisfactory workplace condition for the garment workers compared to 0.61 on a similar scale which was the scenario before the rana plaza accident. A relatively lower FRI for the hard parameter ($FRI_{hard}$ = 1.37) compared to the soft parameter ($FRI_{soft}$ = 1.57) depicts that the factories have performed better in management practices after the rana plaza incident whereas before the incident the hard parameters had better FRI than soft parameters as reported by Wadud and Huda (2017). It should also be remembered that management practices can change over time while structural factors are almost fixed. Thus, regular visit in garment factories to check the management practices would be beneficial to maintain a safe workplace condition in terms of fire safety. We would also like to add here that surprise visits to factories will determine the exact scenario of the management practices compared to any pre-announced visit as our study shows that management practices (soft parameters) are the main factors which are mainly responsible behind achieving a better FRI thus a better workplace in terms of fire safety. Finally, it is important to remember here that the sample factories considered for the present scenario (fire safety condition after the rana plaza incident) in our research have signed either with the ACCORD or ALLIANCE or both of them. These two combinedly covers almost 42% factories out of 4,560 garment factories of the country. Thus, our study results are comparable for a little less than half of the garment factories of the RMG industry of Bangladesh. Therefore, to reveal the whole picture of the present scenario of workplace safety in terms of fire safety in the RMG industry, a comparable study in a big scale would be much beneficial.

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