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Environmental impact on green industrialization of Bangladesh

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Abstract

The main objective of the study was to determine and describe the environmental impact on green industrialization of Bangladesh. It was measured by computing change in building and structural integrity of factory, water and water re use, work place environment and safety, transport and source of energy, factors affected in green industry, operational and maintenance cost of factory and their contribution towards Green industry of the respondents after their involvement with green industry development activities. Data were collected from a sample of randomly selected 58 factories in Dhaka, Narayanganj and chattogram District from April 2019 to July 2019. The standardized partial 'b' co-efficient of the above 14 independent variables formed the equation contributing to 51.8 per cent of the total variation in green industry. The average building and structural integrity of the RMG entrepreneurs increased 3.095, water and water re use in the green industry of the RMG entrepreneurs increased 3.071, work place environment and safety in the green industry of RMG entrepreneurs increased 2.304, transport and source of energy in the green industry of RMG entrepreneur increased 2.548 and factors affected in green industry of the RMG entrepreneurs increased 7.182 after involvement of green industrialization activities. Findings indicate that in building and structural integrity of the factory, water and water re use, work place environment and safety, transport and source of energy, factors affected in green industry, operational and maintenance cost of the factory and Their Contribution Towards Green industry of the respondents increased significantly due to participation with green industrialization.

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Introduction

The Green Industry promotes sustainable patterns of production and consumption i.e. patterns that are resource and energy efficient, low-carbon and low waste, non-polluting and safe, and which produce products that are responsibly managed throughout their lifecycle. The Green Industry agenda covers the greening of industries, under which all industries continuously improve their resource productivity and environmental performance. It also aims to create green industries, that deliver environmental goods and services in an industrial manner, including, for example, waste management and recycling services, renewable energy technologies, and environmental analytical and advisory services. The greening of industries has become a core determinant of economic competitiveness and sustainable growth of the Sustainable Development Goals (SDGs) oriented activities. Since resource inputs represent an important production cost for industries, improving efficiency gives industries a competitive advantage. The greening of industries also plays vital role in poverty alleviation of the country as well as eco-friendly environment through promoting energy security, occupational health and safety, jobs creation, and reducing costs through increased productivity of the RMG sectors of Bangladesh. As the world faces an environmental crisis that affects in many facets, economic progress is to be done in such a way that environmental considerations must be deliberated. As the world is moving forward towards a greener economy, industries are adopting policies that strive towards this goal. Bangladesh is falling in line with these policies and adopting green principles for different industries, namely the garments sector. One of the main tools towards achieving this goal is by certain guidelines that aid in the betterment of the industry for eco-friendly in the RMG sectors of Bangladesh.

A green industry is one which is environmentally friendly in all aspects. This industry is not harmful to the environment as traditional industries. A green industry does not put industrial production above and all at the expense of the natural environment and human health (Hall and Dickson, 2011). A green industry aims to build an industry that intertwines environmental and social consideration with economical considerations of the environmental manners. In a broader sense, a green industry is one that sustainably uses any inputs, where production process requires less use of water, energy, and materials, where solid waste is reused and recycled, any emission of harmful gases are reduced, and production process is free from harmful human toxins. A green industry takes an approach towards any form of growth by reducing its impact on the environment while taking into account of environmental criteria that may or may not directly relate to the development at hand, but to the ecosystem of the world at large. A green industry can help them to reduce costs, fight climate change, re-think long-held business practices and open doors to a myriad of opportunities (Fineman and Clarke, 1996).

Materials and method

Sample size

Bangladesh Bank (BB) has updated its definition of micro, cottage, small and medium enterprises in line with the National Industrial Policy 2016. In National Industrial Policy 2016 Large RMG Industry is defined as the factory that has more than 1000 worker and Medium RMG industry that has utmost 1000 workers. But in case of small RMG factory, the definition does not match with the real scenario. That's why we have defined a factory as small Category if the factory has workers not more than 500. However, some heavily capital intensive factory will not be covered by this self-defined definition. For this, it has considered 3 stratums depending on the size of the factory and their production capacity: small, medium and large.

