GREEN MANUFACTURING PRACTICE OF RMG SECTOR IN PURSUIT FOR GREEN INDUSTRIALIZATION IN BANGLADESH

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June, 2016

INTERNSHIP REPORT

ON

GREEN MANUFACTURING PRACTICE OF RMG SECTOR IN PURSUIT FOR GREEN INDUSTRIALIZATION IN BANGLADESH

BY

MD. ABU HANIF SARKER

REGISTRATION NO: 10-03900

An Internship Report
Submitted to the Faculty of Agribusiness Management,
Sher-e-Bangla Agricultural University, Dhaka,
in partial fulfillment of the requirements
for the degree of

MBA IN AGRIBUSINESS, SEMESTER: JANUARY-JUNE, 2016

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SUPERVISORS CERTIFICATE

This is to certify that the internship report entitled **''GREEN MANUFACTURING PRACTICE OF RMG SECTOR IN PURSUIT FOR GREEN INDUSTRIALIZATION IN BANGLADESH"** submitted to the Faculty of Agribusiness Management, Sher-e-Bangla Agricultural University**,** Dhaka, in partial fulfillment of the requirements for the degree of MASTER OF BUSINESS ADMINISTRATION (MBA) IN AGRIBUSINESS**,** embodies the results of a piece of bona fide internship carried out by **MD. ABU HANIF SARKER**, **REGISTRATION NO. 10-03900** under my supervision and guidance. No part of this report has been submitted for any other degree or diploma.

I further certify that such help or source of information as has been availed of during the course of this investigation has duly been acknowledged.

Dated:18.05.2017
Dhaka, Bangladesh

(Professor Dr. Mohammad Mizanul Haque Kazal)
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LETTER OF TRANSMITTAL

18th May, 2017

To

Dean

Post Graduate Studies,

Sher-e-Bangla Agricultural University

Sher-e-Bangla Nagar, Dhaka-1207

Sub: Letter of Transmittal of the Report

Dear Sir

With due respect, I would like to submit my practicum report on **"GREEN MANUFACTURING PRACTICE OF RMG SECTOR IN PURSUIT FOR GREEN INDUSTRIALIZATION IN BANGLADESH**". This work was assigned under joint supervision of Professor Dr. Mohammad Mizanul Haque Kazal, Department of Development & Poverty Studies, Sher-e-Bangla Agricultural University and Md. Ilias Chowdhury (Manager & Admin), M & H Corporation (Pvt.) Ltd. It was undoubtedly an impressive opportunity for me to work on this topic to actualize my theoretical knowledge in the practical area. Now I am looking forward for your kind appraisal regarding this practicum report.

I would be very happy if you please take trouble of going through the report and evaluate my performance regarding study report.

Sincerely Yours

Md. Abu Hanif Sarker

Reg. no: 10-03900

ACKNOWLEDGEMENT

This study titled **"GREEN MANUFACTURING PRACTICE OF RMG SECTOR IN PURSUIT FOR GREEN INDUSTRIALIZATION IN BANGLADESH"** from M &H Corporation (Pvt.) Ltd. for my internship program.

On completion of the study, I desire to express my gratitude to all who extend cooperation to accomplish the study. On the very onset of this note acknowledgement, I desire to express gratitude to Md. Ilias Chowdhury (Manager & Admin), M & H Corporation (Pvt.), and Professor Dr. Mohammad Mizanul Haque Kazal, Department of Development & Poverty Studies, Sher-e-Bangla Agricultural University for providing timely directions to complete the report.

Gratitude to , Eng. Md. Farhad Abdullah Al Mamun, (Opex Sinha Group) who helped me lot. At the same time, I express my gratitude to Eng. Mazharul Haque (Epilion Group), Eng. Asharul H. Pathan (Beximco Group) for extending necessary cooperation towards study.

Finally, I express my gratitude to the staff of M &H Corporation (Pvt.) Ltd. as they help the field survey by hosting enumerators, supervisor during the survey and later by providing information for verification of data.

Least, but not the least, I am indebted to the entire beneficiary respondent as without their cooperation this study cannot advance to any second steps. I am grateful to them.

Before concluding again I am expressing my heartfelt thanks and gratitude to all.

Md. Abu Hanif Sarker

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LIST OF ACRONYMS

RMG	Ready-Made Garments
ISO	International Organization for Standardization
ETP	Effluent Treatment Plant
LED	Light Emitting Diode
WRAP	Worldwide Responsible Accredited Production
BGMEA	Bangladesh Garment Manufacturers and Exporters Association
OECD	Organization for Economic Co-operation and Development
SMEs	Small and Medium-sized Enterprises
UNDP	United Nations Development Programme
ZLD	Zero Liquid Discharge
ZDHC	Zero Discharge of Hazardous Chemicals
LEED	Leadership in Energy and Environmental Design
TSP	Textile Sustainability Platform
ECMPRO	Environmentally Conscious Manufacturing and Product Recovery

GREEN MANUFACTURING PRACTICE OF RMG SECTOR IN PURSUIT FOR GREEN INDUSTRIALIZATION IN BANGLADESH

MD. ABU HANIF SARKER

EXECUTIVE SUMMARY

As environmental considerations are very important now-a-days, making the RMG industry concern about green manufacturing practices where firms produce their product that minimize negative environmental impacts, conserve energy and natural resources, are safe for employees, communities, and consumers. Indeed, the theory and practices of green manufacturing has become a critical issue in dynamic business development (Jayal et al., 2010). So this report mainly focus on two research questions: one-"To what extent up to which RMG companies are conscious on green manufacturing?" and another is "what are the common green manufacturing practices of RMG sector in Bangladesh?" For this purpose semi-structured questionnaire was developed as a means of conducting the survey for collecting raw data and data were collected from total 30 companies which have at least one international or local certificate related to environment. The major findings of this report are divided into two parts according to research question. Almost all companies are conscious of green manufacturing where 46% companies are highly conscious. Second part mentioned practices of reduction of energy consumption, water consumption, using of renewable energy, reduction of noise reduction. Companies' practices level on sustainable materials: raw materials, accessories, non-harmful chemicals and packing materials are given later. At last some policy suggestions were given related to green manufacturing practice in RMG sector.

CHAPTER-1: INTRODUCTION

1.1 Introduction

The textile industries are playing an important role in Bangladesh's economy for a long time which comprises a mix of small to large-scale privately and publicly owned companies. Currently, the textile industry in Bangladesh accounts for 45 percent of all industrial employment and contributes 13.10 percent to the total national income. The industry employs nearly 4.2 million people, mostly woman. A huge 81.7 percent of the country's export earnings come from textiles and apparel, according to the latest figures available. Bangladesh exports its apparel products worth nearly 10462.76 million US Dollar per year to the United States, European Union (EU), Canada and other countries of the world. It is the sixth largest apparel supplier to the United States and EU countries. Previously, the domestic market was dependent upon imported goods; now the local industry meets over 90 per cent of domestic demand for ready-made garments.

Despite the significant economic contribution of the textile industries in Bangladesh, it has brought with it a range of environmental problems, mostly pollution of water resources of the country. Although the concerned authorities have identified these industrial units and legal procedures have been initiated against them, the scenario of industrial pollution has not improved yet. Recent reports in the national dailies on increased industrial pollution reflects that many ecosystems have already been degraded, some are now under threat, and the livelihoods of tens of thousands of people mostly the local farmers and the fishermen are being affected as wastes and effluents from textile industries are dumped in crop lands and water bodies.

One solution of this current problem of RMG sector in Bangladesh is to introduction of Green Operation (GO). Environmental sustainability through green operation is about finding innovative ways to minimize the impact of industrial operations on the environment through using state-of-the-art technologies. Green manufacturing means to take responsibility – responsibilities towards protecting the environment in which we live and operate. So, all products should be made in a caring and responsible way that

preserves the environment for future generations. While improving working conditions and protecting the environment are certainly admirable goals, they have also proven to be good business strategies. Therefore, international community is getting increasingly interested in green business and eco-friendly production. There is also a growing pressure on industries for environmental compliance, and at the same time international buyers are giving preference to green producers. Moreover, it is now apparent that companies that fail to integrate green operation into their core strategies will fail to maintain their competitiveness over time.

So, this report discusses elaborately about the current scenario of green manufacturing practices in the RMG industry in Bangladesh. The study aims to find out what are the common green manufacturing practices among such companies and to what extent conscious efforts are made to enrich such measures. For this purpose, the paper also discusses the key issues of green manufacturing, what are the level of consciousness of green manufacturing and initiatives taken by manufacturers to ensure green manufacturing. Green manufacturing practices seek to minimize negative environmental impact conserve energy and natural resource, are safe for employees, communities and consumer and are economically sound.

1.1.1 Problem statement

There are differences of opinion about the green production in the RMG sector of the country. Some thinkers gave more importance on the actions of the private sectors only. Another segment of the academician describes the inaction or positive action of the government as a prime factor. Combination of these two things is also mentioned in some study. Some played blame games. But in this critical juncture we seriously need to point out the role of the government from a neutral point of stance for the green production in RMG sectors. Otherwise a dire consequence is waiting for the economy and for the country as a whole. However, Joint effort from both private and public sector is needed to make RMG sector environment friendly. Green production of RMG could be defined as an ability or capacity of it to be maintained or to sustain itself in any adversity in the world market. Role of the government along with the private sector is the important

factor in this regard. That is why; how to make the RMG sector environment friendly and what more all stakeholders can do to make RMG sector eco-friendly are burning issues for this sector.

