PROSPECT OF RAINWATER HARVESTING IN RMG AND TEXTILE INDUSTRY: LESSONS LEARNED FROM 4 FACTORIES IN BANGLADESH

Md. Zahid Hossain * Imrul Kayes Muniruzzaman, PhD** Hasin Jahan ***

* Programme Specialist-Engineer
** Director-Fundraising and Learning
***Country Director

*, **, *** *WaterAid Bangladesh,*
House 97/B, Road 25, Block A, Banani,
Dhaka 1213, Bangladesh
(E-mail: ZahidHossain@wateraid.org and zahidho@yahoo.com)

ABSTRACT

The export-oriented readymade garments (RMG) and its back-linkage textile industries in Bangladesh are playing a pivotal role in facilitating the country's export earnings, contributing more than 83.4% of total export. The high volumes of water used in RMG and textile sector have become environmental concern because of their dependency on groundwater. To address the water crises, under the 7th Five Year Plan, the government of Bangladesh aims at reducing groundwater dependency through taking some initiatives including the option for rainwater harvesting. Country's average annual 2000 mm rainfall makes rainwater use a feasible option in textile industry. WaterAid Bangladesh has constructed rainwater harvesting system (RHS) at 4 RMG-textile based factories in Narayangonj district. This study demonstrates the potential of RHS considering the catchment area and rainfall intensity at 4 RMG-textile industries. Harvested rainwater is used for production purposes, sanitation, and groundwater recharge. This study shows the potential of RHS for return on investment (RoI), construction feasibility factors, and environmental and social benefit of RHS at RMG-textile based factories.

KEYWORDS: Groundwater, RMG-Textile industry, Rainwater harvesting, Return on Investment. Water security

INTRODUCTION

Some industries i.e. textiles and beverage, etc. make more use of water than their other counterparts. Bangladesh's textile industry consumes 1,500 billion litres of groundwater a year for washing and dyeing fabrics (WPN 2014). Besides using water for production, the offices and factories also need water for their huge number of worker's sanitation and drinking purposes. In Bangladesh, there are 475 ready-made garment and 1750 textile factories (BGMEA & BKMEA). Most of the factories are situated at the central part of the country, closed to Dhaka, in where groundwater depletion rate is high (BADC 2010), and other hand this area has been experienced with an average 2000 mm rainfall annually (BMD 2017). Building roof top of the factory is the best catchment for rainwater harvesting, and every factory under this sector has an average 6000 square meter building roof top. So, there is an opportunity to use the rainwater by utilising small volume reservoir as water demand of this sector is too high.

WaterAid Bangladesh (WAB) has pioneered the installation of large-scale rainwater harvesting system in partnership with factories in Bangladesh. WAB has provided technical support to install rainwater harvesting system which has great potential for further scale-up in the textile industry, front of RMG because of savings in terms of reduced water bills, reduced water treatments costs and the active and visible contribution to environment by reducing dependency on groundwater and minimising waterlogging during monsoon.

STUDY LOCATION:

4 factories are deemed as Case Study for Rainwater harvesting, located at Narayangonj district but closed to Dhaka. Factories are: Fakir Fashion Ltd (23.78430 N, 90.58740 E); Metro Knitting & Dyeing Mills Ltd (23.72720 N, 90.40930 E); Epic Garments Manufacturing Company Ltd (23.767760 N, 90.52460 E) and Next Accessories Ltd (23.79100 N, 90.57230 E). Except Next Accessories Ltd, other 3 factories are composite (textile based RMG)

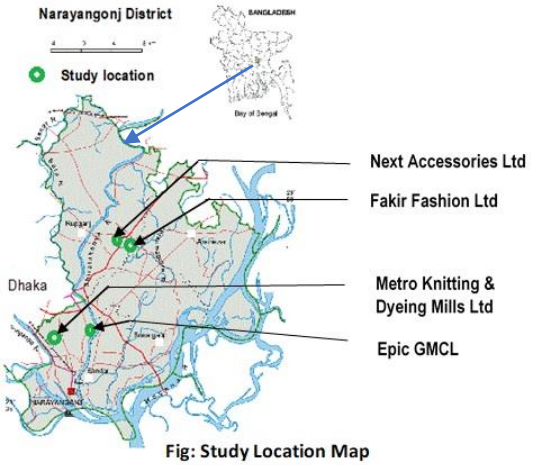


Fig: Study Location Map

METHODOLOGY:

Rainwater is calculated following rainfall intensity, run-off coefficient of roof material and catchment area. Dhaka's rainfall from 1953 to 2017 has been analysed for calculating harvested rainwater. The measurements for the catchment area have been taken directly from physical survey which one is already set up with rainwater harvesting system and which one could be incorporated in future. Rainwater has been tested with different parameters, need for production purposes.