Population and sampling procedure

The proposed study is expected to depend heavily on the sample size 58 Green factories. Study framework will be developed on the structural questionnaire framework from the factory including top and mid-level managements. For collecting factory based

primary data, specially designed questionnaires will be employed. As the study aims to collect case study based primary data, mainly will be collect primary data from mid and top level management in the factory level. In addition to this, information will also be collected to understand the nature of capacity building framework for green industry.

Sampling frame and procedure

The proposed study will conduct field research survey in three clusters including Dhaka, Narayanganj and chattogram Firstly, Using stratified systematic sampling based on RMG industry category's status factories will be selected. In this study selected three types of factories such as (i) Large Factories (ii) Medium Factories and (iii) Small factories (National Labour Act of Bangladesh 2013). An extensive and in-depth questionnaire will be developed to collect basic information and related data to assess the existing situation of industry.

Statistical treatment

On the basis of objectives of the study after data collection, data will be compiled, coded and analysed. The statistical measures such as range, mean, percentage distribution, standard deviation, rank order, categories etc. will be used to interpret the data. Pearson's Product Moment Correlation Coefficient (r) and regression tests will be used to influence of different variables of the study. To comprising the before and after paired t test are used to measure the variables. Using descriptive statistics, the data will be analyse in terms of frequency distribution and percentage using SPSS as raw data was difficult to understand for meaningful conclusions to be made. The data was presented using tables, frequencies, figures, and percentages.

Measurement of the variables

Environmental Impact of green industry activities of the beneficiaries was measured on the basis of the extent of change occurred in three selected dimensions as a result of their involvement with the green industry activities. The measurement of the selected dimensions was as follows.

Water and waste re use

It was measured on the basis of the extent of change occurred in 5 selected dimensions. This five dimensions had two situation-'before' and 'after' all before situation's score had added together and same case for after situation. Finally change in water use ad re use score was measured by computing between 'before' and 'after' situation. A score of one (1) was assigned for each materials used for the factory and 0(zero) for non-used the materials**.**

Workplace Environment &Safety issue

It was measured on the basis of the extent of change occurred in 5 selected dimensions. It referred to the condition of environmental safety issue of the beneficiaries factory both "before" and "after" involvement with Green industry. These responses were scored as 0 for "no ", 1 for " yes". The change in Environment &Safety issue was measured on the basis of housing unit score of the respondents between "before" and "after" involvement with Green industry.

Transports and source of energy

It was measured on the basis of the extent of change occurred in 5 selected dimensions .It referred to the type of toilet facilities of the respondents both "before" and "after" involvement with green industry. Each respondent was asked to indicate whether the transport facilities were squatting "alternative transport", "staff bus" and "on foot".

The Source of Energy used in Factory was measured on the basis of transport and energy score of the respondents between "before" and "after" involvement with green industry in RMG sectors. A score of one (1) was assigned for each materials used for the factory and 0(zero) for non-used the materials.

Climate smart agriculture (csa) practices to established green industry

Knowledge level on Climate Change: Knowledge is those behavior and test situations which emphasized the remembering either by recognition or recall of idea, material or phenomenon (Bloom *et al.*, 1956). In

this study Climate change knowledge would be indicated by the extent of understanding harmful effects of climate change. It will be measured as evident from his responses to a set of questions related to climate change those would be logically and scientifically prepared for this purpose at the time of interview. Score (01) will be given for each of the correct answer and (0) will be given for no or incorrect answer.

Result and discussion

Change in building and structural integrity of the factory

The findings indicate that the average building and structural integrity of the factory of the RMG entrepreneurs increased 3.095 to 2.388 at 95 % confidence interval of the difference after involvement of the green industry activities. Data presented that the mean difference was building and structural integrity of the factor 2.741 after their involvement with green industry activities was than that of "before joining" and this difference was statistically significant (t = 15.522 at 0.01 percent level of probability with 57df shown at table 4.