1.1.2 Illustrations of the problem

Sustainability of RMG in Bangladesh is a major concern for both private and public sector of the country. Due to the importance of RMG sector in the economy of Bangladesh, government needs to pay more attention for the development of this sector. Duty free and quota free (DFQF) access and Generalized System of Preference (GSP) are denied by the United States government. USA is the largest buyer of RMG of Bangladesh. This action of the biggest buyer creates a hindrance to this sector. Rana plaza collapse followed by Tazreen Fashion fire has brought the workers welfare issue in front. International agencies, buyers, development partners, civil society organization both government and private sectors are to take necessary steps to mitigate these sorts of crises. Particularly government should create enabling environment for eco-friendly production in this sector. Presently in the world market China is the leading country of RMG export. Bangladesh is the second largest RMG out sourcing country in the globe. For some valid reasons Bangladesh is now getting more importance to the worlds big buyers from the USA and the EU. “With garment buyers moving out of China, the sourcing caravan is moving on to the next hotspot Bangladesh,” the latest report of McKinsey & Company said, providing an overview of the rapid growth of Bangladesh apparel sector with its prospect and areas of concern. Low wage and abundance of cheap labor are not enough to be the number one apparel out sourcing country. RMG sector would face some major challenges to achieve the opportunity to attain the status of global hub. It needs to bring the green operation in RMG outsourcing in Bangladesh. Green manufacturing dimensions are to be explored and bottlenecks of development to be removed or resolved to gain sustainability in the long run. Otherwise, Bangladesh will miss the train of opportunity in this competitive world market.

1.2. Background of Study

Readymade garments sector is facing realities which are very crucial for that industry and for the economy of Bangladesh as a whole. The United States of America the biggest export destination of RMG of Bangladesh is not giving DFQF access now. They have cancelled GSP for Bangladeshi RMG exporters. It is a big challenge for RMG sector of Bangladesh.

Poor standard of compliance set by the importers and development partners also creating barriers for Bangladeshi readymade garments to its desired growth. Situation created after well talked about Rana Plaza collapse and Tazreen Fashion Fire is big challenge for advancement of RMG sector of Bangladesh. Bangladesh garment exporters and manufacturers should take the lead to abide by the compliance issues set by the buyers and international agencies. New market search, new products innovation, and socio-political stability are also needed to be addressed properly for the green production in RMG sector of Bangladesh.

Social- The readymade garment industry has radically changed the lives of millions of Bangladeshis over the last two decades. RMG creates employment for near about five million people in the country, particularly for women. For their livelihood, sustainability of this sector is a necessity for this country. This sector is now the largest employer in Bangladesh. It helped solve unemployment problem of the state. The garment sector is the largest employer of women in Bangladesh. It has provided employment opportunities to women from the rural areas that previously did not have any opportunity to be part of the formal workforce. This has given women the chance to be financially independent and have a voice in the family because now they contribute financially.

Political- If RMG sector faces problems social and economic sector of the country will become instable. Political situation will become volatile due to instability created by RMG sectors dilemma. It is to be kept in mind that the political impasse is obviously a drag on the economy. This is not only the case to discuss; if we think back to judge the situation where there were no RMG sector in the country, what would happen to the political scenario of a poverty stricken economy like Bangladesh. Unemployment would go beyond control, poverty would be worsened, and lawlessness would grip the country

in such a way that it could face famine and total political collapse. If Bangladesh could maintain political stability, this RMG sector would have taken Bangladesh to a new height.

Economic- In the year 2015-2016 RMG sector of the country earned US$ 1046.2 million and total export earning of that year is US$ 9691.25 million which is near about 81% of total export earnings. A country like Bangladesh cannot afford to take risk of losing these huge amounts of foreign currency. The apparel industries in Bangladesh are the source of major export earnings, Major Player in the export, helping industrialization, contributed to GDP at 13.5%, helped growth of backward and forward linkage industries. This sector contributes 38% of value addition. It generates huge cliental base for banking, insurance and shipping. Transport, hotel, cosmetics, toiletries and related other economic activities have also flourished. It provides indirect employment to 0.80 million workforces in accessories industries related to garments. It also provides 0.2 million job to waste recycle industry related to RMG sector.

Besides, climate change is one of the major challenges of our time and adds considerable stress to our societies and to the environment. From shifting weather patterns that threaten food production, to rising sea levels that increase the risk of catastrophic flooding, the impacts of climate change are global in scope and unprecedented in scale (Zahedi, 2013). Scientists have declared that the negative impact of global warming will continue to make dramatic changes to the earth, making it a bit less livable each day. The act of production and usage of environmentally detrimental products, toxic emissions and irresponsible waste management by the manufacturers and consumers are some of the key reasons behind the rising concern of climate change. Under such circumstances, businessmen are forced to reevaluate their definition of prosperity. Rising public concern and government regulations are causing shifts in the profit maximization orientation of businesses. Now-a-days, they are making conscious efforts to do business with a more "green" approach.

Manufacturing is the production of merchandise for use or sale using labor and machines, tools, chemical and biological processing, or formulation. "Green Manufacturing" is behind many of the green products and processes in demand and celebrated around the

world today. Businesses of all types are already involved in initiatives and innovations that are helping to foster a healthier environment, enhance their competitive edge, reduce risks, build trust, drive investment, attract customers and generate profit. Green Manufacturing Initiative sums it up as: “The creation of manufactured products that use processes that minimize negative environmental impacts, conserve energy and natural resources, are safe for employees, communities, and consumers and are economically sound.” To put simply, green manufacturing is all about minimizing the diverse business risks inherent in any manufacturing operation while maximizing the new opportunities that arise from improving your processes and products. There are very limited studies available on the green manufacturing practices in RMG industry. This study will help shed light on the contemporary scenario of the extent of such practices in the RMG industry in Bangladesh. Through the findings of this study, valuable suggestions can be made regarding the areas where further improvements can be made or how far behind is Bangladesh RMG industry in the arena of green manufacturing practices.

1.3. Justification of the Study

Rising sea levels, loss of wildlife and forests, extreme weather conditions and natural disasters are some of the alarming effects of climate change. Green procurement plays a key role in contributing to sustainable development (UNDP, 2008). Having a profound effect on all of the organizational aspects of human life, sustainability related issues maintain a strong mutual relationship with manufacturing, as the main aspect of the modern lifestyle .These days, doing business built on good environmental practice is increasingly becoming essential in the eyes of investors, regulators, customers and the communities where you operate. Failure brings with it high costs – fines, penalties, local unrest and customers choosing to go elsewhere. Success, on the other hand, can save your money, helps build a reputation, attracts investment, spurs innovation, secures loyal customers and brings in repeat business. “Green Manufacturing as a model of sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” (World Commission of Environment and Development). Benefiting from green manufacturing is not just a game

for big business. New firms and small businesses can also play an exciting role. Startups and small and medium-sized enterprises (SMEs) with their flexible business models and less reliance on established ways of working, can also benefit, evolving and innovating quickly to gain advantage over on the competition. So, this study tries to understand where Bangladesh's RMG industry stands in regards of Green Manufacturing practices.

1.4 Research Questions

The research questions for this report are as follows:

1. To what extent up to which RMG companies are conscious on green manufacturing?

2. What are the common green manufacturing practices of RMG sector in Bangladesh?

    1.2.1 What are the common waste management practices of RMG sector in Bangladesh?

    1.2.2 What types of renewable energy used in RMG sector in Bangladesh?

    1.2.3 What type of measure taken by RMG sector to reduce energy consumption in Bangladesh?

    1.2.4 What are the basic policy implication regarding green manufacturing practice of RMG sector in Bangladesh?

1.5 Objectives

This report aims to shed light on where Bangladesh RMG industry stands in regards green manufacturing practices. It has the following research objectives:

1. To investigate the extent up to which RMG companies are conscious on green manufacturing?
2. To identify the common green manufacturing practices of RMG sector in Bangladesh.
3. To recommend policy suggestion related to green manufacturing in RMG sector.

1.6 Scope of the Study

This study is conducted only three green manufacturing practices namely waste management, green manufacturing process and sustainable materials of RMG industry in Bangladesh. And this study conducted by some selected issues related to above mentioning area of green manufacturing practices of RMG industry. Here the findings does not necessary apply to others sectors. Also here the data are collected from 30 RMG companies which have at least one international or local certificate related on sustainability and green manufacturing situated on Dhaka and Gazipur area.

1.7 Limitations of the Study

This study has a small sample size and the sampling technique used was a mix of convenience and snowball technique. Here due to limited time and financial constraints, a pilot testing could not be conducted which could have helped to yield a more effective questionnaire. All the sample firms are situated in or around the capital city Dhaka and Gazipur and sample firms are those firms which have at least one international or local certificate related to this issue. So, the gaps or differences with the firms outside these cities cannot be retrieved. Lastly, the data collected from the survey respondents had to be recorded as provided; further authentication or validation could not be achieved.

CHAPTER-2: REVIEW OF LITERATURE

2.1 Green Manufacturing Practices

Green manufacturing is a new idea and it has attracted the attention from various business practitioners. Several research projects and many documents related to them have been published. Indeed, the theory and practices of green manufacturing has become a critical issue in dynamic business development (Jayal et al., 2010). Combination of lean and green strategies resulted in the reduction of approximately 10.8% of the production costs of a representative part. (Nancy Diaz-Elsayed et al., 2013). Methods of green manufacturing that are reducing the waste and even pollution (Seadon, J. K. 2006). Capabilities appropriate for green supply are developed by a proactive corporate environmental stance and by a more strategic purchasing and supply management approach (Rusinko, 2007). Many organizations all over the world have taken an opportunity to implement green operation (GO) in term of competitive positioning (M.E. Porter et al., 1995), customer relationship and product quality (Szekely and Knirsch, 2005), environmental management and supply chains management (Kleindorfer and Saad, 2005), strategic plan and action and continuous growth and expansion (Gunasekaran and Spalanzani, 2012). Several works had done by many researchers which is highlighted about green manufacturing practices such as sustainable material (Smith and Ball, 2012; Henry and Kato, 2012), waste management (H. Min et al., 2001), pollution prevention, manufacturing process (Upadhye et al., 2010).

