Existing Practices and Utilization of Rainwater to Minimize the Water Use in Textile Industry: A Review of Industrial Implementation

Shubhra Bhattacharjee
Target Australia Sourcing Ltd.
Bangladesh

Bohnni Saha
Dhaka University
Bangladesh

ABSTRACT: *It is necessary to diminish the reliance on fresh water consumption to produce dyeing fabric in textile industries. A semi structured questionnaire used to address water risk, current status and best practices of 21 factories of Gazipur district of Bangladesh. 50 mid and top level employees were interviewed during March – August 2015. 67% of survey factories were dependent on ground water and 95% of factories mentioned that water was easily available. There was no water conservation system available in 92% of factories however 70% of surveyed factories mentioned that they faced continuous challenges to extract ground water due to nearest factories. Metrological information of study area explicated that significant amount of precipitation recorded over the decades and no significant variation noted in recent years. However, there was a sharp declination of ground water level noted since 1998 which represented the excessive water extraction due to rapid industrialization. 1 of 21 factories introduced rainwater conservation system and used rainwater during the monsoon season. This initiative assisted them to save US$ 1440 annually. Considering the economical and environmental benefits, it is necessary to introduce the rainwater conservation facility in textile industries.*

Keyword: Rainwater, Textile Industry, minimization of ground water use, water conservation

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1. Introduction

Sustainable development refers the economic development with protecting the resource base and environment for future generation. However, to achieve remarkable economic growth, massive industrial establishment requires nonrenewable resource extraction and its utilization which may cause environmental degradation and pollution.

Gazipur is the nearest district of Dhaka witness the rapid industrialization. Location and availability of natural and human resources lead the area favorable for textile industry. As a result, the number of textile industries is growing in a rapid pace. This industry uses large volume of water (approximately 200 liters of water require to produce 1 kg of dyed fabrics) and discharge large volumes of waste water to nearest water body [1]. Thus, these dye houses have notorious impact on environment especially on water of Bangladesh [2]. Absence of adequate water resource and minimization of water use impede the sustainable development and ignite the conflict food security and industrialization [3].

Today there is an enormous pressure for minimizing the fresh water use and reuse waste water [4]. Growing water demand and fresh water scarcity thrust textile industries to introduce mechanism for optimum water use and identify the alternative source of water as well. Rain water harvesting in domestic and commercial place is not a new topic for developed countries however, limited use identify in textile industries [5].

The present paper is an attempt to address the source of water, availability and price, risk associated with water, nature of risk and distribution of organization's perception, use of treated water and conservation and of selected factories of Gazipur, Bangladesh. Besides, this paper also discusses the precipitation status of the study area and case study of a textile that implement rain water harvesting technology.

2. Methodology

In order to achieve the objective of the study, a semi-structured questionnaire used to interview the mid and top level management. Fifty respondents of twenty one textile industries were interviewed during March to August 2015. SPSS used to analysis and represent the data. Regarding precipitation amount, pollution level, water use data and other information were collected from different literatures.

3. Results

It was found that groundwater is the major source of water for textile industries in Gazipur Bangladesh. 62% of those surveyed factories used ground water as a major source of water. Surface and municipal supplied water were other source of water for textile industries (Figure 1). Only 4.5% of factory used all three sources to produce textiles.

