Cost Benefit Analysis of Fire Safety System in Ready Made Garment Industry- A Case Study

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DEDICATION

THIS WORK IS DEDICATED

TO

MY PARENTS

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ABSTRACT

Fire safety has become a major issue of public concern in ready-made garments (RMG) sector encouraging by the Government of Bangladesh and the garment industry to step forward to rebuild consumer confidence. This thesis gathered information on the cost-effectiveness of the protection systems from several garment factories in Bangladesh. A four-step methodology has been used in an attempt to adopt a systemic approach to constructing a fire safety management system (FSMS) for an offshore platform which although the approach is general nowadays, it has been applied to the case of the RMG industry. Significant changes have been made in fire safety management in the readymade garments factories over the past few years. However, fire safety still tends to be analyzed in isolation through all fire loss is affect to the garment industry. Fire loss may be seen as a set of 'systematic' failures, not as a result of only one reason. This study proposes an FSMS for the ready-made garment industry. It is hoped that this approach will lead not only to more effective management of fire safety but also to the more effective management of safety, health and the environment for any organizations. This study discussed the problems encountered by the management and proposed a way for quantitative evaluation of fire risk and to identified the cost-effectiveness of undertaking fire safety measures for the RMG sector of Bangladesh.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

INTRODUCTION

1.1 RMG Sector of Bangladesh and Fire Accidents:

The ready-made garments (RMG) industry play a vital role and important contribution to the economic change of Bangladesh since 1977. Nowadays, this RMG sector has experienced rapid growth by both importing and exporting goods, chemicals, other materials and machineries as well as both local and foreign buyers and expertise which now changing our economy over past 30 years [1]. This sector is now country's largest export earner by exports the largest amount of ready-made garments and ranks Bangladesh as the second largest exporter over millions of factories in the world where people employed 4.2 million in 4328 factories [2]. In 2015, garment exports were estimated about US$31 billion, a significant jump from US$17 billion in 2009 [3, 4]. This rapid and unregulated growth has also created serious problems. In the rush to meet export demands, many factories have been set up in building unsuitable for industrial purposes with exit and entry points not designed for large numbers of workers to use at the same time and the need for industrial safety equipment has never anticipated. In the context, the industry focus has always been on the contribution that the sector was making to employment and export earnings and not on the safety of the factories.

Garment industries in Bangladesh have a long history of industrial accidents. Major fires from 1990 to 2012, resulted about hundreds of accidental death including Tazreen Fashions Limited, Spectrum Sweater Industries, Phoenix Garments, Smart Export Garments, Garib and Garib, Matrix Sweater, KTS Composite Textile Meals, Sun Knitting and so on. Five deadly incidents from November 2012 through May 2013 brought worker safety and labor violations in Bangladesh in front of world attention putting pressure on big global clothing brands such as H & M, Primark, C & A, Loblaw, Zara, Joe Fresh, Charles Vogele, Gap, Tom Tailor, Walmart, Old Navy, Nike, Tchibo, Calvin Klein and Tommy Hilfiger and retailers responded by using their economic weight to create change.

In January 2013, government, workers' and employers' organizations adopted a tripartite statement of commitment to fire safety in the workplace in Bangladesh. In the statement, the partners recognized their individual and collective responsibility to ensure fire safety in every workplace in Bangladesh and committed to the development of a national plan of Action on fire safety. Following a number of meetings facilitated by the International Labour Organization (ILO), the partners subsequently adopted the National Tripartite Plan of Action on Fire Safety in the Ready-Made Garments Sector of Bangladesh [5].

Due to the pressure of buyers, compliance issues and increasing concern about worker safety, many of the garment industries are now having fire safety measures. Based on increasing demand for fire safety measures, a number of organizations or fire safety provider firms have been established in the recent years. They design, install and maintain industrial as well as residential fire protection or detection systems. Considering the required demand for fire safety, this business has high potential. However, the number of fire safety provider is still not adequate.

According to Action for Community Organization, Rehabilitation and Development (ACCORD), there are several consultancies and construction firms such as Tri-Zone, Guraba Telecom Bangladesh limited and Micro Electrical Mechanical Solution Limited are now available now in Bangladesh (ACCORD Guidance, November 2014). These consultancy and construction based companies are providing advice, design and installation of fire protection and fire detection system. They also provide public address (PA) system. These firms have been working in this field for about eight years. They provide a fire safety system to many residential buildings, hospitals, factories, garment industries and so on.

1.2 Scope of the study:

Fire safety systems are very important and essential for every industry. In this study, the researcher has conducted a cost-benefit analysis of installation of fire safety systems in the garment industries of Bangladesh. In Bangladesh, the garment industry is considered as a vital contributor to the economy. Again, the researcher has chosen to conduct cost-benefit analysis because it is very important to know because if any decision about any installation is cost effective or not. First, the researcher has tried to determine the benefits achieved through the implementation of fire safety systems and cost associated with these systems in garment industries. Both the total benefit and total cost were determined for 10 garments industries. Finally, a comparison study between the determined total benefit and the total cost was conducted in order to recognize whether the fire safety system is cost effective or not.

1.3 Objectives of the study:

The objective of this study was to determine the cost-effectiveness of undertaking fire safety measures for the RMG sector of Bangladesh. The socioeconomic development of our country is highly dependent on the RMG sector and the growth and development of this sector largely depends on the worker's safety and compliance issues. This study is concerned with determining the cost-benefit analysis of taking fire safety measures. Cost-benefit analysis is a systematic approach to estimating the strengths and weaknesses of alternatives that satisfy transactions, activities or functional requirements for a business. Cost-benefit analysis has two purposes: to determine whether it is a sound investment or decision and to provide a basis for comparing projects. It involves comparing the total expected costs of each option against the total expected benefits to see whether the benefits outweigh the costs and if so by how much. Cost for undertaking fire safety measures encompasses consultancy cost, system installation cost and maintenance cost, whereas benefits include the value of the net reduction in property damage, injuries and fatalities, an increase in profit from order gain and concession in insurance cost.

1.4 Significance of the study:

This study will give a clear view to the garment owners about the cost and benefit associated with the implementation of fire safety systems in their garment industries. It will help the factory owners to be aware of the fire safety issue, its benefit and associated costs, which will help them to make decisions regarding the implementation of fire safety measures. The RMG sector is the main and the biggest contributing sector in Bangladesh economy. Therefore, any types of implementation should be given priority for the betterment of this sector. Along RMGs economic importance, a large portion of our population works in the garment industry. They are an asset for Bangladesh, from both business and social prospective. Therefore, it is very important to provide better and safer working condition. Buyers from all around the world are highly concerned about the worker safety issues. In order to improve the workers working condition, various programs have been undertaken such as ILO RMG Program, Better Work Bangladesh, the Accord on Fire and Building Safety in Bangladesh, the Alliance for Bangladesh Worker Safety Program and so on. Moreover, each incident of fire and related damage adversely affect the reputation of the Bangladeshi garment industry abroad, especially since the working conditions in the manufacturing sectors in the developing countries is a general cause of concern in many developed countries. Therefore, awareness and implementation of fire safety are very important to make a better image for our garments industries. Taking proper fire safety measures can bring many foreign orders and also save a large number of workers' lives. The researcher believes that the findings of this study would help all stakeholders of Bangladesh garment industry in their decision making regarding the implementation of fire safety systems.

1.5 Limitations of the study:

While conducting the research, the researcher has tried his best to make the report as accurate and informative as possible. However, due to a number of limitations, it becomes impossible to make this report absolutely accurate. The researcher encountered difficulty while searching for the secondary data source regarding cost-benefit analysis on the RMG sector of Bangladesh as there is negligible research conducted before on this topic. Some research reports, articles, papers, etc. are available that discuss the present working conditions in the garment industries, their fire safety measures and ways to improve the present conditions. Most of them have tried to show the importance of taking fire safety measures from the prospect of having better working conditions and fulfilling the requirements of the foreign buyers. However, these are mainly qualitative analyses; there is merely any quantitative analysis, which can help the owners of garments to make a decision on the basis of profit and loss acquired from implementing a fire safety system in their factories. Due to the time constraint, the survey sample had to be small. Therefore, the survey was conducted on a sample of 10 factories situated in Chittagong Export Processing Zone and Karnaphuli Export Processing Zone. Data involve total factory values increase in revenue, amount of insurance premium paid or confidential information and the respondents were unwilling to reveal the accurate values. Therefore, approximate values have to be used. Again, the cost of injuries and death of employees is not included as it is very difficult to determine the value of one's life in numerical value.