2.1.1 Waste Management

The three R's are commonly used terms in waste management; they stand for "reduce, reuse, and recycle". As waste generation rates have risen, processing costs increased, and available landfill space decreased, the three R`s have become a central tenet in waste management efforts (Seadon, 2006; Suttibak & Nitivattananon, 2008; Tudor et al., 2011). Waste minimization is a process of increasing resource utilization or reduction of waste and extracting maximum from the waste stream before final disposal or recycling (Mohan

Das Gandhi et al., 2006). As globalization leads to increased knowledge and capability standards, it is possible to achieve a high quality of life and living standards through waste minimization without long-term harm to the environment. Organizations that adopt lean practices could minimize or eliminate wastes in all forms. In addition, lean as a green practices are helpful for firms to remove pollutant and harmful emissions by means of reduction in product shipment volumes and waste reductions (Hong et al., 2012).

2.1.2 Green manufacturing process

Implementing new manufacturing processes in the business environment is also one of the approaches for organizations to be more sustainable. Many Manufactures have adopted various approaches to improve their products and developed new additive formulations and technologies which can minimize the environmental impact. Other innovations include developing systems with unique properties and focusing on reducing waste production and energy consumption (Jayaraman et al., 2012). Upadhye et al. (2010) suggested that humanity adopts technology which uses renewable resources, reduces pollution where collapse would be avoided and consequently would provide high living standards and human welfare.

2.1.3 Sustainable materials

New materials development is a necessary part of meeting the growing demand for infrastructure while reducing the industry's environmental impact. Material technologies will provide the foundation for moving forward and embracing sustainable practice, while many other opportunities exist for new innovations (Henry and Kato, 2012). Sustainable Materials or intermediate products sustainability measurement indicators are non-sustainable materials intensity, restricted substances intensity, and recycled materials (OECD, 2012). Gungor and Gupta (1999) presented a review of the research development in Environmentally Conscious Manufacturing and Product Recovery (ECMPRO) and provided a survey of published work. Not only does ECMPRO involve integrating environmental thinking into new product development such as design,

material selection, manufacturing processes, and delivery of the product to the consumers, but also it covers the end-of-life management of the product after its useful life. O'Brien (1999) remarked the characteristics of a sustainable production system and discussed that organizations moving towards environmentally friendly and sustainable processes will recover costs quickly. Based on a sustainable manufacturing paradigm, a new approach to product development which integrates the environmental requirements in every very stage of product's life cycle (Kaebernick et al., 2003). Joung et al. (2013) presented a review of a set of indicators and a categorization of quantifiable indicators based on environmental stewardship, economic growth, social well-being, technological advancement, and performance management- for measuring sustainability. It is also explained how these indicators can be used in assessing a company's manufacturing operations. Besides adding technology and education as the two enablers of sustainability in manufacturing, a wide picture of the research challenges in the area of green manufacturing based on the IMS2020 project has built (Garetti and Taisch, 2012). In the area of manufacturing systems design, Nagel and Tomiyama (2004) discussed the concept of design for environment (DfE). By assessing 25 manufacturing systems in the printed board industry, it concluded that using less resource and generating less waste and emissions along with measuring and managing the environmental balance with information technology will assist in making a sustainable and intelligent system. Having surveyed the members of the U.S. commercial carpet industry, Rusinko (2007) addressed the effects of incorporating environmental sustainability in manufacturing systems on their competitive outcomes such as manufacturing cost and product quality.

2.2 Theoretical Framework

The existing literature related to this topic, helped to establish the conceptual framework for this report. Previous studies have highlighted of green manufacturing practices such as waste management, green manufacturing process, pollution prevention, sustainable material which are adopted by organizations. However, this study only focuses on three green manufacturing practices namely waste management, green manufacturing process and sustainable material. After a rigorous review of the literature, it was found that

scholars have suggested several areas of green manufacturing practices. With the help of the literature, specifically from Rajon Sarkar (2016) “Eco-manufacturing and green financing in Bangladesh RMG”, proposed green manufacturing practices for RMG industry is given here:

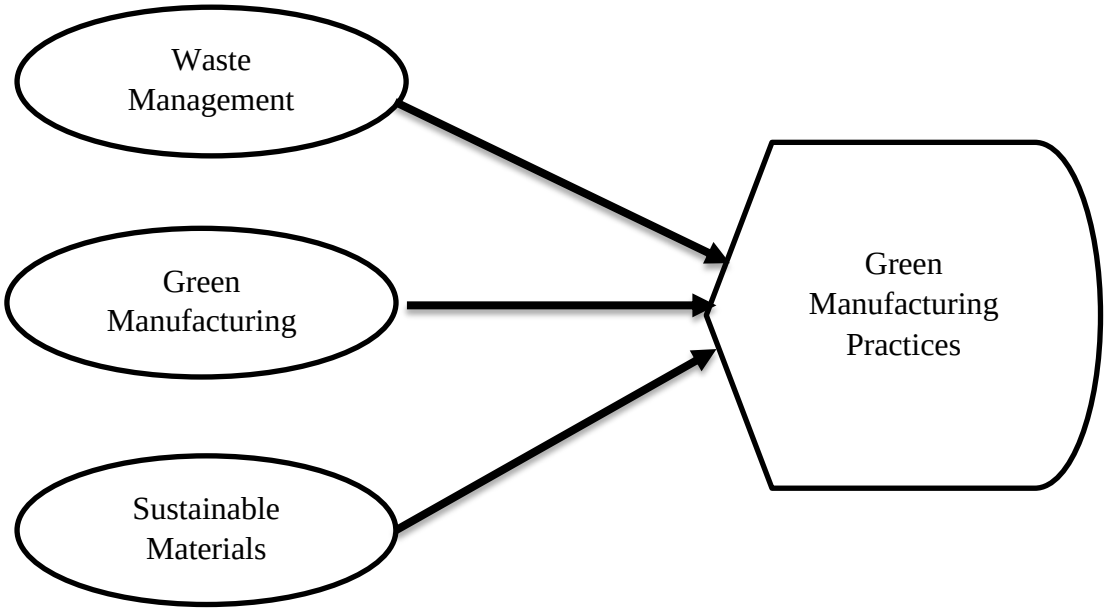

Figure1: Proposed theoretical framework for green manufacturing practices

For this report which discussed about waste management practice, green manufacturing process and procurement of sustainable materials practice that can help to measure RMG industry’s green manufacturing practices in Bangladesh. Here this paper investigate waste management system, energy reduction, water consumption reduction, noise pollution reduction system, usage of renewable system and sustainable raw materials purchase, recycled/ reused materials usage as well as non-harmful chemicals usage practice of different RMG companies that help to find out the overall scenario about green manufacturing practices in RMG industry of Bangladesh.

CHAPTER-3: OVERVIEW OF RMG INDUSTRY

3.1 An Overview of RMG Industry

RMG Industry of Bangladesh has developed on the foundation of widen demand spectrum driven by macroeconomic outlook of major export destination synchronized by evolved pricing strategy, quality and relative development of backward linkage support. Bangladesh received more than three fourth (about 81.7%) of total export earnings from Readymade garments (Woven and Knitwear). In the 2015-16 (July to November) Bangladesh earned total 10462.76 million US Dollar where at same time in 2014-15 earning from RMG sector was 9691.25 million dollar. It was a growth of almost 8 percent comparing to same time of the previous year. The RMG export growth in July-November, FY 2015 was mainly driven by increase of the export of woven garments. However, against the target of July-November, 2015, total RMG export growth increased by 0.5 percent. The export of knitwear garments was 2.60 percent lower than the target level while woven garments registered 3.77 percent growth against the target. According to EPB during July-November FY 2016, 40.7 percent and 40.6 percent of total export earnings received respectively from woven and knitwear. In FY 2015, share of these two subsectors in total export earnings were 41.4 percent and 38.9 percent respectively.

In July-September FY16 first quarter earnings from woven garments stood at USD 3189.12 million, which is 2.19 percent and 4.78 percent higher compared to previous quarter and July to September FY15 respectively. It is 6.53 percent lower than targeted export earnings from this subsector. In July-September FY16 first quarter earnings from Knit garments stood at USD 3250.11 million, which is 15.18 percent and 2.15 percent higher compared to previous quarter and July to September FY15 respectively. It is 1.28 percent Higher than targeted export earnings from this subsector.

Macro contribution to the Economy: Bangladesh's RMG sector contribution in terms of GDP is highly remarkable; In FY15 it has reached 13.10 percent of GDP, which was only about 3 percent in 1991. Although in FY14 it was 14.2 percent of GDP. The contribution of Bangladesh Knitwear sector on GDP is 6.39% and woven sector is 6.72%.

So, RMG plays a pivotal role in promoting the development of other key sectors of the economy like banking, insurance, shipping & Logistic industries, etc.

RMG Market: In terms of market share of RMG, Bangladesh has achieved second position in EU market, but market share of RMG in EU market declines at the beginning of FY16. With the negative growth of RMG exports during August 2016, Bangladesh RGM industry has received a loss of market share by amount of 6.9 percentage points in EU market, while market share of Bangladesh RMG exports gradually follows upward trend in others emerging market – China, India, Brazil, Turkey, UAE. During FY09, four emerging economies- Brazil, India, China and Japan accounts 1.09 percent RMG export share, while it reaches to 4.9 percent in FY15 due to product diversification, attractive price and intra-industry trade. Major reasons behind the declining market share of Bangladesh's RMG industry are sharp Euro devaluation against US dollar and cost of production. Bangladesh RMG industry incurs higher cost for per unit RMG.

The main importer countries of Bangladeshi RMG are USA, UK, Germany, France, Spain, Italy, Belgium, Netherlands and Canada. In January-March 2016 quarter, total export to these nine countries stood at USD 4956.73 million, of which 91.14 percent (woven 51.55% and knitwear 39.59%) is RMG export. Bangladesh's export to the USA is currently experiencing a decline as evidenced by recent statistics. The political turmoil, labor situation coupled with the compliance factors as regards workplace safety etc., are believed to have left a dent in the momentum of exports. Compared to Bangladesh's exports to the USA in January 2015, exports in January 2016 experienced a downslide of 7.16 per cent. This reflected not only in value but also in volume. In January 2016, Bangladesh exported 15,200,000 square meters of garments which are 8.38 percent less than the corresponding month of previous year. Export earnings from RMG sector was quite sluggish in this period by any comparison with recent past years. As is known, RMG sector faced several compliance related challenges and associated consequences in FY2015-16.