LITERATURE REVIEW

Many literatures have been taken to review with a view to gathering the information about on rainfall pattern and intensity, return on invest and environmental benefit helping to study and research on the above subject. Techno-centric theory as pioneered by O'Riordan (1997) emphasizes the need for environmentally friendly products and clean technology. The economic, social and environmental consciousness of corporation-the tripod goal creates a balance that makes their operations and actions sustainable in business, Elkington (1997). Environmental management strategies including ecological investment is ideal if environmental and social responsibility of businesses is to be achieved to support sustainable economic development. These theories are encapsulated in the United Nation's (UN) definition of sustainable development as 'development that meets the needs of the present without compromising the ability of future generations to meet their own need.

The rainfall patterns in Bangladesh are governed by seasonally varying meteorological system of south-west monsoon, in where monsoon and winter seasons are separated by two transitional seasons namely pre-monsoon and post-monsoon (Quadir et al., 2006). Several studies (Choudhury et al., 1997; Quadir et al., 2001) have reported that the precipitation in Bangladesh has been increasing during the recent decades. Hussain et al. (2001) found that the mean annual rainfall was 2387.20 mm from 1975 to 1995. May to September were the highest rainfall months when the rainfall was more than 300 mm in over 63.80 % of the

years. Karmakar and Mian (1994) stated, the correlation between pre-monsoon rainfall and monsoon rainfall over different station of Bangladesh According to Ahmed and Karmakar (1993). Chowdhury and Debsarma (1992) investigated a significant upward trend of precipitation (by 18%) in the north, west south-west 11 region since the early 70%, and a downward trend in the south-east. Quadir et al. (2003) reported that the average annual over Bangladesh varies from 1429-4338 mm. About 75% of the annual precipitation occurred during the monsoon period, about 15% in the pre-monsoon season and the rest 10% occurred in winter and post-monsoon season. In Bangladesh monsoon, average rainfall varies from 1194 mm to 3454 mm (BBS, 2002). More than 70% of Bangladesh annual rainfall occurs in the monsoon (June-September) season (Hussain and Sultana, 1996; Matsumoto, 1998). The main rainfall during the monsoon season range from 1000 to 3000 mm in the country. The annual rainfall in the country ranges from 1400 to 5800 mm, but its distribution is uneven.

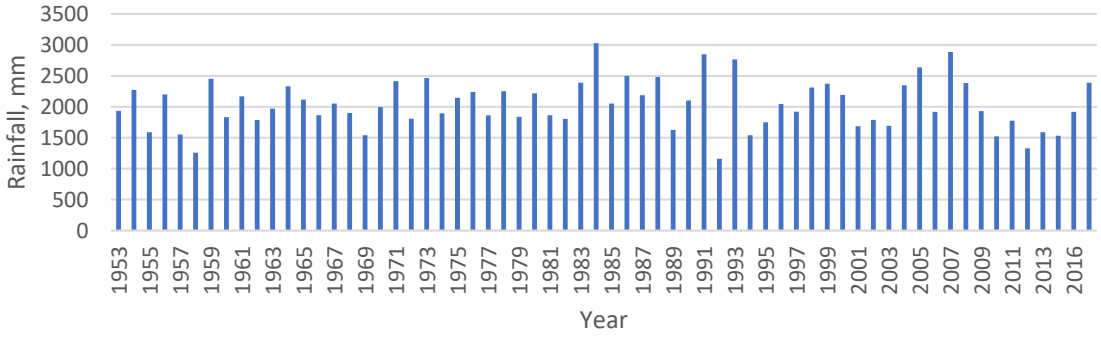
DISCUSSION AND RESULT:

Rainfall intensity in study area:

Availability of rainfall data, rain curve in hydrological map of country and distance between factories to rain gauge station, Dhaka is the best for choosing as rainfall station. Monthly and yearly rainfall from 1953 to 2017 has been collected from Bangladesh Agricultural Research Council (BARC).