1.6 Organizations of the Study:

These 10 ready-made garment industry are selected from Chittagong Export Processing Zone and Karnaphuli Export Processing Zone. From Chittagong Export Processing Zone we selected Pacific Jeans Limited, NHT Fashion, Universal Jeans and Jeans 2000 and from Karnaphuli Export Processing Zone Xin Chang Limited, Alamode Apparels Limited, F&F Fashion, Charm Fashion, Divine Design Limited and Nafisa Apparels Limited where Pacific Jeans Limited and Jeans 2000 are specially manufactured Jeans, Xin Chang Limited manufacture footwear, NHT Fashion, Alamode Apparels Limited, F&F Fashion, Charm Fashion, Divine Design Limited and Nafisa Apparels Limited manufacture T-Shirt, Polo Shirt, Trousers and Universal Jeans manufacture jeans along with T-Shirt, Polo Shirt, Trousers etc.

Chapter 2

LITERATURE REVIEW

The ready-made garment industry act as the backbone of our economy and as a catalyst for the development of our country. We take pride in the sector that has been fetching billions of dollars as export earnings and creating jobs for millions of people in the country. The sector accounts for 80 percent of total export earnings of the country [6]. Some 59 percent of Bangladesh exports are destined for the European market, while 26 percent is exported to the United States. Attracting a growing number of foreign buyers over the last years, Bangladesh becomes the second largest exporter of apparel, after China. Bangladesh's garment industry is characterized by fast production, relying on cheap labor and low production costs. Over three million workers, the majority of whom are young women, are employed in the Bangladesh garment industry and not only remain the lowest paid garment workers in the world, but also limited opportunity for workers to claim improved wages, health and safety from industry management [7, 8]. Many workplaces fail to adhere to the most basic standards of health and safety. In the past decade, Bangladesh's production share of the world's one of the cheapest clothing has skyrocketed. In 2015, Bangladesh exported nearly $31 billion of the goods, nearly twice what it did just six years earlier in 2009-2015 according to data from the BGMEA [3].

Along with other sectors, the position of RMG sector in Bangladesh economy is truly remarkable. It's seen that RMG sector continuously contributes to the national economy in considerable rate. Over 76% of the total export earnings come from RMG sector [1]. Figure 2.1 shows Bangladesh RMG exports in relation to total exports for the financial years 2000-01 to 2015-2016.

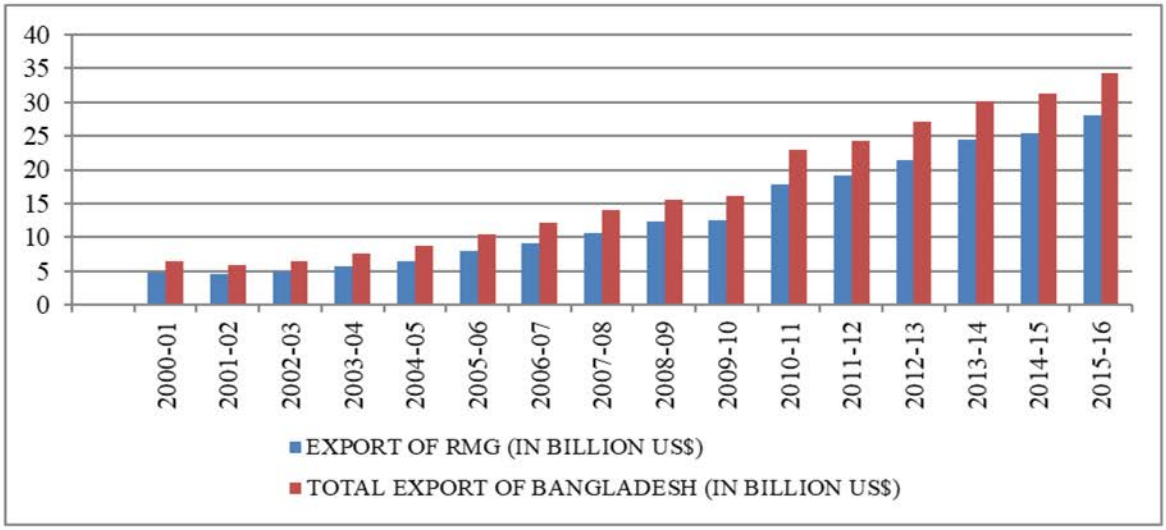

Figure 2.1: Export value and total export value of Bangladesh (Billion US$)

Despite the epic growth of our RMG industry, there still some challenges among them one of the biggest challenges is to ensure workplace safety and better working conditions for the millions of garment workers. Bangladesh has a long history of health and safety tragedies in the garment industry fires and collapses, killing at least 1800 workers since 2005 [9]. Two major accidents, the Tazreen fire and the Rana Plaza collapse, have brought the major issue of workplace safety to the fore and led all stakeholders to act accordingly [26]. Following the unfortunate incidents, various platforms such as the Alliance for Bangladesh Workers Safety and National Plan of Action and the Bangladesh Accord on Fire and Building Safety have been formed to improve building and fire safety of Bangladesh's garment industry. The corrective action plans suggested by Accord, Alliance and National Plan of Action after inspections, all members of the Bangladesh Garment Manufacturers and Exporters Association (BGMEA) and Bangladesh Knitwear Manufacturers and Exporters Association (BKMEA) are working all-out to carry out, even investing a huge amount of money [10].

Undertaking fire safety measure has become a matter of serious concern due to both social responsibility and foreign buyer requirements. Fire safety measures mainly consist of fire detection (FD) systems and fire protection (FP) systems. Fire detection systems work as an early warning of fire. Fire detection systems detect the fire and smoke and alert people, whereas fire protection systems help to suppress or control the fire. Both fire detection and fire protection systems are necessary to provide proper fire safety environment in a garment industry [11].

Automatic fire alarm systems are required in all garment factories. Fire detection systems include smoke detectors, heat detectors, pull stations, fire alarm, horn, strobe, control panel, etc. Smoke and heat detector detect any fire sensing smoke and heat, respectively.

Fire alarms can be initiated automatically by smoke detections or heat detectors or manually by pull stations. This alarm means to notify the occupants to evacuate the building for safety as well as security purpose. Here, the control panel is the hub of the system, monitors inputs and system, monitors inputs and systems integrity, controls output and relays information.

Fire protection may include fire hydrants, fire brigade connection, sprinkler based fire suppression system, fire extinguishers and so on. There are other fire safety measures such as providing proper fire exits, spacious corridors, fire doors and exit signs, etc., which are very important for any garment industry.

Many research reports, articles, papers, etc. are available that discuss the present working conditions in the garment industry, their fire safety measures and ways to improve the present conditions. Most of them have tried to show the importance of taking fire safety measures from the prospect of having better working conditions and fulfilling the requirements of the foreign buyers.

After Tazreen Fashions' fire incidents in Ashulia on the outskirts of Dhaka, where at least 117 people were confirmed dead and over 200 were injured, journalist Zafar Sobhan wrote, "It is this dehumanizing, soul-destroying, exploitative trade that has provided employment to over 3 million impoverished Bangladeshis', the vast majority of them women and utterly transformed the economic and social landscape of the country". In the 40 years since independence, the poverty rate has plummeted from 80 percent downs to less than 30 percent todays, GDP growth has averaged around 5 to 6 percent for over 20 years and the garment industry has had a lot to do with it" [12].

According to an article by Ahmed, the working conditions in a Bangladeshi garments' sector are poor and facing challenges in Social compliance, despite Bangladesh labor laws and the country's membership of the WTO and ILO [7]. According to BGMEA and ILO, these include an inadequate application of labor standards and labor rights, law and enforcement, collective bargaining activities, fair labor practices as well as the government of Bangladesh and entrepreneur's role in implementing the decent work in

the RMG sector [25]. It suggested that monitoring was needed to ensure compliance with these laws. Lastly, it suggested improved human resource management in RMG factories could ensure social compliance [7, 8].