RMG marketing is basically divided into three segments: woven and denim, fine knit and heavy knit (sweater) and non-oven. The type and style of products vary from place to place depending of consumers' tastes and preferences. The marketing professionals need

to know the taste, choice and culture of the consumers by applying marketing tools and techniques, surveys, research, analyses, feasibility studies on the demand and supply of RMG products. A major strategic factor which contributes to a company's success and exposure is marketing. Individual companies often adopt certain marketing techniques and methods which will complement their brand and image. Marketing determines how the consumer views a particular company or product. The dynamics of the apparel industry is changing day by day. To succeed amid the shifting tides, apparel companies need to build up competence and proficiency in conformity with market trends. The destination of RMG products need to be scattered to other destinations like Japan, Middle East, Australia, New Zealand, and South Africa since the current markets in EU, USA and Canada are almost at the stage of saturation. The market and product diversity would be the key of sustaining export proceeds of the industry.

Employment, Wages & Productivity: With Wage increases, bound higher investments for RMG industry owners of Bangladesh in improving compliance issues, and persistent devaluation of euro currency against US dollar, Bangladesh has lost market share in EU market, but Bangladesh has still highest relative comparative advantage (RCA). This relative comparative advantage for Bangladesh in RMG sector attributes to mainly for two reasons – lower wages and lower price for RMG products in international market. Productivity of RMG increases over time in RMG sector in Bangladesh. Moreover, challenges in productivity of RMG sector still remains due to lack of investments, lower backward linkages and lack of infrastructures and skilled labor. Productivity in Bangladesh increases overtime because improvement in reduction in lead time, higher value addition leading improvement in backward linkages through higher investment in capacity development and quality improvement.

Worker's efficiency is a fundamental to meet up buyer's demand in time, management skill among product lines in production process. Based on the Emerging Survey in 2015, 88 percent of the owners think that productivity and efficiency largely depend on the outcome of the sewing and cutting line, skill of operators of sewing to operate machines and in some extent less noisy environment. In Bangladesh, worker's efficiency lower

attribute to lack of proper training of sewing operators, lower wages and compliance issues that disturb worker's attention.

Problem of RMG Sector: The garment industry of Bangladesh has been the key export division and a main source of foreign exchange for the last 25 years. National labor laws do not apply in the EPZs, leaving BEPZA in full control over work conditions, wages and benefits. Garment factories in Bangladesh provide employment to 40 percent of industrial workers. But without the proper laws the worker are demanding their various wants and as a result conflict is began with the industry. Taking the advantages of workers' poverty and ignorance the owners forced them to work in unsafe and unhealthy work place overcrowded with workers beyond capacity of the factory floor and improper ventilation. Most of the garment factories in our country lack the basic amenities where our garment workers sweat their brows from morning to evening to earn our countries the major portion of our foreign exchange. Anybody visiting the factory the first impression he or she will have that these workers are in a roost. Because of the carelessness of the factory management and for their arrogance factory doors used to be kept locked for security reason defying act. Safety need for the worker is mandatory to maintain in all the organization. But without the facility of this necessary product a lot of accident is occur incurred every year in most of the company.

The Environmental Regulatory System for RMG Industry

Industrial units in Bangladesh are classified into four categories. The primary textile sector and fabric washing units fall under the Orange B category, whereas fabric dying and chemical processing units are in the Red category. Pollution concerns arise from the use of toxic raw materials (chemical dyes), the volume of water used in production and the volume of wastewater generated.

Most industries require an environmental clearance certificate when they are initially registered under the DOE. Industries in the Orange B and Red categories need to provide a process flow diagram. They may also be subject to an initial environmental examination for site technical clearance, and, in some cases, a full impact assessment. Environmental compliance also requires industries to record tests on discharged wastewater and submits

quarterly reports. Solid waste needs to be disposed within six months and records maintained on sludge management.

Factory inspectors generally visit industries without prior notice. The DOE prepares an inspection report with details on the operational status of a firm's ETP, its waste disposal system and its environmental performance, gauged by the measurement of pollution parameters collected from factory premises. Further, regulations provide for a penalty to be paid by non-compliant firms. While the rules are clear, implementation is challenged by limited capacity and incentives that do not promote compliance.

Major Policy changes by government related to green manufacturing:

(a) No garment unit under Orange-B category shall be allowed to be located in any residential area.

(b) Industrial units shall preferably be located in areas declared as industrial zones or in areas where there is concentration of industries or in vacant areas.

(c) Industrial units likely to produce sound, smoke, odor beyond permissible limit shall not be acceptable in commercial areas.

(d) After obtaining location clearance on the basis of Initial Environment Examination (IEE) Report, the Environmental Impact Assessment (EIA) Report in accordance with the approved terms of reference along with design of ETP and its time schedule shall be submitted within approved time limit

Seventh Five Year Plan FY2016 –FY2020 has outlined strategies to adapt to the impact of climate change

The National Adaptation Programme of Action (NAPA) identified six priority areas: food security, social protection and health; comprehensive disaster management; infrastructure; research and knowledge management; mitigation and low carbon development; capacity building and institutional strengthening.

The Renewable energy policy 2009 is committed to facilitate both public and private sector investment in Renewable Energy projects to substitute indigenous non-renewable

energy supplies and scale up contributions of existing Renewable Energy based electricity productions.

Implementing Zero Liquid Discharge has been identified as KPI of Department of Environment. A draft sludge management guideline has been made. Low cost green finance has been made available: 1. Refinancing scheme for Renewable energy and green industry. 2. Around 50 green refinance line has been introduced by Central Bank.

Steps taken so far by BGMEA related to Green Manufacturing:

BGMEA as the apex trade body of Ready Made Garments sector has already taken a number of initiatives under its umbrella TREES (Toward Resource Efficiency and Environmental Sustainability). Conducted two pilots with IFC-SEDF on cleaner production. Implementation partner of PaCT Project., Environmental Performance improvement project with German International Co-operation.

TREES (Toward Resource Efficiency and Environmental Sustainability)

TREES is the BGMEA's initiative, an umbrella under which BGMEA runs several programs. PaCT (Partnership agreement for Cleaner textile project) being implemented in 102 wet processing factories. Another project are being implemented at 10 factories on specific geographic clusters collaboration with GIZ. These factories are tier two factories, never been intervened by any development projects before.

PaCT (Partnership for Cleaner Textile)

67 factories are undergoing CP assessment basic Cleaner production assessment on how a factory can incorporate cleaner processes that lead to a water footprint reduction by adopting low or no-cost measures. This also includes Operational Health and Safety (OHS) and Water and Sanitation (WASH) improvements.

Textile Technology Business Centre (TTBC)

IFC and BGMEA jointly set up TTBC. TTBC is a Knowledge center act as a platform to collaborate between industry and academy. Provide unbiased information to factories on technology. Match making between service providers and industry. Act as a depository of knowledge on best practice in the area of environmental sustainability.

3.2 Company Profile

In 1998, M & H Corporation (Pvt.) Ltd. started its voyage in limited extent at Dollipara, Uttara, Dhaka. “Now embraces the spirit of global trade”. The company is dedicated to excellence in merchandising, product development and production. It has earned a reputation throughout the global apparel industry as one of the foremost factories in Bangladesh for commitment to quality, timely delivery, and total value. Through extensive sourcing network, it has the ability to effectively procure the best

M & H Corporation (Pvt.) Ltd. focuses entirely on the clothing Industry. The plants have equipped with modern machines for a total production capacity of between 1.2 million pcs of garments per month depending on items and style. It has 350 employees of both production and management teams are dedicated to achieving clients’ production goals.

M & H Corporation (Pvt.) Ltd. is a 100% export oriented woven Ready Made Garment (RMG) unit. It is under the membership of the Bangladesh Garment Manufacturers and Exporters Association (BGMEA). The main products are Light knitwear: T-Shirt, Polo Shirt, Tanks tops, Shorts, Heavy knitwear: Sweat shirt, Fleece jackets, pants, Jogging sets etc.

Mission

Our mission is to continue support the apparel fashion world with our world class products **.**

KEY INFORMATION

Year of inception: 1998

Product	:	Light knitwear: T-Shirt, Polo Shirt, Tanks tops, Shorts etc. Heavy knitwear: Sweat shirt, Fleece jackets, pants, Jogging sets etc.
Total production floor space	:	13,500 feet
Total workforce	:	3,50 (Male female ratio: 32:68)
Total sewing machines	:	150
Manufacturing business	:	Readymade woven apparel.
Monthly production capacity	:	1.2 million pcs of RMG
Sales Turnover	:	54,00,00 USD
% of export sales	:	100%
Address	:	10, Madrasha Avenue (Dag No. 1415/5482), Dolipara, Sector # 3, Uttara, Dhaka.

Commitment to the Employee

The company has a progressive management team and provides wage and benefit programs that meet the standards set by international agencies and exceed the national minimums. M & H Corporation (Pvt.) Ltd. is among the first companies in Bangladesh to implement innovative employee ownership, profit sharing, and health care programs. It recognizes that health, safety, and worker morale are keystones in attaining the capability to produce high-quality apparel. The factory provides an excellent work environment that includes sanitation, ventilation, and natural lighting. M & H Corporation (Pvt.) Ltd. believes in education and provides all employees with free health, hygiene, medical and educational programs.

Business concerns

The company has achieved the certification of good number of top brands. All manufacturing units have social, environmental, structural, technical certification from buyers, Govt. authorities.