Table for yearly rainfall in Dhaka from 1953 to 2017 showed not continuously degradation or upgradation for 6 years but showed a fluctuation which did not follow a time interval. After analysed, it was seen, yearly rainfall was unpredictable from 1953 to 2017. As example, in 1958 annual rainfall was 1258 mm, and next year in 1959 it was 2453 mm, in addition after 45 years it was 1919 mm in 2006 and 2885 mm in 2007, means that there was a huge gap in consecutive two years. On the other hand, another observation was founded, in 1994 annual rainfall was 1540 mm, and since then it was gradually increased up to 1999 with 2374 mm, then it was decreased with fluctuation until reaching 2885 mm at 2007. Rainfall intensity lowest to highest was 1258 mm to 2885 mm respectively, but we can assume an average rainfall in Dhaka is 2000 mm based on analysed and correlation with literature review.

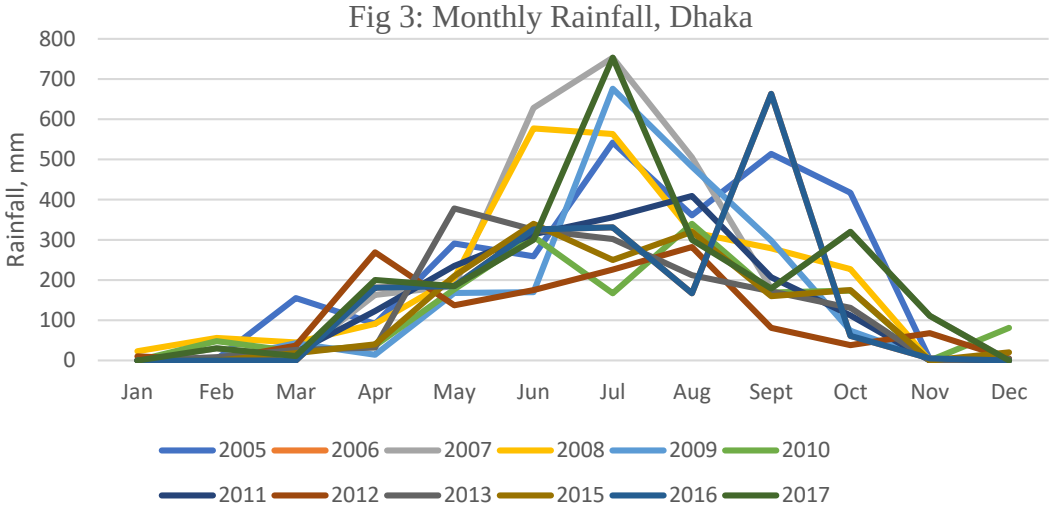
Fig 2: Yearly Rainfall, Dhaka



Source: Bangladesh Agricultural Research Council

From 2005 to 2017, monthly rainfall showed that there was a fluctuation in their intensity, but maximum rainfall has been happening from June to mid of July. But in 2009 and 2016, rainfall was highest in September. Monthly rain pattern is unpredicted.

Fig 3: Monthly Rainfall, Dhaka



Source: Bangladesh Agricultural Research Council

Calculation of rainwater and using purposes for 4 Factories

Calculation for rainwater has been taken considering catchment area with its material and monthly rainfall intensity.

Here the equation is followed

Rainwater = A x I x C

Rainwater is measured, m^3

A= Catchment area, m^2

I = Rainfall intensity, m

Runoff Coefficient = 0.8 to 0.9

Fig 4: Catchment Area for RHS

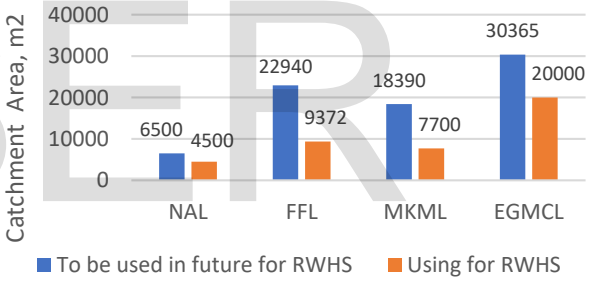
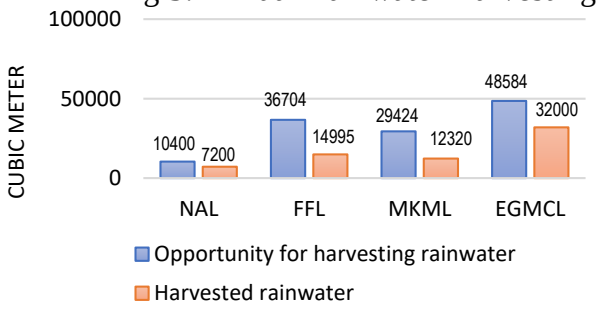


Fig 5: Annual Rainwater Harvesting



Next Accessories Ltd (NAL):

Under present RWHS, 7,200 m^3 rainwater is to be harvested annually at NAL. Among 7200 m^3, 3,000 m^3 is to be used for toilet flushing purposes and rest 4,200 m^3 is to be used for underground water recharge. Still having the opportunity to incorporate additional 2,000 m^2 catchment when 10,400 m^3 rainwater would be harvested.