Reported by United States Senate committee on foreign relations, Washington, DC (2013), international pressure is growing against the government of Bangladesh, apparel brands and factory owners in Bangladesh. Bangladesh's garment sector may not be able to withstand another tragedy on the scale of Tazreen and Rana Plaza. The surest way to guarantee the success of the apparel industry is to avoid another disaster by promoting and protecting labor rights now, while the world's attention is in Bangladesh. The present opportunity to improve working conditions in Bangladesh cannot be squandered [13].

According to a Transparency International Bangladesh research (2013), reasons identified for accidents and a lack of compliance in RMG sector include lack of coordination among the stakeholders, negligence in their duties, political influence, corruption and irregularities. The report suggests that government has to accelerate its efforts to establish Garments Village to relocate vulnerable factories and ensure timely implementation of initiatives that stakeholders have taken for sustainable development of the RMG sector [14].

Although fire safety issue in RMG sector still not totally solve because of the management practices such as weak structural elements, the absence of safety equipment's, lack of professional expertise etc. [15]. By avoiding the announcement bias through surprise visits to the factories, they found clear evidence that on-site fire safety situation is substantially different from the certified situations. It has been found strong evidence that the BGMEA member industry performed better than the non-members in the ten most important fire risk parameters, which are shown in Table 2.1.

Table 2.1: List of the major fire risk parameters

Rank	Parameters	Parameters description
1	Locked exit	Locked or unlocked condition of exit door
2	Chemicals	Existence of chemical material inside
3	Block furniture	Blockade of exit corridor by furniture/other material
4	Fire drill	Practice of fire drill
5	Extinguisher workability	Serviceability of fire extinguisher
6	Water in tank	Presence of adequate water in tank
7	Extinguisher operator	Performance of fire extinguisher operator
8	Exposed utility inside	Exposed electric or gas line inside factory floor
9	Bottleneck corridor	Formation of bottleneck between corridor and exit door
10	Announcement	Workability of announcement system

Although the evidence is less strong when all soft parameters are included in the report. This indicates BGMEA should be further proactive to improve its membership base and continue the good practice. However, it must also be noted that even the BGMEA members still have large improvements to make in their industry.

According to Md. Atiqul Islam, an article in the Daily Star, country director, ILO Bangladesh, support is needed from the highest levels of government to drive forward greater coordination between the regulatory bodies charged with oversight of safety in the RMG sector: the Department of Inspection for Factories and Establishments, the Fire Service and Rajuk [16].

According to Md. Atiqul Islam, "Safety is a game-changer" article published in Dhaka Tribune, the transformation that our apparel industry has undergone in the areas of workplace safety and workers' welfare issues in the last two years will certainly play a crucial role in changing the future course of the industry, turning it into a sustainable sector [17].

According to Bdnews24.com, the European Union Commissioner on labor issues has said Bangladesh has made "encouraging progress" on post-Rana Plaza factory safety and labor rights issues, but more needs to be done [18].

European Commission Press Release on Technical Progress Report, 2014 shows that, effective steps need to be taken to ensure new legislation by effective implementation and that monitoring mechanisms for ensuring sustainability. In addition, further amendments to the Bangladesh Labor Act (BLA) are necessary to ensure full compliance with core labor standards. It must become easier to establish a trade union and workers must be free to organize and exercise their right to collective bargaining. Various trade unions, anti-trade union faces discrimination, intimidation and harassment for denials to resister from the government of Bangladesh. Various local RMG industry should keep their commitments to improve labor rights at the industry level [18, 24].

The importance of fire safety system implementation for the growth of RMG sector of Bangladesh is no doubt very necessary. All the past research shows that in the last two years, considerable steps have been taken to ensure fire safety in factories but there is more space for improvement.

To collect primary data for this study, data gathered by sampling process, surveying several ready-made garment factories with a questionnaire on the basis of fire safety installation. Transparency International Bangladesh (TIB) and different non-governmental organizations surveyed various garment factories for collecting data by different questionnaire by different sampling methods.

Sampling is a process which is used for statistics for responsive data which is concerned with the predetermined number of observations from among a statistical population to estimate characteristics of the whole population in the survey. There are two types of sampling in statistics

1. Probability sampling method
2. Non-probability sampling method

Utilize some form of the random selection is known as probability sampling. In probability sampling, all segments such as people or households in the population have an opportunity of being attached in the sample where the mathematical probability selected one of them for calculation wherein non-probability sampling, population segments are

selected by the researcher's personal judgment that they are representative. Again probability sampling and non-probability sampling divided into different types which are shown in Table 2.2.

Table 2.2: Types of probability and non-probability sampling

Serial number	Probability sampling method	Non-probability sampling method
1	Simple random sampling	Convenience sampling
2	Stratified sampling	Consecutive sampling
3	Cluster sampling	Quota sampling
4	Systematic sampling	Snowball sampling
5	Mixed sampling	Judgmental sampling

Judgmental sampling is one form of convenience sampling, where subjects are hand-picked from the accessible population. This technique leaves much to be desired because of its inherent bias. Subjects usually are selected using judgmental sampling because the researcher believes that certain subjects are likely to benefit or be more compliant [19]. It does not produce any member of the population an equal chance of being selected as part of the sample. One disadvantage of using this sampling technique is the possibility of biasing. A bias is the greater probability of certain type/class of sample units/ elements to be included in the selected sample [20]. In addition to that, Cooper and Schindler state that non- probability sampling is arbitrary (non-random) and is generally subjective [21]. Data gatherer choose sample cases, “as they wish” or “whatever they find them”. Gill and Johnson [22] do not provide a direct definition of non-probability sampling, but they state that when a sampling frame is unavailable, or where research is exploratory, researchers may decide to strategically select a sample based on his judgment about the population of interest, with a specific purpose in mind. However, because it is judgmental and purposive, it is essential that the researcher provides a clear rationale for his selection in the light of research objectives and questions. Mercado [23] describes non-probability sampling as choosing the respondents by researcher choice. Here the findings apply only to the different sample. Small parts in the whole group are deliberately not included in the selection of the representative sub-group. This is also called non- probability sampling or judgment sampling because it makes use of judgment in the selection of items to be put

into the sub-group. Non- random sampling includes purposive or deliberate sampling, quota sampling and convenience sampling.

Different authors reported non-random sampling as an unequal chance is offered to every member of a population to represent an entire population. It also the selection criterion depends on the researcher's choice himself. In this study, the researcher used a questionnaire to collect data for applying judgmental sampling method which might appropriate for this research.

As for the owners, benefit with respect to the cost of implementing the fire safety system is a very crucial decision factor. However, there is almost no document or research paper which shows the cost-benefit analysis of implementing a fire safety system in the context of the RMG sector of Bangladesh. The current research had tried to conduct a cost-benefit analysis in this thesis paper which would depict the financial loss or gain and help factory owners to make a decision about implementation of fire safety system.

This literature review indicates that in Bangladesh, most of the garment factories pay little attention to the safe working environment and labour standards which led the labour unrest in the RMG sector. Consequently, now in RMG sector placing import orders most of the international buyers demand compliance with their own codes of conduct. Therefore, an effective initiative has been taken by the researcher on this research can provide a clear idea taking the decision by the RMG sector management about this present condition. At the same time, significant reform of the relevant garment agencies to perform their duties and responsibilities is a prerequisite to monitor social compliance.

Chapter 3

RESEARCH METHODOLOGY

3.1 Research Design

This is an exploratory research where data have been collected from a relatively small group of respondents through a semi-structured interview. Here the research findings are not determined by quantitative analysis. Generally, qualitative research methods are used primarily as a prelude to quantitative research. It is inexpensive, fast and small number of respondents involved. Due to the small group involved, these exploratory research methods cannot be used to generalize to the entire population but it is very valuable for exploring an issue at the initial stage. The analysis is mainly based on primary data collected from the respondents and secondary data are only used to understand the allied issues.

3.2 Sources of primary data

The primary data ware obtained by conducting survey interviews (Face to Face) over the selected RMG factory owners or top management of garment industries in selective areas of Bangladesh. For collection of data, the researcher has prepared a Structured Questionnaire which is included in Appendix 1. The survey has been conducted on a sample of 10 garment industries having fire safety systems. The selective factories have taken on a judgmental basis. The questionnaire contains several questions and the questions are of various types. Some questions are of a dichotomous type, some are multiple choices and the rest composed of both open-ended and ranges based questions. All the questions are designed in such a way to the relevant information with the survey can be collected from owners or managers of garments of Bangladesh.