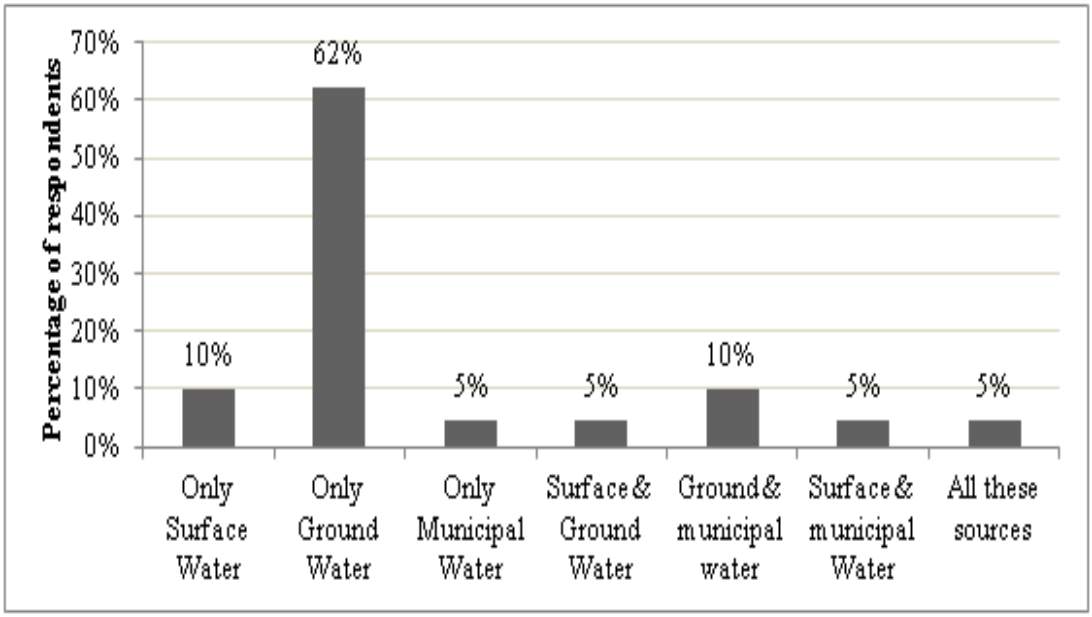


Figure 1. Source of water for textile industry

About 95% of responded factories mention the easily availability of water. Besides, factory responded the pricing of water was not higher for companies. None of the factory mentioned that water was not available or price was barrier for production (Figure 2).

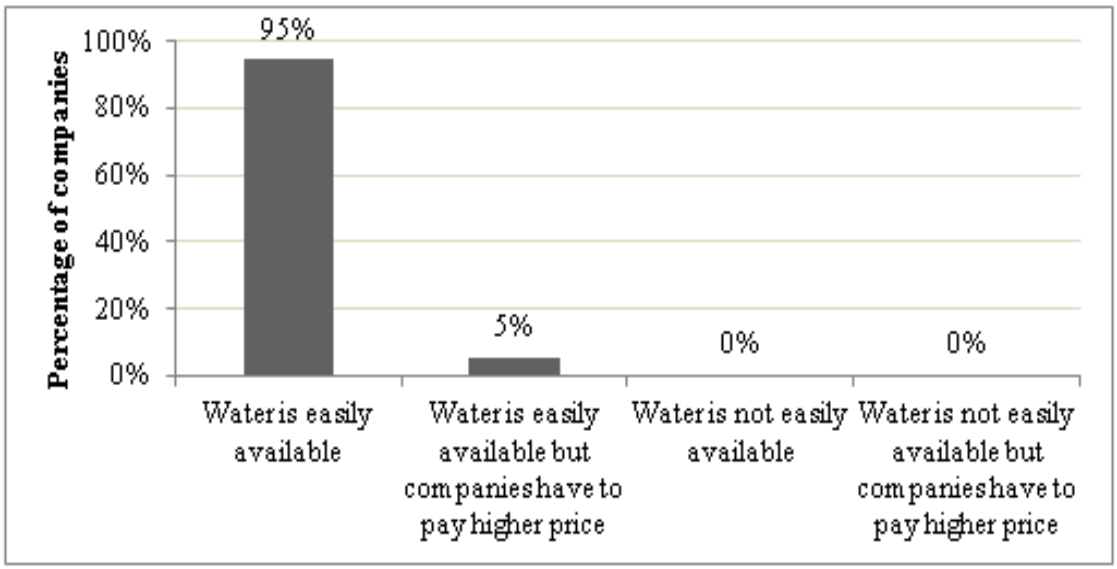


Figure 2. Availability and water price for textiles

Figure 3 illustrated the reuse and water conservation techniques. 92% of surveyed factories had no water conservation techniques. Rain water storage and use facility found in 1 factory. Similarly 1 factory introduced greywater treatment and reuse facility.