Social responsibility

Vision of the company is conducting business in a socially responsible and sustainable way. It's overall vision and aim is to find the way of successfully balancing economic activities with the necessary care for natural environment as well as for human beings that are involved or affected by these economic activities. Therefore submit business partners in addition to the standards set for quality, business transactions and the protection of the environment, to the following social standards and requirements.

CHAPTER-4: METHODOLOGY

4.1 Research Design

A pragmatic research was followed to conduct this study; this is a very critical issues in present business world and many researchers and practitioners still working on it. Under such circumstances, a conceptual framework was created according to the existing literature and published reports of green manufacturing practices by established foreign firms, researchers and practitioners. Since the research was conducted from a pragmatist point of view, any suitable method or technique that can be used to answer the research questions was adopted. The key purpose is to acquire mostly qualitative data through knowledge sharing and discussion.

4.2 Data and Sources of Data

In this report topic data were collected about energy reduction practices, water consumption practices, using of renewable energy, noise reduction measurements, sustainable raw materials and accessories, practices of using or procure non-harmful chemicals and packaging materials, and so on. In order to gather preliminary knowledge about the study topic, a range of information sources such as research reports, journals, local and foreign public procurement policies, procurement policies of international organizations and company's published green procurement regulations were searched for using google generic search and google scholar search tools. These served as the secondary sources of data for the report. Raw data was collected through a survey conducted via face to face interviews and telephone interviews. These primary data are mostly qualitative in nature.

4.3 Target population and sample distribution

The targeted populations of this paper were 4286 RMG companies listed in BGMEA that conduct their operation within country. RMG companies which have at least one international or local certificate on green production issues were pick as a sampling frame. Due to time constraints, 30 companies could be possible to pick as sample. A combination of two sampling techniques were used- convenience sampling and snowball approach. This implies that the samples were selected according to convenience and ease of access to the managers. Also, a string of references were used to identify information rich samples and peruse them for an interview.

4.4 Questionnaire Design, Data Collection and Analysis

A semi-structured questionnaire (Appendix) was developed as a means of conducting the survey for collecting raw data. The questionnaire contained four sections. The first section contained about basic information of company, consciousness of green manufacturing and initiatives taken to ensure it. The second portion contained waste management issues of green manufacturing, third portion contained green manufacturing process such as energy reduction, usage of renewable energy, reduction of water usage and so on. And the final portion contained procurement of sustainable materials like sustainable raw materials, recycled materials, usage of non-harmful chemicals. During data collection, freedom will be given to the respondent to add any additional information they liked to share. During the survey, utmost effort will be given to collect authentic, relevant and accurate data. The data collected were analyzed using descriptive statistics and presented in the form of percentages and bar charts, pie charts generated using Microsoft Excel.

CHAPTER-5: RESULT AND DISCUSSION

Green Manufacturing Practices in RMG industry of Bangladesh

Green Manufacturing is very new issues in RMG industry of Bangladesh. But day by day RMG companies are trying to produce their product on sustainable ways. Several firms take initiative to run their production process on green manners and take several international certificates after fulfilling green practice criteria. According to the predetermined questionnaire, the 30 selected RMG firms which have at least one related certificate are brought to account for checking the condition of their Green Manufacturing practices. The collected data from the questionnaire and the other sources are analyzed for evaluations. The analysis of the current green procurement practices is shown here:

5.1 Companies Consciousness on Green Manufacturing

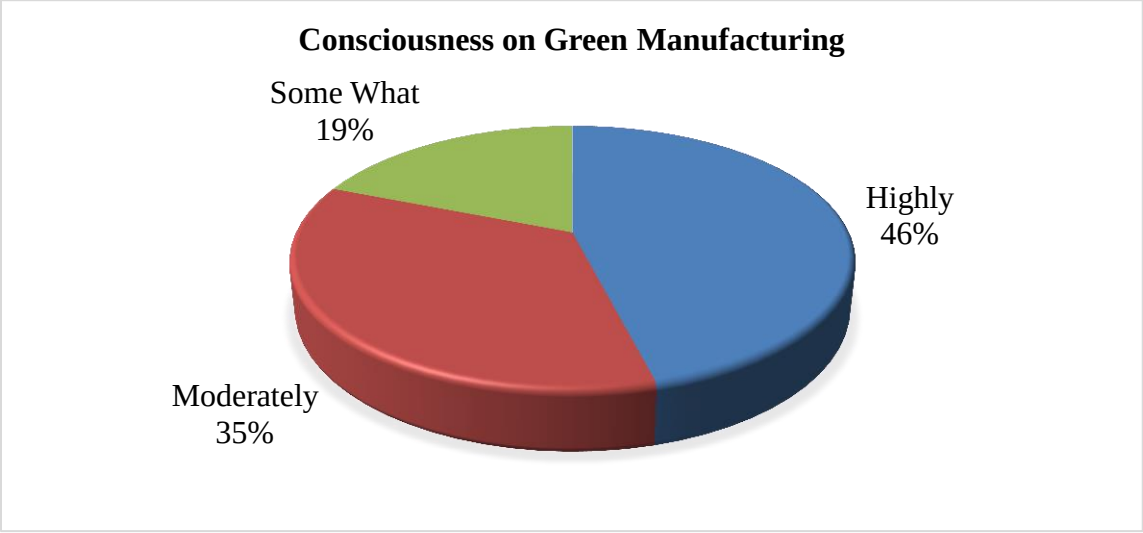

Figure-2: Consciousness on Green Manufacturing

The figure 2 above shows companies consciousness on green manufacturing where 46% (14 out of 30) companies are highly conscious on green manufacturing. Some these 4

companies have green operation (GO) related international latest LEED certificate, ISO 14401:2015 certificate and others certificate and some companies have suitability report and policy. And rest 35% (11 out of 30) and 19% (5 out of 30) companies are moderately and somewhat conscious on issues because they have other certificate along.

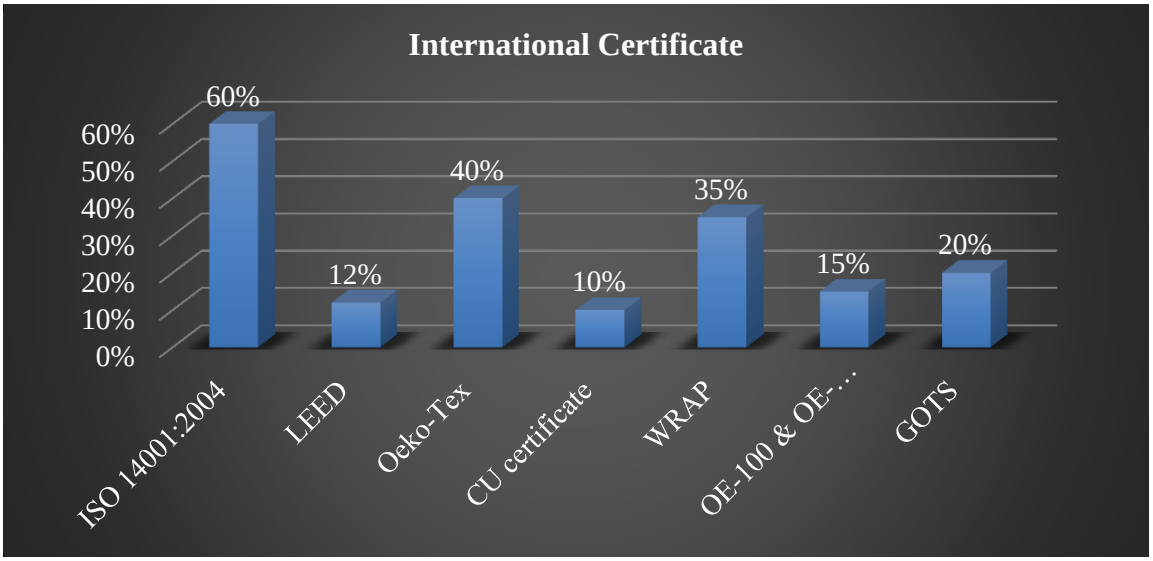

Figure 3: International Certificate Related to Green Manufacturing

This paper work is based on those companies which have at least one international[1] or local certificate related to green manufacturing. Most of the companies have more than

ISO 14001:2015 specifies requirements for an environmental management system to enable an organization to develop and implement a policy and objectives which take into account legal requirements and other requirements to which the organization subscribes, and information about significant environmental aspects.

LEED-Leadership in Energy and Environmental Design is basically a third-party certification program. It is a nationally accepted organization for design, operation and construction of high performance green buildings.

Oeko-Tex Standard 100 (textiles tested for harmful substances) is supplemented by the certification of environmentally friendly production facilities.

one certificate. And these certificates are ISO 14001:2015, LEED, Oeko-Tex, CU certificate, WRAP, OE-100 & OE-Blended and GOTS. Firms obtained above mentioning certificate because of fulfilling of criteria which related to green manufacturing practice in RMG industry. Figure 3 shows international certificate of surveyed firms. Here environment management system related ISO 14001:2015 certificate is obtained by 60% (18 out of 30) firms and US green building council provided LEED is obtained by 12% (4 out of 30) firms.

Figure also showed that 40% (12 out of 30) firms take textile related Oeko-Tex 100 standard, 10% (3 out of 30) CU compliance certificate. This figure further shows that Economy & Resource Efficiency certificate WRAP is taken by 35% (11 out of 30) firms, OE-Blended 15% (5 out of 30) and GOTS (global organic textile standard) 20%(6 out of 30).

5.2 Waste Management

The trash left out after each process during production remains waste. Waste Management is the human control of the collection, treatment and disposal of different wastes (liquid and solid). Waste Management serves dual purposes by making the industrial operations more competitive as well as protecting the environment. The

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CU compliance certificate is done by CU inspections and India private limited and it declared that inspected company's processing steps or activities carried out under responsibly.

WRAP is a registered charity. It works with businesses, individuals and communities to achieve a circular economy through helping them reduce waste, develop sustainable products and use resources in an efficient way.