3.3 Sources of Secondary Data

Relevant information was collected from scholarly journals, research papers, articles of different newspapers. These are collected primarily from websites on the World Wide Web. Search engines such as Google and Yahoo were also used to search for relevant information.

3.4 Sample Design

These 10 ready-made garment industry are selected from Chittagong Export Processing Zone and Karnaphuli Export Processing Zone. From Chittagong Export Processing Zone we selected Pacific Jeans Limited, NHT Fashion, Universal Jeans and Jeans 2000 and from Karnaphuli Export Processing Zone Xin Chang Limited, Alamode Apparels Limited, F&F Fashion, Charm Fashion, Divine Design Limited and Nafisa Apparels Limited. The judgmental sampling method is used for this study.

Target Population: Garments factories of Bangladesh.

Sample Size: 10 garment factories having fire safety systems.

Sampling Methods: Judgmental sampling.

Chapter four analysis the collected data and discuss the findings.

Chapter 4

ANALYSIS AND FINDINGS

In this report, the researcher has mostly worked with the primary data to conduct the cost-benefit analysis of implementing fire safety systems in the garment industries in Chittagong, Bangladesh. Secondary data are used to support the analysis of primary data and help to understand the current situations of garment industries, problems, prospects etc.

4.1 Overview of the sampled garments factories

First, an overview of the sampled garments industries is given in Table 4.1 by providing information such as the name of the firm, address, total factory area, number of employees, type of products produced and type of existing fire safety systems and year of installation of the safety system in tabular form. After providing the general information about the sampled industries, Table 4.2 is added to show the value of different factors (total factory value, total installation cost of fire safety system, annual maintenance, replacement, servicing cost of installed fire safety systems, cost due to taking fire safety measure and annual increase in sales, etc.) contributing directly to the total cost as well as total benefit associated with taking fire safety measures.

Table 4.1: General information of the sampled factories

Serial number	Name of the factories	Address	Total factory area (sq. feet)	Number of employees (approximate)	Products types	Types of existing fire safety systems	Years of installation of the fire safety system
01	Pacific Jeans Limited	Chittagong EPZ	145789.3	11,000	Jeans	Both FD and FP Systems	2008
02	NHT Fashion	Chittagong EPZ	66951.52	8,000	T-Shirt, Polo Shirt, Trousers	Both FD and FP Systems	2015
03	Universal Jeans	Chittagong EPZ	83086.62	11,000	Jeans, T-Shirt, Polo Shirt, Trousers	Both FD and FP Systems	2014
04	Jeans 2000	Chittagong EPZ	43055.64	4,000	Jeans	Both FD and FP Systems	2015
05	Xin Chang Limited	Karnaphuli EPZ	32,000	4,000	Footwear	Both FD and FP Systems	2009
06	Alamode Apparels Limited	BSCICI/A, Kalurghat, Chittagong	22,000	800	T-Shirt, Polo Shirt, Trousers	Both FD and FP Systems	2009
07	F&F Fashion	Kadamtalli, D.T. Road, Chittagong	2,080	100	T-Shirt, Polo Shirt, Printing	Both FD and FP Systems	2005
08	Charm Fashion	Nandirhat, Hathajari, Chittagong	15,000	800	T-Shirt, Polo Shirt, Printing	Both FD and FP Systems	2014
09	Divine Design Limited	Kalurghat, Chittagong	20,000	1,100	T-Shirt, Polo Shirt, Printing	Both FD and FP Systems	2010
10	Nafisa Apparels Limited	Kalurghat, Chittagong	22,000	1,600	T-Shirt, Polo Shirt, Printing	Both FD and FP Systems	2011

Table 4.2: Information related to the cost and benefits of having fire safety systems of the sampled factories (all are approximate values and given in BDT)

Serial number	Name of the factories	Total factory value including equipment's, raw materials & finished goods (Billion Taka)	Installation cost of fire safety systems (Million Taka)	Annual maintenance, replacement, servicing cost of installed fire safety systems	Cost due to accident after installation of fire safety systems
01	Pacific Jeans Limited	3.80	400	950000	500000
02	NHT Fashion	2.30	25	400000	-
03	Universal Jeans	2.00	15	250000	-
04	Jeans 2000	1.50	10	200000	-
05	Xin Chang Limited	1.00	8.0	200000	-
06	Alamode Apparels Limited	0.70	10	240000	-
07	F&F Fashion	0.10	1.0	10000	-
08	Charm Fashion	0.25	1.5	350000	-
09	Divine Design Limited	2.70	6.0	130000	-
10	Nafisa Apparels Limited	1.50	0.6	100000	-

4.2 Types of fire safety systems and their implementation

Figure 4.1 given below shows the percentages of sample garment industries having fire detection (FD) system, fire protection (FP) system and both FP and FD Systems. From the collected data the researcher found that among the 10 sampled garments industries, all of them have both FP and FD systems. Fire detection system and fire protection system used as fire safety measures. FP systems help to suppress or control the fire. FD systems include smoke detectors, heat detectors, fire alarms, horn, strobe, control panel, etc., where FP systems include fire hydrant, sprinkler based fire suppression system, fire

extinguisher, fire bridge connection and so on. Both FD and FP systems are necessary to provide proper fire safety environment.

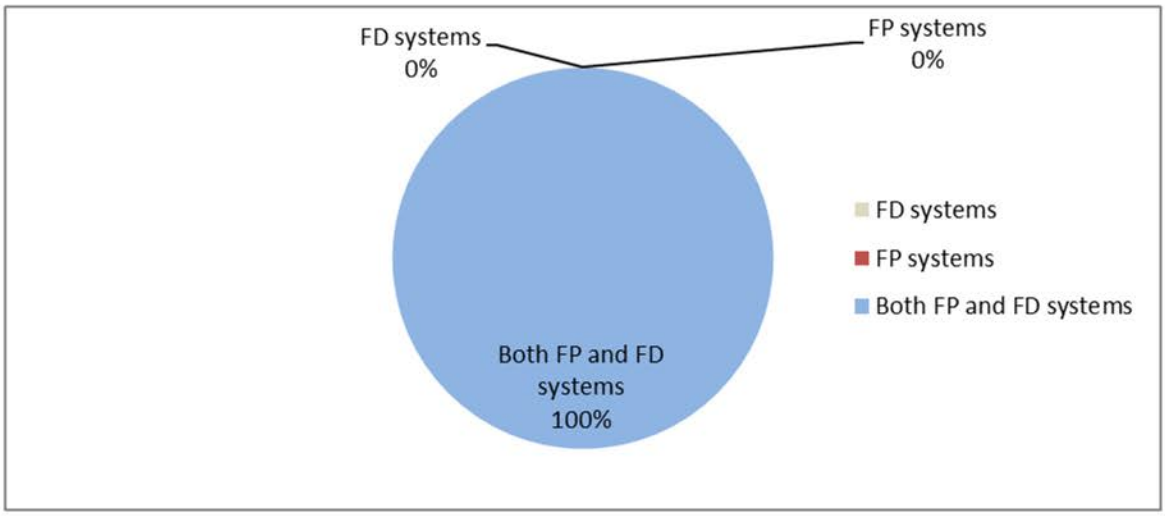

Figure 4.1: Types of fire safety system in the sampled factories

Implementing only FD system or FP system is not a wise decision. FD system will make people aware of the fire and help early evacuation, but cannot help to control the fire. To control and suppress the fire, factories require FP systems as well.

4.3 Purpose of implemented fire system in factory

Generally, there are four types of purposes available for the implementation of fire safety systems, such as safeguarding lives and properties, corporate responsibility, statutory obligation and peer group pressure. Normally safeguard are provide garment workers and properties, where corporate responsibilities are only to maintain buyer requirements, statutory obligations are those obligations that do not arise out of a contract, but are imposed by law and Peer pressure (or social pressure) is the direct impact on people by peers which is different from general social pressure. Peer pressure means the effect on an individual who gets encouraged to follow their peers by changing their behaviors to conform to those of the influencing group. Peer pressure can change an individual to respond to a feeling of being influenced by a peer or peer group. Social groups affected membership groups to trade unions. However, a person may be to be a member or be seeking membership of a group to be affected by peer pressure.