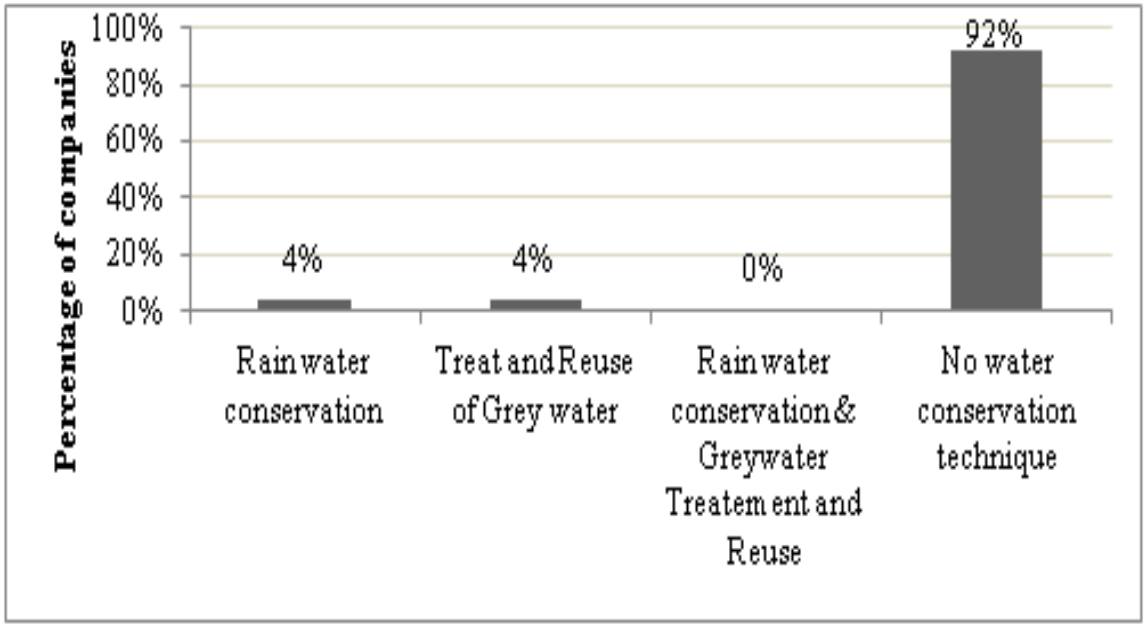


Figure 3. Water conservation techniques of factories

67% Responded factories consumed 20,000 – 50,000 liters of water per month. Less than 20,000 liters and more than 50,000 liters of water were consumed by 19% and 14% factories respectively (Figure 4).

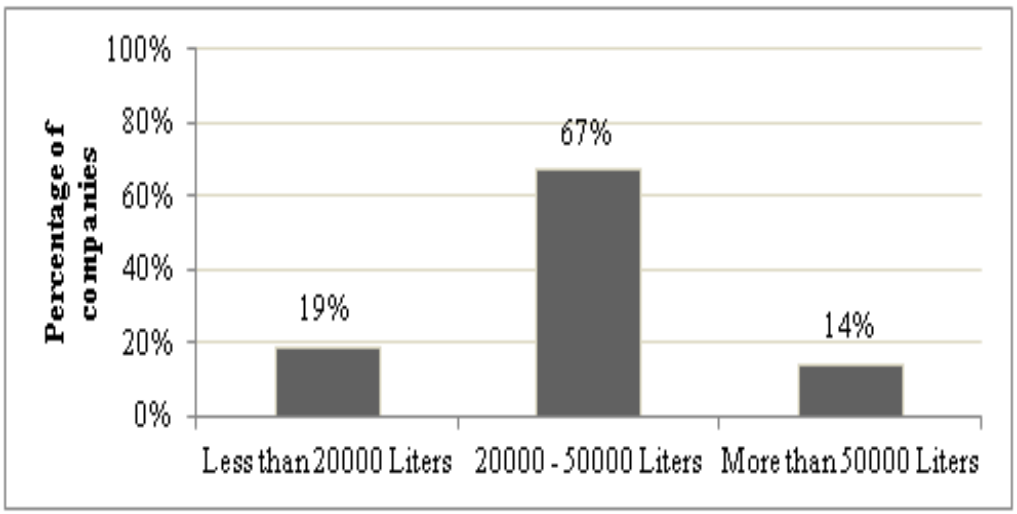


Figure 4. Monthly water consumption of surveyed textiles

70% of those survey factories mentioned that there was an increasing pressure with nearest factories for obtaining water. Inadequate water availability was addressed among 10% of factories. Poor water quality, high cost for obtaining water and environmental policy was a barrier identified among 5% factories. Figure 5 illustrated the risk associated with the water.