Pic 2: Catchment, Pipe networking and Storage

Fakir Fashion Ltd (FFL)

Under present RHS, 14,995 m^3 rainwater is to be harvested annually at FFL. Total rainwater is to be used for cloth washing and dyeing purposes. Still having the opportunity to incorporate additional 13,568 m^2 catchment when 36704 m^3 rainwater would be harvested.

Pic 3: Catchment, Pipe networking and Storage

Metro Knitting & Dyeing Mills Ltd (MKML)

Under present RHS, 12320 m^3 rainwater is to be harvested annually at KKML. Total rainwater is to be used for cloth washing and dyeing purposes. Still having the opportunity to incorporate additional 10,690 m^2 catchment when 29924 m^3 rainwater would be harvested.

Pic4: Pipe networking and Storage

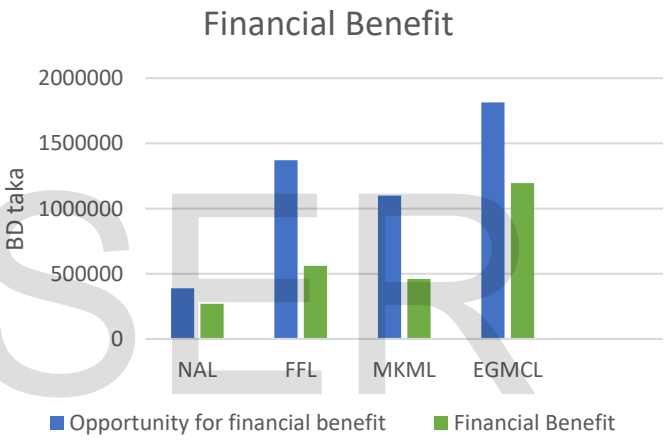
Epic Garments Manufacturing Company Ltd (EGMCL)

Under present RHS, 32,000 m^3 rainwater is to be harvested annually at Epic GMCL. Total rainwater is to be used for cloth washing purposes. Still having the opportunity to incorporate additional 10,365 m^2 catchment area when 48,584 m^3 rainwater would be harvested.

Pic 1: Catchment, Pipe networking and Storage

Tangible Benefit

a) Water pricing cost



EGMCL is situated at Adomzee Export Processing Zone (EPZ), and they are not allowed to extract groundwater as Bangladesh Export Processing Zone Authority providing groundwater to factory in EPZ at the rate of BDT 37.35 per cubic meter. Rainwater Harvesting System will save BDT 11,95,200 annually and could increase BDT 18,14,600 if more catchment area is incorporated that has opportunity. So, considering the same pricing rate, NAL will save annually BDT 2,68,920 and could increase BDT 3,88,648 if extend catchment area; FFL will save annually BDT 5,60,063 and could increase 13,70,894 BDT if incorporate more catchment area which has opportunity to be included in future and MKML will save BDT 4,60,152 annually and could increase 10,98,986 BDT if incorporate more catchment area which are in adjacent to RWHS.

b) Water quality and treatment cost

For dyeing and washing processing, some standard in water quality parameters need to maintain, like colour less, iron free and hardness should not exceed 5 to 7 mg/l. In this regard, FFL and MKML are treating the groundwater to make it iron free and keep hardness below 7 mg/l. For this treatment purpose, without capital cost of treatment plant they need 9 BDT for treating per cubic meter groundwater. However, rainwater which was tested in factories, showing that is colour less, iron free and hardness near to 6 to 7 mg/l. So, 1,35,000 BDT and 1,10,000 BDT will be saved for FFL and MKML respectively as no need treatment for rainwater. Here rainwater is being stored through passes a stone bed filter which is enough to make it fit for dyeing and washing purposes.

Indirect Benefit

a) Environmental benefit:

Though reducing dependency on groundwater is not too much for textile industry by RHS but significant considering the volume of rainwater that has been using. As example, 4 factories currently harvesting 66515 m^3 rainwater which could meet up yearly 1215 people's water demand (150 litres/person/day) in community. NAL also recharging the groundwater which is best practice with a view to replenish the aquifer eventually making a balance in environment.