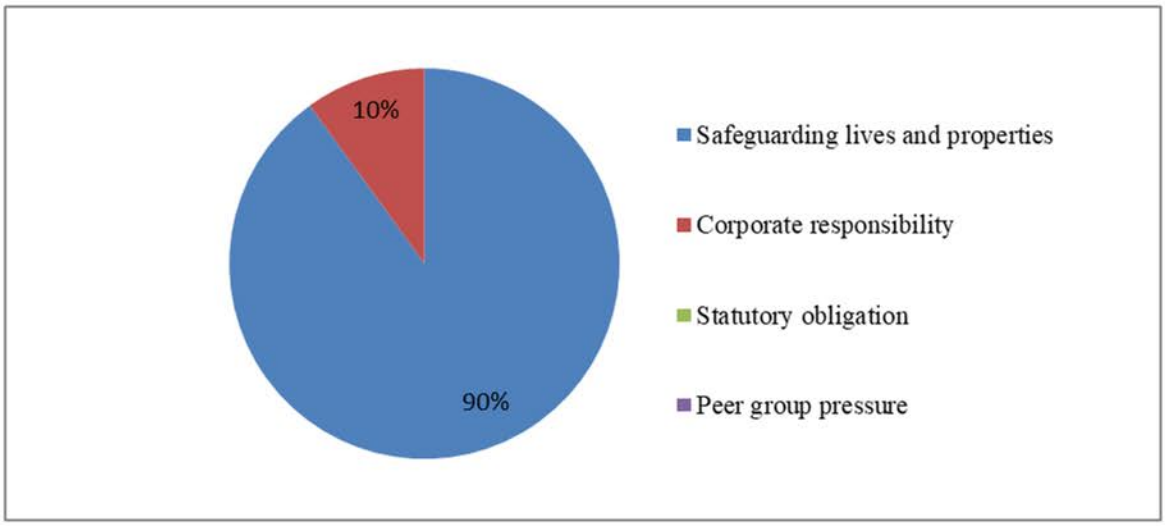

Figure 4.2: Purpose of implemented fire system in factory

Figure 4.2 shows the purpose of implemented fire safety system in industries. From the collected data the researcher found that among 10 sampled garment industries, ninety percent of them have implement fire protection system for safeguarding lives and properties while the rest one installs it only for corporate responsibilities.

4.4 Fire safety systems and fire accidents

Figure 4.3 shows any percentages of fire accidents after installation of the fire safety systems. Taking fire safety measures cannot stop fire accident, but can definitely reduce the risk and loss due to the fire accident. Among the 10 sampled garment industries, only one undergoes fire accident. Some other sampled factories also face fire accident which was not major enough to cause any considerable loss and were controlled successfully by the existing fire safety systems.

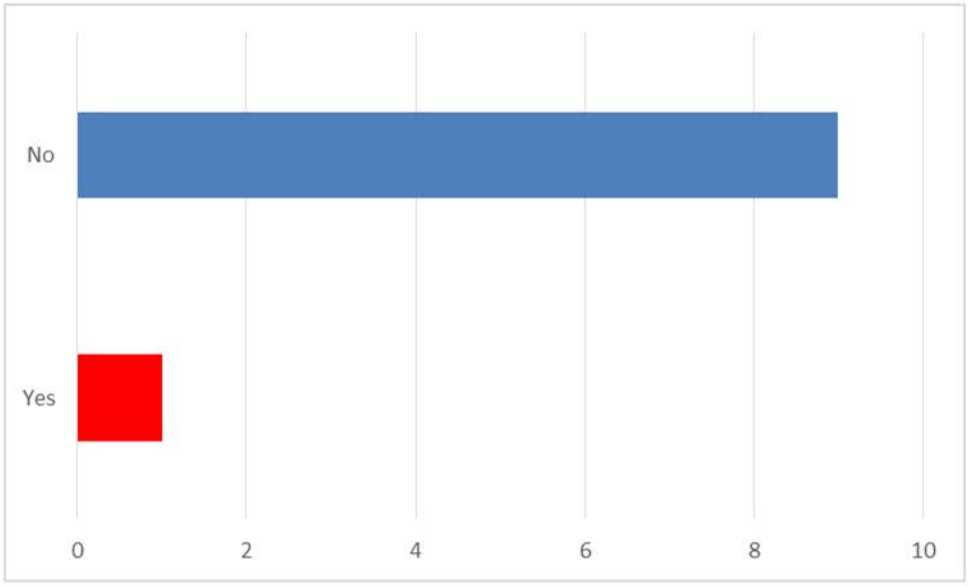

Figure 4.3: Percentages of fire accidents after installation of the fire safety systems

Figure 4.4 shows whether the fire safety systems helped during fire accidents or not. While asking 10% of the respondents or factory owners said that the existing fire safety measures had somewhat helped them to fight fire accidents successfully. 20% of the respondents believe that fire safety system was very helpful and 70% say it was extremely helpful in case of fire accidents in controlling the fire successfully.

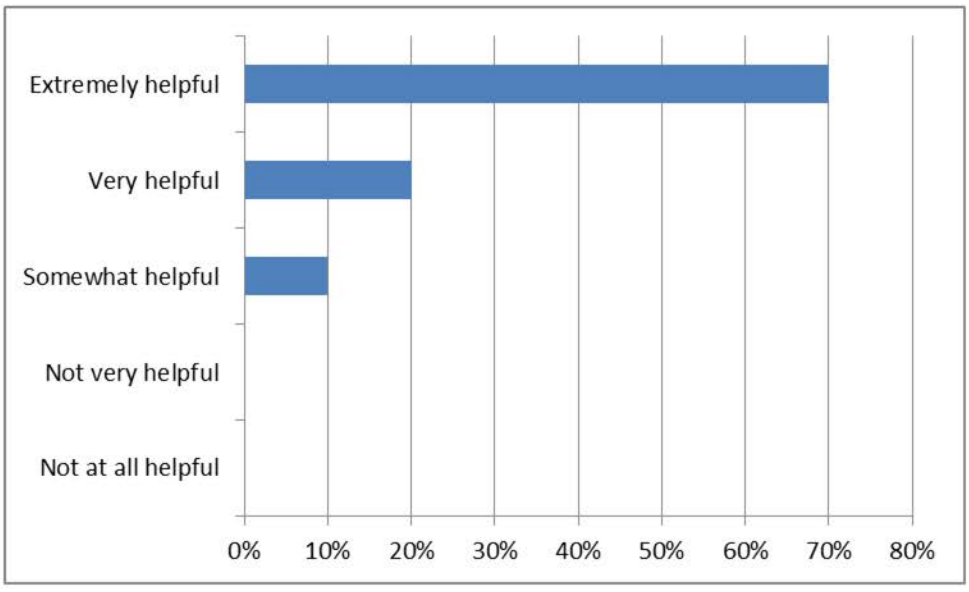

Figure 4.4: Utilization of fire safety systems helped during fire accidents

4.5 Level of productivity and confidence with the existing fire safety systems

The Level of productivity of the higher authority and confidence of workers are the purposes of any business where worker safety issues are the major concern in today's work environment.

Figure 4.5 shows the level of confidence with the existing fire safety systems. From the collected data the researcher found that among the 10 sampled garment industries, all of them are extremely satisfied with their productivity and confidence level and all of them have a practical training program in every month in their factory and try to minimize escape from.