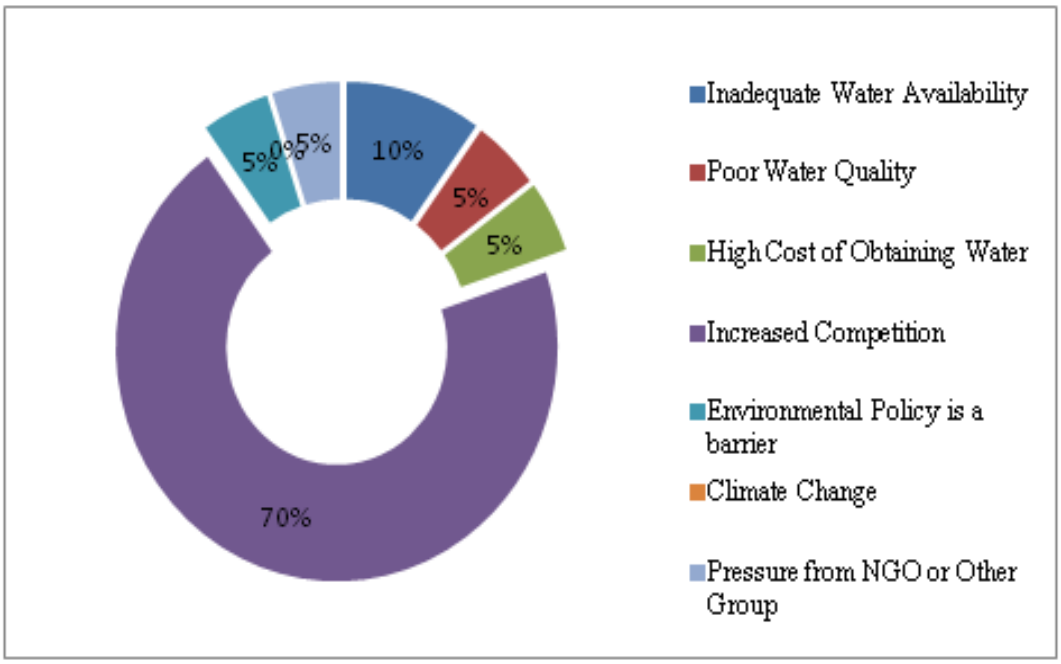
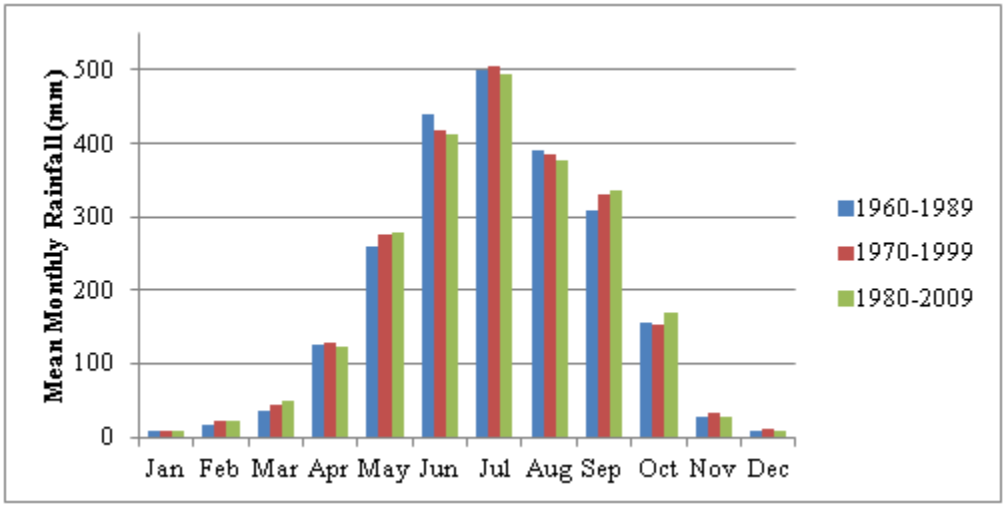


Figure 5. Risk associated water

Figure 6 described the mean rainfall status of different months of Bangladesh during the period of 1960 to 2009. Maximum rainfall noted in the month of July and minimum precipitation addressed during December to January. The average rainfall and river erosion status of Gazipur district during 2008 – 2011 was illustrated in the Table 1. Dhaka and nearest area noted a sharp decline of ground water for the period of 1996 to 2009 (Table 2).



Source: Ministry of Food and Disaster Management, 2012 [6]
Figure 6. Monthly mean rainfall status of different months

Year	Average rainfall (mm)	River erosion
2008	2197	No
2009	1912	No
2010	1181	No
2011	1777	No

Table 1. Rainfall and River erosion status during the year 2008 – 2011

Source: Bangladesh Bureau of Statistics, 2013 [7]

Figure 7 illustrated the water conservation techniques of surveyed factories. 71% of responded factories discharge the water through drain. Use of treated water for gardening purpose was performed by 24% factories. Only 1 factory used treated water for horticulture.

Factory who introduced rain water conservation facility used rain water for dyeing the knit fabric and met 25% of water consumption during June to August. Only US$ 625 cost to build the entire system. Figure 8 illustrated the rain water harvesting technologies of this factory.