Ali (2003) in his study observed that 52.48 percent of the respondents had low income difference, 45.54 percent medium difference and 1.98 percent high income difference in Micro-credit programme of BRAC.

Table 1. Defining of Small, medium and large categories of RMG factories.

Sl. No.	Size of Factory	Number of employed workers
01.	Small	499
02.	Medium	500-999
03.	Large	1000 or above

Change in water and water re use in green industry

The findings indicate that the average water and water re use in the green industry of the factory of the RMG entrepreneurs increased3.071 to 2.274 at 95 % confidence interval of the difference after involvement of the green industry activities. Data presented that the mean difference was building and structural integrity of the factor 2.672 after their involvement with green industry activities was than that of "before joining" and this difference was statistically significant (t = 13.437 at 0.01 percent level of probability with 57df) shown at table 4.

Table 2. Location and category of factory.

Location	Factory Category			Total
	Large (A)	Medium (B)	Small (C)	
Dhaka	13	8	11	32 (55.17%)
Narayanganj	6	6	4	16 (27.59%)
Chittagram	3	3	4	10 (17.24%)
Total	22 (37.93%)	17 (29.31%)	19 (32.76%)	58 (100%)

Values in parenthesis are in percentage.

The average water and water re use in the green industry of the factory of the RMG entrepreneurs increased to 2.388 at 95 % confidence interval of the difference after involvement of the green industry activities. Data presented that the mean difference was building and structural integrity of the factor 2.741 after their involvement with green industry activities was than that of "before joining" and this difference was statistically significant.

Table 3. Method of primary data collection and sample size of the study.

SN	Survey Methods	Respondents	Sample Size factories	respondents	Tools Used
1.	Individual Interview	Key representative from factory	58	58	Structured and standardized questionnaire (well pretested)

The average water and water re use in the green industry of the factory of the RMG entrepreneurs increased to 2.388 at 95 % confidence interval of the difference after involvement of the green industry activities. Data presented that the mean difference was building and structural integrity of the factor 2.741 after their involvement with green industry activities was than that of "before joining" and this difference was statistically significant.

Table 4. Dimensions of change in green industrialization of RMG sectors of Bangladesh.

Dimension of Change	Indicators	Mean	Mean paired Difference	St. Deviation	St. Deviation difference	Paired t test with 57 df	Value of co-efficient of co relation (r)
Building and structural integrity of the factory	After	4.47	2.741	1.012	1.345	15.522	0.232
	Before	1.72		1.152			
water and water re use	After	4.64	2.672	0.873	1.515	13.437	-.029
	Before	1.97		1.213			
Work place environment and safety	After	4.91	1.845	0.470	1.745	8.051	-0.037
	Before	3.07		1.663			
Transport and source of energy	After	4.41	2.172	.859	1.428	11.584	.087
	Before	2.24		1.218			
Factors which affected in green industry	After	8.84	6.707	.644	1.807	28.275	.226
	Before	2.14		1.840			

Change in Work place environment and safety of green industry

The findings indicate that the average work place environment and safety in the green industry of the factory of the RMG entrepreneurs increased 2.304 to 1.386 at 95 % confidence interval of the difference after involvement of the green industry activities. Data presented that the mean difference was building and structural integrity of the factor 21.745 after their involvement with green industry activities was than that of "before joining" and this difference was statistically significant (t = 18.051 at 0.01 per cent level of probability with 57df) shown at table 4.

Change in Transport and source of energy of green industry

The findings indicate that the average transport and source of energy in the green industry of the factory of the RMG entrepreneur increased 2.548 to 1.797 at 95 % confidence interval of the difference after involvement of the green industry activities. Data presented that the mean difference was building and structural integrity of the factor 2.172 after their involvement with green industry activities was than that of "before joining" and this difference was statistically significant (t = 11.584 at 0.01 percent level of probability with 57df) shown at table 4.

Table 5. Knowledge on Climate Smart Agriculture (CSA).