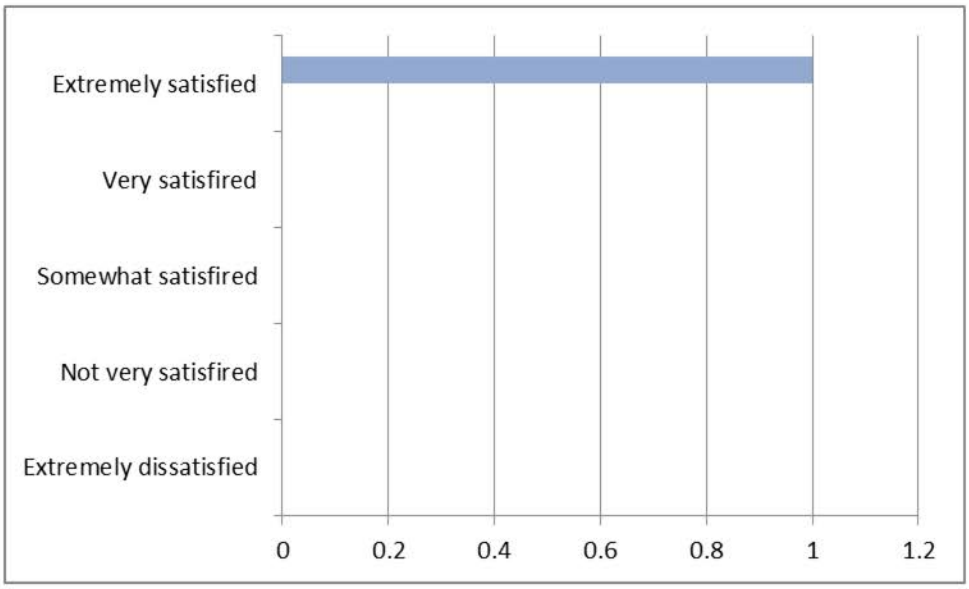

Figure 4.5: Level of productivity and confidence

4.6 Fire safety systems and increase of sales

Revenue generation is the main purpose of any business. Again, worker safety issues are a serious concern for the large markets such as USA (27.28% of exports) and Europe (61.28% of exports), the main two markets in Bangladesh. Figure 4.6 shows the increase in sales after installing fire safety systems. From the collected data the researcher found that among the 10 sampled garment industries, 70% of respondents believe that sales are extremely high increment after installing fire safety system and 20% of respondents believes that the increase in sales is very high rate were 10% factory owner claim that their sales have somewhat increased after taking fire safety system.

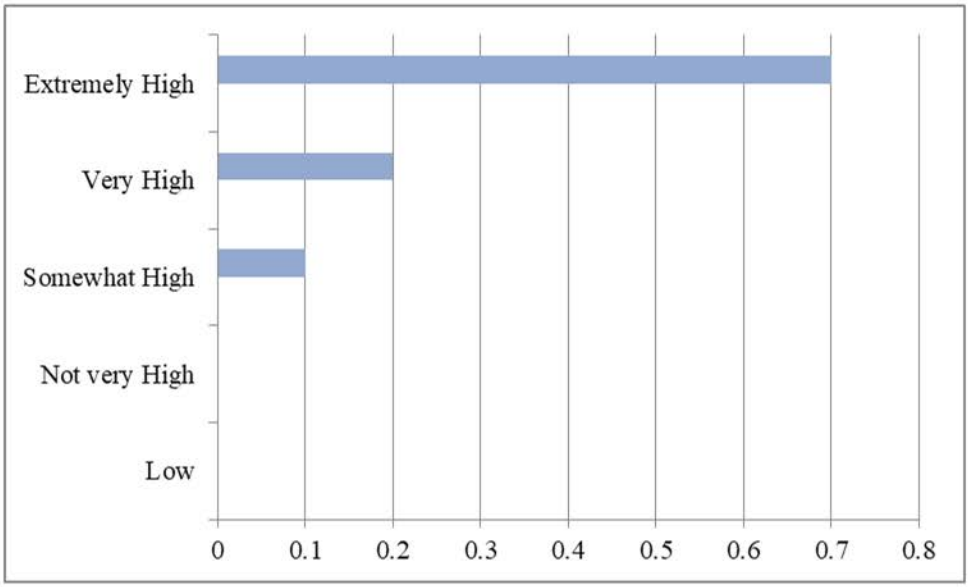

Figure 4.6: Increase in sales after installation of the fire safety systems

4.7 Level of satisfaction with the existing fire safety systems:

Level of satisfaction with the existing fire safety systems are presented in Figure 4.7. While asking 60% of the respondents said that they were somewhat satisfied with the installed fire safety systems and 40% find the implemented systems are very satisfactory. Satisfaction with any installation is a very important consideration which increased the level of confidence and increased the productivity.

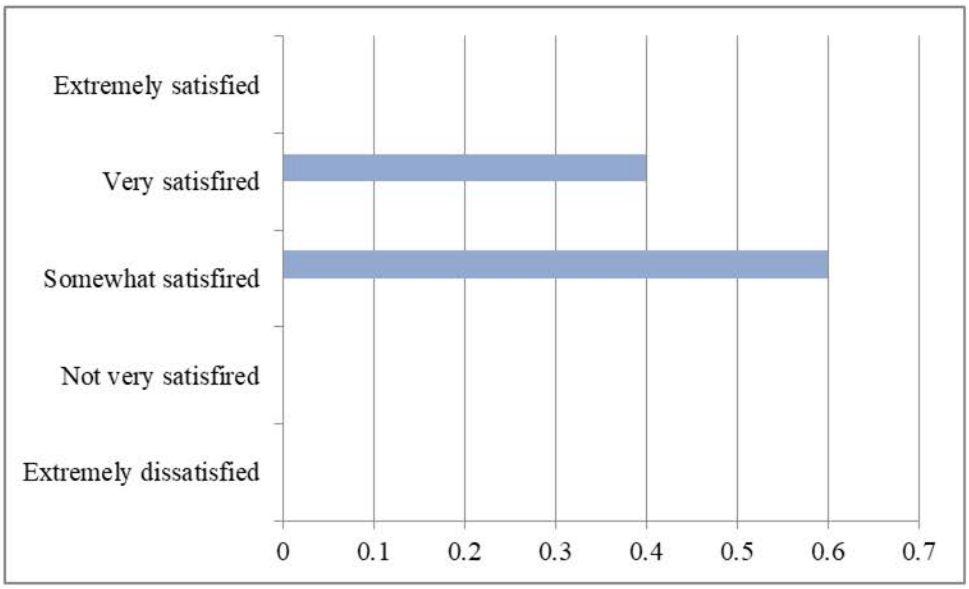

Figure 4.7: Level of satisfaction with the installed fire safety system

4.8 Basement and Construction Characteristics and Air Emissions

From the collected data the researcher found that among the 10 sampled garment industries, all of them are built with concrete and brick which are not up to the mark according to their design specification. Some machineries are extremely vibrating, therefore, for proper stability and safety, the basement should be made up of stone not the regular brick chips. According to the ACCORD report, 20% of the industry building are built with proper safety design [23].

The other issue found that among the 10 sampled garment industries, most of them use only windows as an air emission system and a very few of them use other air purification system rather only using windows.

4.9 Waste Management in RMG Sector

From the collected data the researcher found that among the 10 sampled garment industries, none of them is aware of any kind of wastage. Everybody dumps their liquid waste into a nearby river or canal. Most of the solid wastes are sold in local markets and some of the solid wastes are incinerated by Pacific Jeans Limited.

4.10 Boiler safety in RMG Sector

Boilers safety conditions in RMG sector are shown in Table 4.3 where the type of fuel, number and size of the boiler, type and number of fire extinguishers are presented. Class A for trash, wood and paper, Class B for liquids and gases, and Class C for energized electrical sources (ABC) and Carbon dioxide (CO_2) are common fire extinguishers all of the industries. Most of the factories use ABC and CO_2 fire extinguisher along with water and sand. Again Diesel boiler is common in RMG industries while nowadays compressed natural gas (CNG) are available in industries. In ten sampled RMG factories eight of them have diesel boiler where four of them install CNG boiler along with them, they are Pacific Jeans Limited, NHT Fashion, Universal Jeans and Jeans 2000. Again Pacific Jeans Limited, NHT Fashion, Universal Jeans has the highest number of the boiler where NHT Fashion has the largest boiler size which totally was twenty-four tons. Universal Jeans has total twenty-one tons and Pacific Jeans Limited have total eighteen tons boiler. Jeans 2000 have three boilers which size is totally thirteen tons. Divine Design Limited and Nafisa Apparels Limited have two boilers which were totally ten and eight tons respectively. Xin Chang Limited and Alamode Apparels Limited has one boiler each and

both sizes was eight tons. The highest number of fire extinguishers present in the boiler room in Pacific Jeans Limited and NHT Fashion. Universal Jeans has eight fire extinguishers in their boiler room and Xin Chang Limited has seven fire extinguishers in their boiler room. Jeans 2000, Alamode Apparels Limited, Divine Design Limited and Nafisa Apparels Limited have five fire extinguishers in their boiler room.