OE Blended: Applies to all goods that contain a minimum of 5 percent organic cotton and can be used for blends that contain any fiber, including conventional cotton.

GOTS- Global Organic Textile Standard is the worldwide leading textile processing standard for organic fibers, including ecological and social criteria, backed up by independent certification of the entire textile supply chain

common waste management process followed by RMG industry in Bangladesh are ETP for treating liquid waste and reusing water for washing toilet as well as sprinkling onto the gardens and plantations, reusing spinning waste, reusing fabric, making organic fertilizer and selling rejected garments to local markets or third parts. The survey result of waste management followed by the RMG selected manufacturers are given in figure 4:

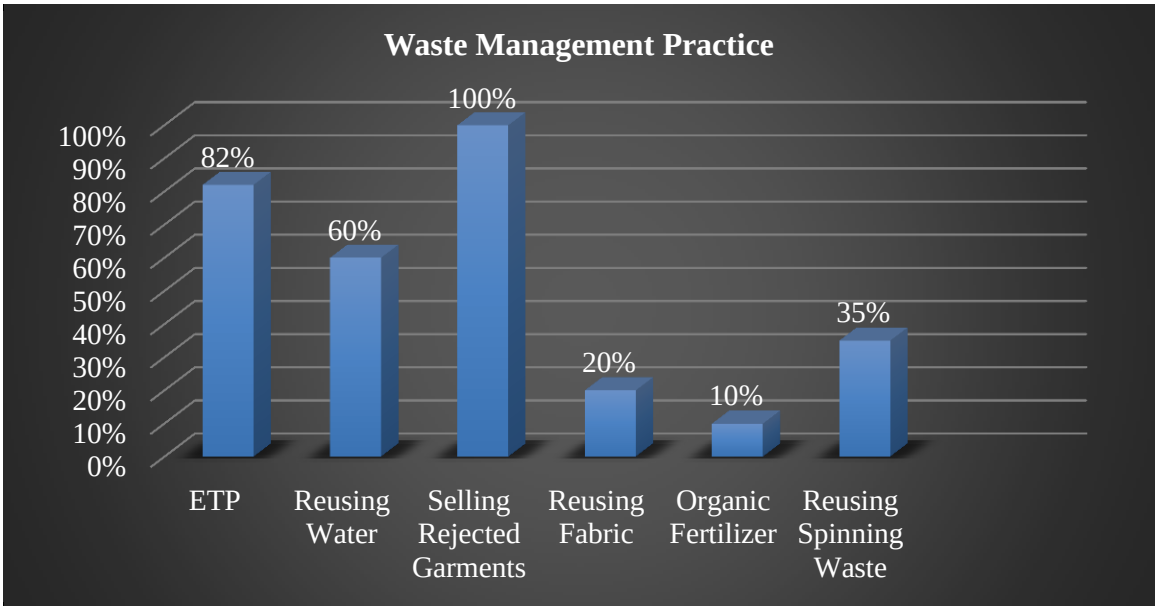

Figure-4: Waste Management

82% (27 out of 30) manufacturers used Effluent Treatment Plant for treating liquid waste coming from different producing process specially dying section. Also 100% (30 out of 30) of the companies have selling their rejected garments to third party or local markets.

60% (18 out of 30) companies responded that they have used their ETPs treated water for gendering and plantation as well as used as flash water for their worker toilets. 35% (11 out of 30) companies reported that they reused their spinning waste as raw materials and organic fertilizer. Organic fertilizer also produced from citizen waste and other natural ingredients which are done by 10% (3 out of 30) companies. Waste management another process is reusing fabric that is adopted by 20% (6 out of 30) companies and these wastes are coming from cutting section.

5.3 Sustainable Manufacturing Process

These sections consist of reduction of energy consumption, usage of renewable energy, reduction of water consumption and reduction of noise pollution practices.

5.3.1 Reduction of Energy Consumption Practices

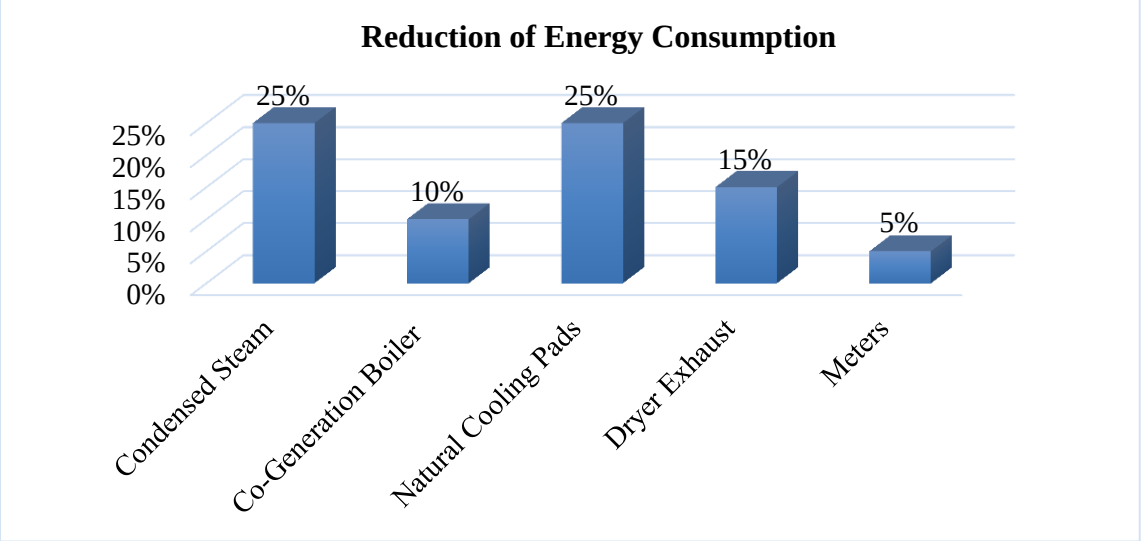

Figure 5: Reduction of Energy Consumption Practices

25% (8 out of 30) companies claimed that they reused their condensed steam. This heated water is supplier to boiler to produce steam once again which save natural gas. Only 10% (3 out of 30) used co-generation boiler which also save fuel gas. The natural cooling pads are used by 25 % (8 out of 30) companies instead of air condition or hundreds of ceiling fans that saving electricity. 15% (5 out of 30) companies claimed that they install dryer exhaust to save gas used in dying unit. Only 5% (2 out of 30) company installs meters (water flow meter, energy meter, and steam flow meter) to reduce energy consumption.

5.3.2 Renewable Energy

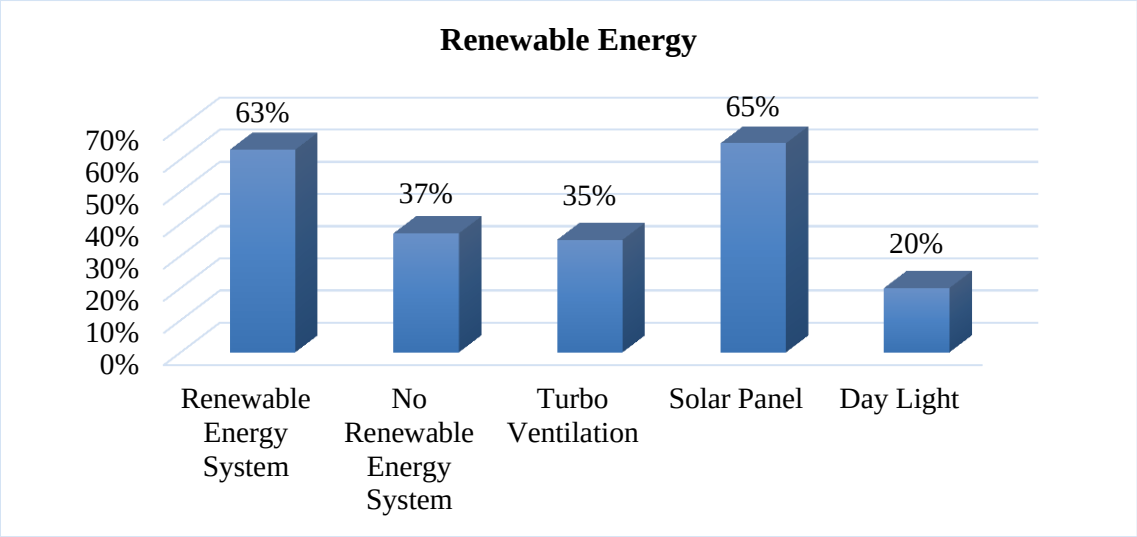

Figure-6: Renewable Energy

Renewable energy is defined as energy that is collected from resources which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat. Because of global warming, world is emphasized more on renewable energy. Now a day organizations as well as industries try to convert renewable energy system from traditional system. The surveyed data showed on figure 6 that 63% (19 out of 30) companies partially install renewable energy system in their industries and offices and 37 % (11 out of 30) still not take any initiative to install renewable energy system.

Among 30 RMG companies, 35% (11 out of 30) used turbo ventilation, 65% (20 out of 30) used solar panel and 20% (6 out of 30) used day light as a renewable energy system for meet up their partial energy demands.