Item	Frequency	Valid Percent	Mean	Median	Mode	Std. Deviation
Understand Climate Smart Agriculture	2	3.45	3.62	4.00	5	1.240
Three important CSA	12	20.69				
Use shade involving tree in factory	11	18.97				
Why use stress tolerant variety	14	24.14				
Why use zero tillage cultivation	19	32.76				
Total	58	100.00				

Change in Factors which affected in green industry

The findings indicate that the average factors which affected in green industry in the green industry of the factory of the RMG entrepreneurs increased 7.182to 6.232 at 95 % confidence interval of the difference after involvement of the green industry activities. Data presented that the mean difference was building and structural integrity of the factor 6.707 after their involvement with green industry activities was than that of "before joining" and this difference was statistically significant (t = 28.275 at 0.01 per cent level of probability with 57df) shown at table 4.

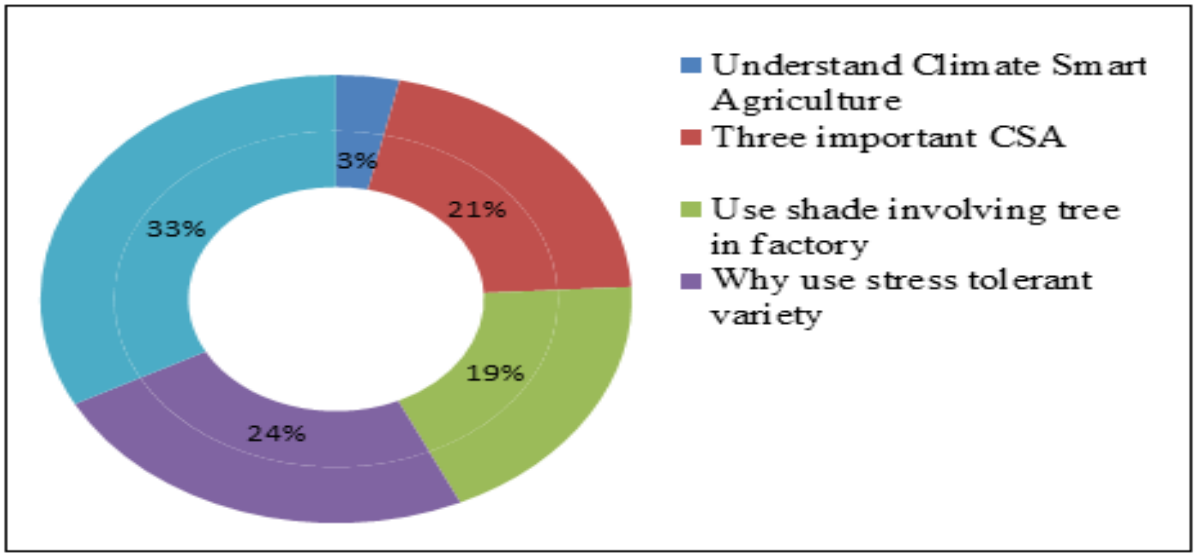

Fig. 1. Knowledge on Climate Smart Agriculture (CSA) practices to established green industry.

Knowledge on Climate Smart Agriculture (CSA) practices to established green industry in RMG

The Knowledge on Climate Smart Agriculture (CSA) practices to established green industry in RMG of the RMG factory ranged from 2 to 19 score and standard deviation of 1.240. On the basis of Knowledge on Climate Smart Agriculture (CSA) practices to established green industry were classified five categories as shown in Table 4. Data presented in Table 4 shows Knowledge on Climate Smart Agriculture (CSA) practices to established green industry 32.76 per cent of zero tillage cultivation of the factory grounds.

Conclusion

Government of Bangladesh has already taken several programs to address the Coherently addressing the 17 Sustainable Development Goals (SDGs) requires planning tools that guide policy makers. Among the 17 Goals this study adopt SDG6 Ensure access to water and sanitation for all ,SDG7 Ensure access to affordable, reliable, sustainable and modern energy, SDGs 8 Decent Work and Economic Growth,SDG12 Ensure sustainable consumption and production patterns and SDG13 Take urgent action to combat climate and its impacts to green industrialization of Bangladesh.

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