Table 4.3: Boiler information of the sampled factories

Serial number	Name of the factories	Boiler present	Type of fire extinguisher	Number of Boilers	Total boiler Size (Tons)	Fuel type	Number of fire extinguisher in boiler room
01	Pacific Jeans Limited	Yes	ABC, CO_2	4	18	Diesel, CNG	10
02	NHT Fashion	Yes	ABC, CO_2	4	24	Diesel, CNG	10
03	Universal Jeans	Yes	ABC, CO_2	4	21	Diesel, CNG	8
04	Jeans 2000	Yes	ABC, CO_2	3	13	Diesel, CNG	5
05	Xin Chang Limited	Yes	ABC, CO_2	1	8	Diesel	7
06	Alamode Apparels Limited	Yes	ABC, CO_2	1	8	Diesel	5
07	F&F Fashion	No	-	-	-	-	-
08	Charm Fashion	No	-	-	-	-	-
09	Divine Design Limited	Yes	ABC, CO_2	2	10	Diesel	5
10	Nafisa Apparels Limited	Yes	ABC, CO_2	2	8	Diesel	5

In the above subsections, the primary data to conduct the cost-benefit analysis of implementing fire safety systems in the garment industries has been presented. These data are collected through a survey questionnaire which was conducted by the researcher. These primary data are correlated with the secondary data to draw the final analysis which is described in the upcoming chapter.

Chapter 5

COST BENEFIT ANALYSIS

In this thesis, the cost-benefit analysis of existing fire safety systems of the sampled garment industries is conducted to analyze the cost-effectiveness of fire safety systems. The researcher has taken the approximate values for determining the total cost and benefit as most of the respondents disagree or are unable to provide confidential information such as property values, increases in revenue and so on.

5.1 Determination of total annual cost on fire safety system

Total annual cost of fire safety systems is determined using the following equation 5.1;

$$C = C_1 + C_2 + C_3 \text{ - - - - - - - - - - - - - - - - - - - } Eq.(5.1)$$

Where,

C is total annual cost of fire safety system,
C_1 is installation cost of fire safety systems,
C_2 is annual maintenances, servicing and replacement cost,
C_3 is an annual cost due to fire accidents after installation of fire safety systems.

Table 5.1 shows the installation cost of the fire safety systems, annual maintenance, servicing and replacement cost, annual cost due to fire accident after installation of fire safety system from where we can evaluate total annual cost on fire safety systems of the ten sampled RMG factories. The highest installation cost of the Pacific Jeans Limited which was 40 million BDT and the lowest was Nafisa Apparels Limited which was 0.60 million BDT. Again Pacific Jeans Limited has high annual maintenance, servicing & replacement cost which was 0.95 million BDT and lowest was F&F Fashion which is 0.01 million BDT. After, install fire protection system Pacific Jeans Limited faces one fire accident which cost them 0.50 million BDT. After, putting all data in equation 5.1 we can calculate total annual cost on fire safety systems. The highest expenses were Pacific Jeans Limited which was 41.45 million BDT and lowest was Nafisa Apparels Limited which was 0.70 million BDT.

Table 5.1: Total annual cost on fire safety systems of the sampled factories

Serial number	Name of the factories	Installation cost of fire safety systems (C_1) (Million BDT)	Annual maintenance, servicing & replacement cost (C_2) (Million BDT)	Annual cost due to fire accident after installation of fire safety system (C_3) (Million BDT)	Total annual cost of fire safety systems (C) (Million BDT)
01	Pacific Jeans Limited	40.00	0.95	0.50	41.45
02	NHT Fashion	25.00	0.40	0	25.40
03	Universal Jeans	15.00	0.25	0	15.25
04	Jeans 2000	10.00	0.20	0	10.20
05	Xin Chang Limited	8.00	0.20	0	8.20
06	Alamode Apparels Limited	10.00	0.24	0	10.24
07	F&F Fashion	1.00	0.01	0	1.01
08	Charm Fashion	1.50	0.35	0	1.85
09	Divine Design Limited	6.00	0.13	0	6.13
10	Nafisa Apparels Limited	0.60	0.10	0	0.70

5.2 Determination of annual concession in insurance cost

If an RMG company installs FD system or both FD and FP systems in their factories, they are entitled to get a 5% discount for BGMEA membership, 1% discount for installing only FD systems or 5% discount for installing both FP and FD systems.

$$Co = 10\% \times I_1 \quad ---------- \quad Eq.(5.2)$$

Where,

Co is Concession due to taking fire safety measures and I_1 is installation cost of the fire safety systems.

Table 5.2 shows the concessions obtained due to taking fire safety measures from BGMEA for their membership. Due to high installation cost, Pacific Jeans Limited has the high concession for BGMEA membership and F&F Fashion has the lowest concession for BGMEA membership. We can calculate concession using equation 5.2 and the highest concession was 4.00 million BDT and the lowest concession was 0.10 million BDT.

Table 5.2: Concessions obtained due to taking fire safety measures of the sampled factories

Serial Number	Name of the factories	Installation cost of the fire safety systems (I_1) (Million BDT)	Concession due to taking fire safety measures (Co) (Million BDT)
01	Pacific Jeans Limited	40.00	4.00
02	NHT Fashion	25.00	2.50
03	Universal Jeans	15.00	1.50
04	Jeans 2000	10.00	1.00
05	Xin Chang Limited	8.00	0.80
06	Alamode Apparels Limited	10.00	1.00
07	F&F Fashion	1.00	0.10
08	Charm Fashion	1.50	0.15
09	Divine Design Limited	6.00	0.60
10	Nafisa Apparels Limited	0.60	0.06

5.3 Determination of annual safeguard of property:

In most of the factories the total annual safeguard of property associated with fire safety systems is determined using Equation 5.3;

$$S = V_1 \times P_2 \times P_3 - - - - - - - - - - - - - - - - - - Eq.(5.3)$$

Where,

S is total annual safeguard of property,
V_1 is total value of fire accidents in a garments factory annually,
P_2 is percentage change in fire accidents factory annually,
P_3 is a percentage of damages due to each fire accident.

As discussed in Appendix 1 according to Bangladesh Fire Service and Civil Defense, total 48 fire accidents occur in RMG factories from January to October 2013 and a total number of RMG factories in 2013 was 5876. Using these data, percentage change of accidents in an RMG factory annually 0.00987 [15]. Again, for determining the chances of loss due to fire accident the researcher considered the result of a report on "Assessment of Fire Risk in the RMG industry in Dhaka, Bangladesh" by Wadud where Fire Risk Index (FRI), for 60 random garment factories through surprise inspections to understand the current status of fire risk due to inadequacies [15]. Results show that the mean FRI is 2.8 on the scale of 5.0, which means 56% of the risk. Percent of damages due to each fire accident (P_2) is 0.56.

Putting values in equation 5.3, we found

$$S = V_1 \times 0.00987 \times 0.56 - - - - - - - - - - - - - - - - - - Eq.(5.4)$$

Table 5.3 shows the total annual safeguard of property which we have calculated using equation 5.4. The highest value was found for Pacific Jeans Limited, which is 0.199 million BDT and the lowest was for Nafisa Apparels Limited, which is 0.003 million BDT.

If a fire accident occurs in a garment factory, the complete facilities can be destroyed but in equation 5.3 calculating annual cost due to fire accident after installation of fire safety system are only considered the value of garments factory after excluded the value of concession.

Table 5.3: Annual safeguard of property of the sample factories

Serial number	Name of the factories	The total value of the property after concession (V_1) Million BDT	Percentage change of fire accident in a garments factory annually (P_1)	Percent of damages due to each fire accident (P_2)	Annual safeguard of property (S) Million BDT
01	Pacific Jeans Limited	36.00	0.00987	0.56	0.199
02	NHT Fashion	22.50	0.00987	0.56	0.124
03	Universal Jeans	13.5	0.00987	0.56	0.075
04	Jeans 2000	9.00	0.00987	0.56	0.050
05	Xin Chang Limited	7.20	0.00987	0.56	0.040
06	Alamode Apparels Limited	9.00	0.00987	0.56	0.050
07	F&F Fashion	0.90	0.00987	0.56	0.005
08	Charm Fashion	1.35	0.00987	0.56	0.007
09	Divine Design Limited	5.40	0.00987	0.56	0.030
10	Nafisa Apparels Limited	0.54	0.00987	0.56	0.003

5.4 Annual increase in sales

Table 5.4 shows an annual increase in sales from the questionnaire where Alamode Apparels Limited claims 40% increase due installing fire safety system where F & F Fashion claims only 10%. This value is only an assumption by the management. The garment factories are willing to share any legal proof about this information during this study. But it is clear that installing fire safety system always increase the sales.