Year	Ground Water Level (m)
1996	27.60
1997	28.15
1998	30.45
1999	31.86
2000	34.18
2001	37.78
2002	42.00
2003	46.24
2004	50.60
2005	57.42
2006	59.72
2007	61.18
2008	64.27
2009	67.12

Table 2. Ground water status of Dhaka city and nearest area including Gazipur

Source: Groundwater Monitoring Survey Report, BADC 2010 [8]

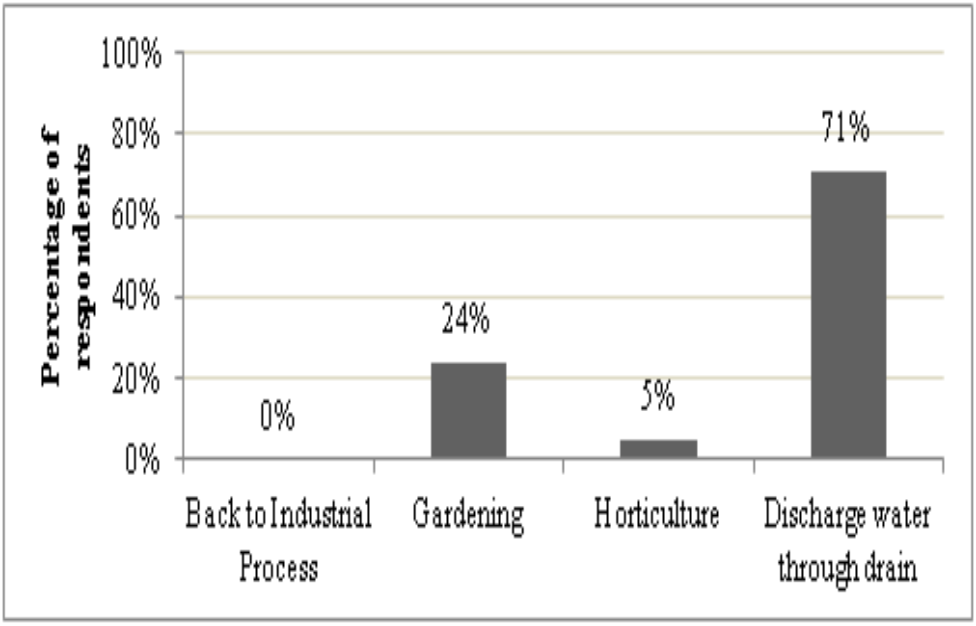


Figure 7. Status of treated water

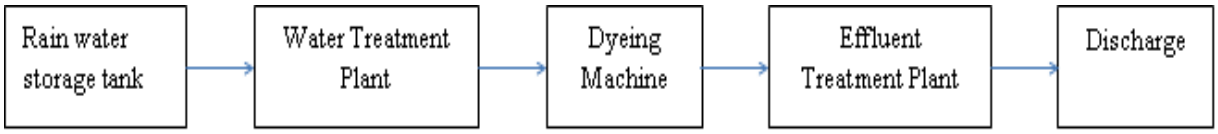


Figure 8. Schematic diagram of rain water harvesting of textile

4. Discussion

The growing water demand and continuous thrust from environmental legislation were common challenges for industries. The present study showed that using of rain water was an alternative source of water to meet the demand partially in textile industries since there was enough precipitation recorded in recent years.

The main water source for the textiles was ground water. Few factories were dependent upon surface or municipal water. Since there was no strict environmental legislation about extracting ground water thus, factories mostly reliant on ground water. Moreover, the price of ground water was not expensive thus, factory extracted water in uncontrolled manner. Patricia et al. (2011) described the similar practices and pricing of Brazil where most of the industries used ground water due to availability and inexpensive in nature [9].

There was a substantially water demand identified for growing number of textiles in recent decades. The observation of present study indicated that the ground water level was depleting remarkably due to uncontrolled extraction for industrial and agricultural activities. Total annual recharge did not meet the total annual extraction rate which caused this diminution. Similar observation was noted by other researchers during 1982 to 2007 [10], [11], [12].

The precipitation data explicated that Gazipur situated in a place where significant amount rainfall noted over the years. As reuse of waste water was not practiced thus rainwater can significantly diminish the water pressure. To reduce pressure on ground water, a factory introduced rain water harvesting system and found approximate 25% of water saving during June to August. This also allowed factory to save money. For extracting ground water, it cost US$ 0.10 m^3 at 800 m^3/h flow rate. Thus, factory saved annually approximate US$1440 from rain water harvesting. Feres et al. (2008) identified similar types of findings of Brazil where price of water was inexpensive and only few industries were partially reliant on rainwater [13].

Conclusion

There is significant depletion of water level address in recent years in industrialized area which may pose serious water scarcity in upcoming years. Since textile industry dependent on water thus it is necessary to induce water conservation techniques and establish rainwater harvesting system. To achieve sustainable development in textile sector, rainwater harvesting is able to play significant role.

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