Waterlogging has been created due to heavy rainfall, poor drainage facilities and uplifting water body's bed, a common picture of the country. Last couple of years, it has been seen that rain day is shorten, but intensity of rainfall is increased which is main cause to make sudden flood or inundation. In April 2017, within 24 hours 48 mm rainfall was happened and 3 factories' premises were inundated for few hours which hampered their productivity. So, RWHS reducing the drainage volume which has financial and environmental benefit also.

b) Social benefit:

RHS has been contribute the factory to be green factory which draws the attention to buyers, government, policy makers, civil societies positively, and eventually contributing to extending their brand. 4 factories getting extra benefit by RHS, one is meeting the demand of H & M, a big buyer in Bangladesh, as they are choosing the RMG factory which has RHS. RHS also contributing for getting LEED certificate as it helps to increase the score.

Return on Investment and Environment

For constructing the RHS at 4 factories, average 30 lakh to 40 lakh BDT were spent. So, 5 to 10 years is needed to recover the investment in where structural life span of RHS in average 60 years.
Environmental benefit is huge, interms of reducing dependency on groundwater and refilling the aquifer. Besides, drainage management specially during heavily rainfall day.

CONCLUSION REMARK

Against the water demand in textile, harvested rainwater is very less. However, utilization the rainwater in industry has been exploring a significant benefit as it includes environmental, social and economic benefit, ultimately contributing to sustainability in broader space.

REFERENCE

Website of Bangladesh Garment Manufacturers and Exporters Association (BGMEA) and Bangladesh Knitwear Manufacturers and Exporters Association

Published a report on 2014 by partners for water programme of the Netherlands (WPN)

Rainfall data from Bangladesh Agricultural Research Council

Newsletters of PaCT (Participatory clean textile)

Groundwater Zoning map-2004 and 2010 developed by Agricultural Development Corporation

Elkington, J. (1997). Cannibals with forks: The triple Bottom line of 21st Century Business, London. Capstone.

Reference: O' Rindun, T. (1997). Environmentalism, London. Pion Books

Quadir DA 2006: Climate variability of Bangladesh. Contribution to monsoon Asia Integrated Regional Study (MAIRS). SMRC, Dhaka

Ahmed, A.U. and Haque, N., 2002: Climate Change and Sustainable Development. Paper presented at the Dhaka Meet on Sustainable Development, March 14-18, 2002.Incorporated in Q.K. Ahmad and A.U. Ahmed (eds.), Citizens' Perspectives on Sustainable Development, Bangladesh Unnayan Parishad (BUP).

Ali MM, Ahmed M, Talukder MSU and Hye M A 1994: Rainfall distribution and agricultural droughts influencing cropping pattern at Mymensingh region. Progressive Agriculture, 5: 197 204.

Basak, J. K, Titumi, R. A. M. and Dev, N. C., 2013: Climate Change in Bangladesh: A Historical Analysis of Temperature and Rainfall Data, Journal of Environment (2013), Vol. 02, Issue 02, pp. 41-46

Elahi, F. and Khan, N. I., 2015: A Study on the Effects of Global Warming in Bangladesh: 2015, International Journal of Environmental Monitoring and Analysis 2015; 3(3): 118-121, Published online April 17, 2015 (http://www.science publishinggroup.com/j/ijema) doi10.11648/j.ijema.20150303.12 ISSN: 2328-7659 (Print)

Folland, C.K., Kari, T.R. and Vinnikov, E.Ya.1990: "climate change: The IPCC Scientific Assesment", Cambrige University Press, Cambridge.

Hussain MA and Sultana N 1996: Rainfall distribution over Bangladesh stations during the monsoon months in the absence of depression and cyclonic stoilils. Mausam. 47: 339-348.

IPCC WG-I 2001: Summary for the policy markers climate change 2001: Scientific Basis . Intergovernmental Panel on Climate Change, WMO, Geneva Switzerland p. 20.

Karmakar S 2004: Regression forecasting pre-monsoon rainfall in Bangladesh. Proc. of SAARC Seminar on Agricultural Applications of Meteorology during 23-24 December 2003 held in Dhaka, Bangladesh.p.101.

Karmakar S and Main ER 1994: Regression forecasting of monsoon rainfall in Bangladesh, paper presented in the seminar on monsoon dynamics held at the German Cultural Center Dhaka, Bangladesh, November 1, 1994.