Table 5.4: Annual increase in sales of property of the sample factories

Serial number	Name of the factories	Annual increase in sales from Questionnaire (%)
01	Pacific Jeans Limited	20
02	NHT Fashion	22
03	Universal Jeans	21
04	Jeans 2000	20
05	Xin Chang Limited	15
06	Alamode Apparels Limited	40
07	F&F Fashion	10
08	Charm Fashion	30
09	Divine Design Limited	25
10	Nafisa Apparels Limited	25

In this cost-benefit analysis, the researcher found that for all the sampled factories the benefit of implementing fire safety systems is very high with respect to the cost associated and thus it can provide a higher annual gain. Again the performed cost-benefit ratio shows that the total cost of having fire safety systems is negligible when compared to the total benefit achieved. We can understand that can factories which have only implemented FD systems the gain can be very high as the cost is lower due to avoiding FP systems. However, only installing fire detection system is not a wise decision as the risk of loss due to fire accident becomes high.

Moreover, if here the benefit achieved from savings of potential workers' lives and injuries would have been considered then the amount of total benefit would be even higher. Therefore, implementing a fire safety system is very cost-effective. Garment industries owners must take proper fire safety measures in their factories, which are beneficial in so many aspects and also very cost-effective.

Chapter – 6

CONCLUSIONS AND FUTURE WORK

6.1 Conclusions

The Ready-Made Garments (RMG) industry occupies a major position in the Bangladesh economy. It is the largest export earning industry in Bangladesh, which experienced phenomenal growth during the last 30 years with an alarming challenge, namely, safety, especially fire safety. But the unfortunate history of Bangladesh's RMG factories disaster has enough evidence that fire safety system should be installed for avoiding these kinds of abnormal phenomena. Recently, factory management is concerned and taking initiative about installing fire safety system to save their asset like infrastructure, raw material as well as workers safety issue.

Fire safety system is not only saving assets but also minimize cost and increase sales. Installing fire safety system factories can safeguarding their property by some insurance policy which makes them comfortable. Today RMG factories are more concern about maintaining fire safety management to get proper accreditation certificate from ACCORD, Alliance as well as the government safety regulation board. Thus they can bring more foreign buyers for investing Bangladesh's RMG sectors which earn more foreign currency and enhancing our economic growth.

To remain successful, Bangladesh needs to remove all the structural obstacles in the factories, power supply, management of seaport, utility services and in the law and order situation. The government and the RMG sector would have to jointly work together to continue competitiveness in the global RMG market. Given the remarkable entrepreneurial initiatives and the dedication of its workforce, Bangladesh can look forward to advancing its share of the global RMG market and RMG factory owners should be joining this novel approach to workplace safety.

6.2 Future work

Bangladesh is an export-oriented country which mostly depends on RMG sectors. Exporting a large number of products too almost all over the world RMG sectors can play a vital role in our economic growth. However, Bangladesh needs to be careful about its ready-made garment exports because it has many competitors around the world. The country has been managing to get the orders from different countries by improving its working condition.

This research proves that fire safety system can be safeguarding the assets as well as increase the level of confidence and productivity in the garment factories. But this research cover a little portion of safety in this sector were considered only one factor among verities factor. The other safety factors like building infrastructure design safety, electrical equipment safety, personal safety and security etc. can be considered in future research which is as important as this research factor. Again, this research only focuses on 10 sampled garments in Chittagong zone especially Chittagong export processing zone and Karnaphuli export processing zone but remaining 4318 factories in another six export processing zone around Bangladesh should be considered in our account for further research. So there is a good scope for researching other factories considering all the safety factors briefly where we can show either those factor effects or not.

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Appendix: 1

Determination of annual safeguard of property:

$$S = V_1 \times P_2 \times P_3 - (A_1)$$

Where,

S is total annual safeguard of property,
V_1 is total value of fire accidents in a garments factory annually,
P_2 is percentage change in fire accidents factory annually,
P_3 is a percentage of damages due to each fire accident.

From Bangladesh Fire Service and Civil Defense website, total 48 fire accidents occur in garment factories from January to October 2013 and a total number of garments factories in 2013 was 5876 (Source: BGMEA web portal).

Using these above data, the percentage change of accidents in a garments factory annually 0.00987.

Again, for determining the chances of loss due to fire accident the researcher has considered the result of a report on "Assessment of Fire Risk in the readymade Garment industry in Dhaka, Bangladesh" by Wadud, Z., Huda, F., & Ahmed, N. (2013). This paper has developed a Fire Risk Index (FRI), for 60 random garment factories through surprise inspections to understand the current status of fire risk due to inadequacies. Results show that the mean FRI is 2.8 on the scale of 5.0, which means 56% of the risk.

Appendix 2

	Bangladesh University of Engineering and Technology
	M. Sc. In Advanced Engineering Management (AEM)
	Department of Industrial and Production Engineering (IPE)
	Survey for cost benefit analysis of the fire safety system, A preliminary study on RMG factories of Bangladesh

01. Factory Characteristics	
Name of the factory:	
Address:	
Total Factory Area: sq. feet	
Type of building:	
Number of Floors:	
Area per Floor: sq. feet	
Number of Occupants/persons at this location:	
Types of product manufacture:	
Building age:	Year

02. Basement and Construction Characteristics			
Above grade construction:			
Wood Frame	Concrete	Stone	Brick
Basement floor:			
Concrete	Dirt	Stone	Other_____

03. Occupancy			
Is basement/lowest level occupied?			
Full-time	Occasionally	Seldom	Almost Never
Level General Use of Each Floor Basement _____ 1st Floor _____ 2nd Floor _____ 3rd Floor _____ If more _____			

04. Air Emissions (Venting And Air Conditioning)			
Air conditioning:			
Central Air	Windows Units	Open Windows	None
Air conditioning system:			
Air	Water	Nitrogen	Mixed_____
Are there air distribution ducts present?			Yes/No
Is the building insulated?			Yes/No
How air tight?			
Tight	Average	Not Tight	

05. Waste Management	
Amount of waste	
Do you produce or handle any of the following?	Yes/No
Solid waste	Yes/No

06. Fire Safety Installations		
Fire safety system present		Yes/No
If Yes then what kind of the fire safety system do you have		
Fire Detection System	Fire Protection System	Both Fire Detection and Protection System
Installation year		
Equipment which generates heat or utilizes energy have guards		Yes/No
Escape route size		
Number of Exits		
Smoke Alarms		Yes/No
Emergency Lighting		Yes/No
Exit Signage		Yes/No
Fire Extinguishers		Yes/No
Fire Hose Reels		Yes/No
Check all fire safety equipment on a regular basis to be sure it is in proper working condition.		Yes/No
Fire safety training for plant higher authority (Officers)		Yes/No

Fire safety training for plant lower authority (workers)	Yes/No
If yes, how much workers productivity and confidence has been increased according to you? Extremely helpful Very helpful Somewhat helpful Not very helpful Not at all helpful	
Fire insurance	Yes/No
Do you concern in insurance premium due to implementation of fire safety system?	Yes/No
How much concession do you get…….percent/taka	
Purpose of implemented fire system in factory	

Safeguarding lives and properties	Corporate responsibility	Statutory obligation	Peer group pressure

Fire accident after fire safety installation:	

07. Boiler safety	
Boiler present?	Yes/No
Type of fire extinguisher	
Fire extinguisher (Boiler room)	Yes/No
If yes how many in plant	
Industrial Boiler Size	
Monitoring	Yes/No
Fuel type	
Fuel use	

08. Cost Estimation	
Total approximate value of the factory (Including equipments, finished goods and raw materials)	
Total cost for implementing fire safety system	
Annul maintenance cost of the fire safety system	
How much does those fire accident cost?	
How much helpful do you think the fire safety systems have been in dealing with the fire accident 1. Extremely helpful 2. Very helpful 3. Somewhat helpful 4. Not very helpful 5. Not at all helpful	
Do you have revenue generation has increased after installation of the fire safety system?	Yes/No
Do you think revenue generation has increased after installation of the fire safety system?	Yes/No
According to you how much revenue generation has increased after installation of the fire safety system? 1. Extremely High 2. Very High 3. Somewhat High 4. Not very High 5. Low	
Annual increase of revenue……percent/taka	