5.3.3 Reduction of Water Consumption

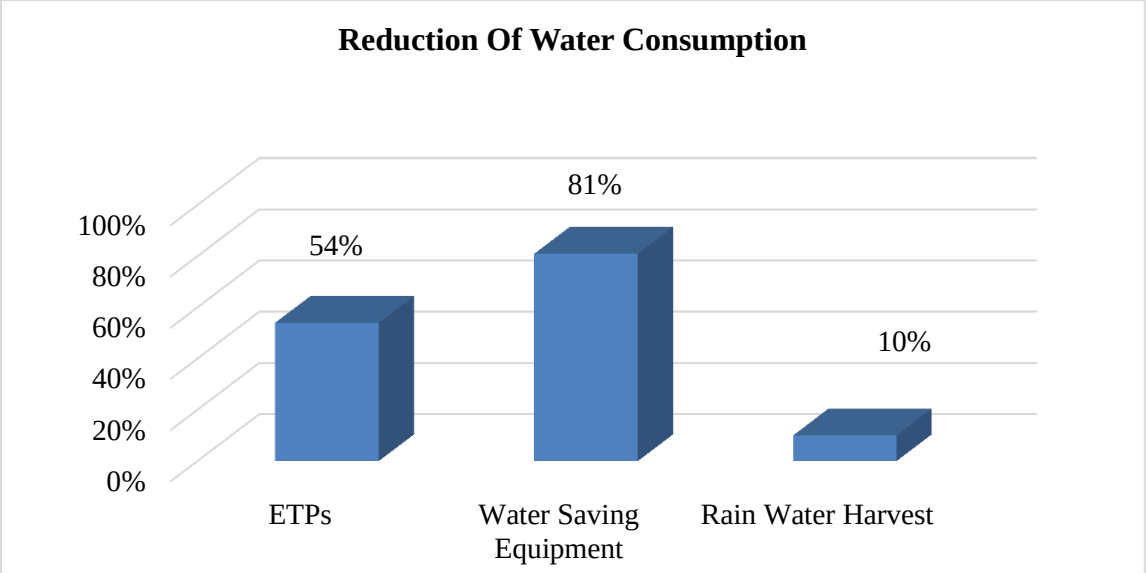

Figure-7: Reduction of Water Consumption

54% (16 out of 30) companies reported that they reused their process water (ETPs treated) that can save their water consumption. 81% (24 out of 30) companies used water saving equipment such as servo motors, air dying machine that can save water consumption in RMG industry. In the study 10% (3 out of 30) companies used their roof top space or free space as rain water harvesting system to re-use the water for fabric dyeing, washing and other purposes which ultimately reduce ground water usages.

5.3.4 Reduction of Noise Pollution

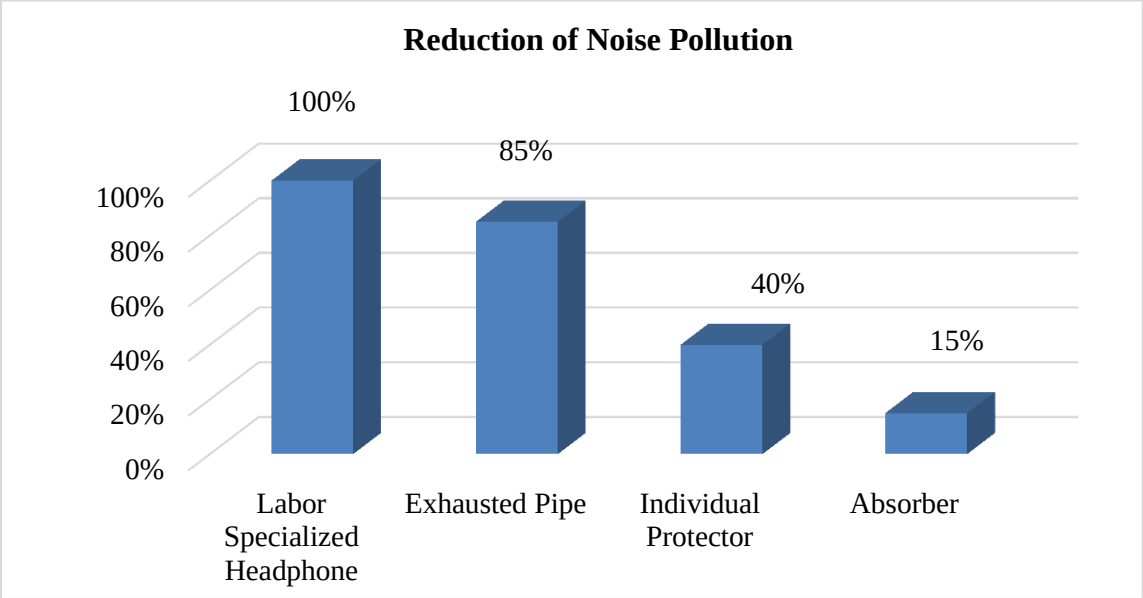

Figure-8: Reduction of Noise Pollution

RMG companies take two types of measure to reduce noise pollution: Active measure and Passive measure. Most of the companies generally take active measures to reduce noise pollution. Figure 8 showed both active and passive measure along with its percentage of usage among the companies.100 % (30 out of 30) companies said that they provided their labor specialized headphone to reduce noise pollution harmful effect and 85 % (26 out of 30) companies used exhausted pipe to wipe out noise from the generator or boiler rooms. 40% firms used individual protector for their labor or using plastic machine enclosure and 15% companies absorb airborne sound by lining their interior walls of the enclosure with an absorber.

5.4 Sustainable Materials

This section discus about purchase or use of sustainable raw materials, accessories, non-harmful chemicals, and non-harmful, recyclable and reusable packaging materials

5.4.1 Sustainable Raw Materials

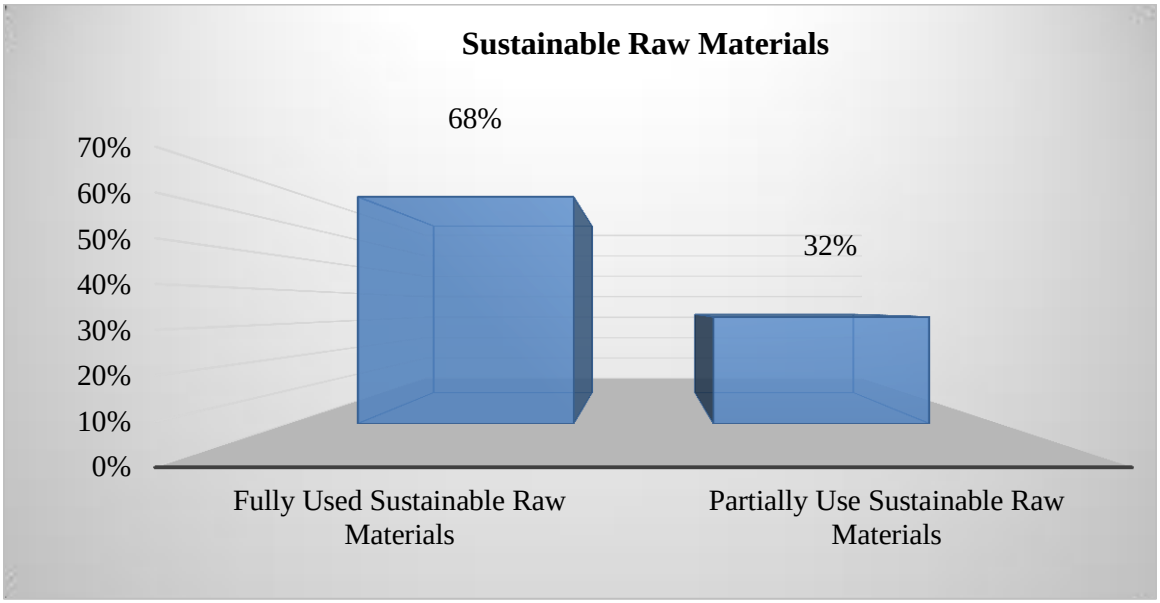

Figure-9: Sustainable Raw Materials

Sustainable raw materials are those components that provide environmental, social and economic benefits while protecting public health and environment over their whole life cycle, from the extraction of raw materials until the final disposal. RMG industry of Bangladesh is highly concern about sustainable raw materials because of the concerns of the high-end-brands as customers. The common sustainable raw materials of RMG industry are cotton, organic linen, recycled polyester, and polyamide. 68% (20 out of 30) companies claimed that they are fully used sustainable raw materials for their production house and rest of 32% (10 out of 30) companies claimed that they partially use sustainable raw materials.

5.4.2 Recyclable or Reusable Materials (Accessories)

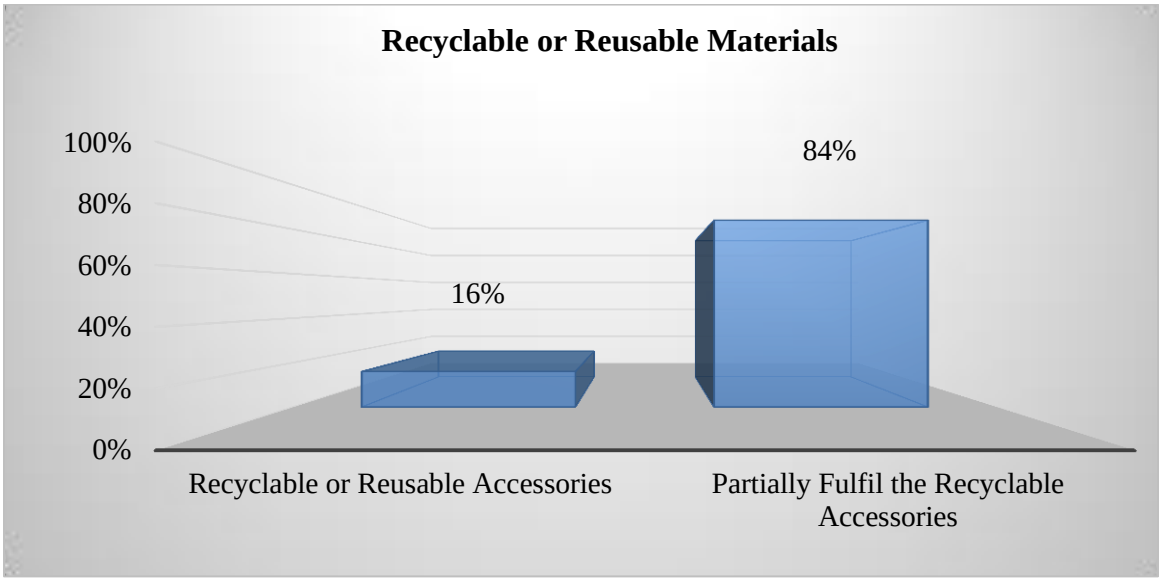

Figure-10: Recyclable or Reusable Materials (Accessories)

Except fabric of garment, the other materials are known as garment accessories. The common garments accessories buttons, zippers, interlining etc. 16% (5 out of 30) manufacturers claimed said that they used recyclable or reusable accessories for their production house and 84% (25 out of 30) claimed that they are partially fulfill the recyclable accessories. But most of the companies said that it depends on buyers requirements and Bangladesh RMG buyers are concern about environment so they usually demands sustainable accessories materials.

5.4.3 Chemicals not Harmful to Human Health

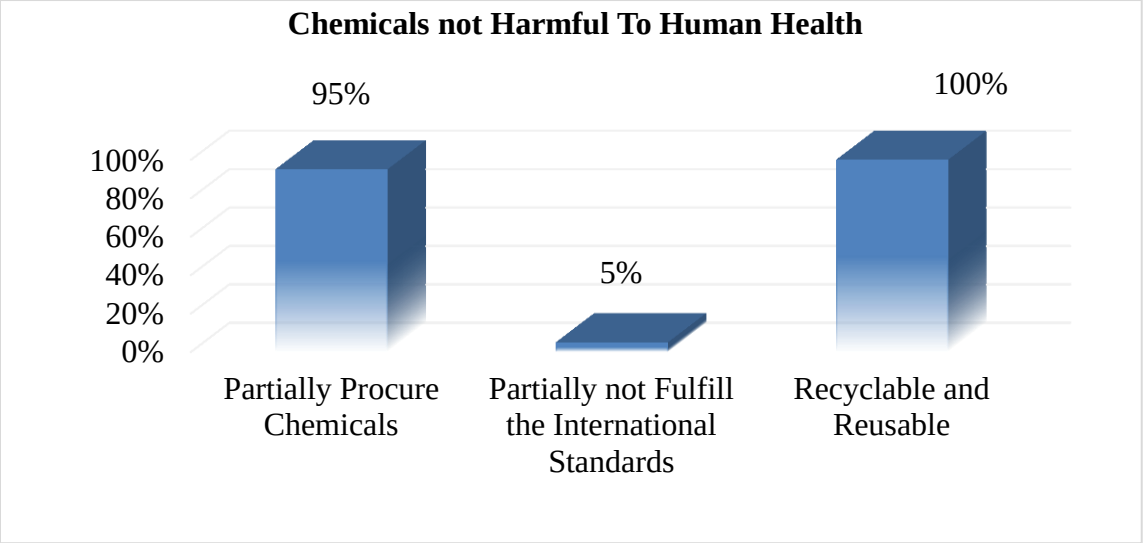

Figure-11: Chemicals not Harmful to Human Health

RMG firms need to use chemicals for fabric color and washing of the garments. According to International standard organization like Oeko-Tex, a firm should use chemicals that are not harmful to human health.

In the study, 95% (28 out of 30) RMG firms partially procure chemicals that are not harmful to human health. The rest 5% (2 out of 30) partially not fulfill the international standards of procuring safe chemicals.

5.4.4. Packaging Materials Not Harmful to Human Health or Recyclable and Reusable

100% (30 out of 30) companies partially used packing materials which is not harmful for human health or environment and recyclable or reusable like purchasing chemicals with refutable dump, purchase bulk among with refutable container and so on.

5.5 Major Findings

This chapter summarizes the results and findings of the study. It attempts to pinpoint answers to the research questions and shed light on the common scenario of green manufacturing practices in the RMG industry of Bangladesh.

Research question 1 raised the discussion topic of consciousness of RMG companies on green manufacturing. Among 30 selected companies all companies are consciousness on it but their level of consciousness is 46% companies are highly conscious and rest 35% and 19% companies are moderately and somewhat conscious respectively. Highly conscious companies on green manufacturing practices have LEED certificate provided by US Green Building council and ISO 14001:2015 and others international certificate. These firms follow waste management, green manufacturing process and sustainable materials almost properly. Rest companies have others certificate along with ISO and partially and fully practice in waste management, green manufacturing process and sustainable materials purchase and usage.

Research question 2 raised the discussion topic of common green manufacturing practice of RMG industry in Bangladesh. This paper shows green manufacturing practices in three areas are: waste management, green manufacturing process and sustainable materials.

Firstly, findings of the report show that the common waste management practices. Among 30 companies, 82% companies have ETPs and 100% companies have selling rejected garments practices. 60% companies used ETPs treated water for gendering and plantation as well as used as flash water for their worker toilets, and 35% companies reused their spinning waste. Organic fertilizer produced by 10% companies and 20% companies reused fabrics are coming from cutting section.

Secondly, green manufacturing process findings show on reduction of energy consumption, usage of renewable energy, reduction of water consumption and noise pollution.

Among 30 firms, common energy reduction practices are using LED light, Servo motors, reusing condensed steam, using co-generation boiler and natural cooling pads, installing dryer exhaust and meters (water flow meter, energy meter, and steam flow meter) to

reduce energy consumption. 63% companies partially use renewable energy in their offices and production plant. The common renewable energy uses in RMG industry are Solar panel, turbo ventilation and day light system.

The common water reduction practices in RMG industry are reused ETPs process water, using water saving equipment and rainwater harvesting. All most 30 companies use active measurements to reduce noise pollution and very few companies use passive measurements.

Thirdly, sustain materials practices findings show on purchasing or using sustainable raw materials, recyclable or useable accessories, non-harmful chemicals, and non-harmful as well as recyclable or reusable packaging materials. Among 30 companies, 68% companies fully and rest 32% companies partially use sustainable raw materials. 16% manufacturers fully used recyclable or reusable accessories, 84% used partially recyclable accessories, 95% firms are partially fulfil international standard not to use harmful chemicals for human heath but 5% companies did not fulfil this criteria.

All 30 companies partially used packing materials which is not harmful for human health or environment and recyclable or reusable

The major findings of this report are divided into two part according to research question. Almost all companies are conscious of green manufacturing where 46% companies are highly conscious. Second part mentioned practices of reduction of energy consumption, water consumption, using of renewable energy, reduction of noise reduction. Companies' practices level on sustainable materials: raw materials, accessories, non-harmful chemicals and packing materials are given lastly.

CHAPTER-6: CONCLUSIONS & RECOMMENDATION

Due to the gradually increasing expenses of energy, industrial contamination, deficiencies of strategic raw materials and natural resources, and ecological disasters, sustainability has become most taking issues nowadays. So, the awareness and movement for saving the environment and reducing pollutions is growing everywhere over the world. Being one of the most polluting parties, the business firms or industries are also being brought to the point of saving environment from pollutions. The Ready-Made Garments is one of the key industries of Bangladesh. This is the biggest and most productive industry which involves a huge number of firms, employees and capital. As environmental considerations are very important nowadays, making the RMG industry concern about green manufacturing practices where firms produce their product that minimize negative environmental impacts, conserve energy and natural resources, are safe for employees, communities, and consumers. The finding of the research is divided into two part: consciousness on green manufacturing and common green manufacturing practices of ready-made garments industry where the common practices is shown on waste management practices, green manufacturing process and sustainable materials procurements practices among the ready-garments manufacturers.

Policy Recommendations

A number of actions can improve the environmental compliance of the textile sector:

- Govt. should need policy reformation to encourage RMG sector in green manufacturing
- Training on waste management.
- To introduce up-to-date technology related to green manufacturing.
- Assistance to small- and medium-sized industrial units to help them adopt and operate ETPs.

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APPENDIX:

Questionnaire

Manufacturer's Name:.....

Address:.....

Email :.....

Website:.....

1. Briefly explain the concept of green manufacturing?

- ◯ Highly Aware
- ◯ Moderately Aware
- ◯ Somewhat Aware
- ◯ Slightly Aware
- ◯ Not at all Aware

2. Did your company take any Local or international certificate in the area of green manufacturing? (LEED -Leadership in Energy and Environmental Design, ISO etc)

- ◯ Yes
- ◯ No

3. Name Five (5) initiatives (top of mind) your company has taken to ensure green manufacturing?

1.....

2.....

3.....

4.....

5.....

Waste Management

4. Did your company implement any of these waste management system (ETP-water, use packing materials to yarn packing, efficient process system?

- ◯ Fully
- ◯ Partially
- ◯ Not at all

Green Manufacturing Process

5. Did your company take initiative to reduce energy consumption? Which one?

.....

6. Did your company implement energy efficient technology to reduce energy consumption?

- ◯ Fully implemented
- ◯ Partially implemented
- ◯ Not at all

7. Does your company use renewable energy? If yes –

Which one?.....That is

- ◯ Fully
- ◯ Partially
- ◯ Not at all

8 . If use, what type of renewable energy?

- ◯ Turbo ventilation
- ◯ Solar energy
- ◯ Others (mention)

9. Did your company take any initiate to reduce water usage?

- ◯ Reused of processed water
- ◯ Using water saving equipment
- ◯ Others (mention) …….....

10. Did you company take initiatives to reduce noise pollution?

1. Actives measurement

- ◯ I. Exhausted pipe
- ◯ II. Headphone

2. Passive measurement

- ◯ I. Blocking airborne sound
- ◯ II. Absorption of airborne sound
- ◯ III.Vibration dumping

Sustainable Materials

11. Do you company purchase or use sustainable raw materials (fabric, yarns etc)?

- ◯ Fully Use
- ◯ Partially
- ◯ Not at all

12. Do you company use or purchase recyclable or reusable plastic(buttons and others) or metals products materials(zippers, metal buttons etc)?

- ◯ Fully Use
- ◯ Partially
- ◯ Not at all

13. Do your company use/purchase chemicals which is not harmful for human or environment?

- ◯ Fully Use
- ◯ Partially
- ◯ Not at all

14. Do your company use/purchase packaging materials which is not harmful for human or environment?

- ◯ Fully
- ◯ Partially
- ◯ Not at all

Thank You