The effect of Green Supply Chain management on Environmental Performance: Evidence from Bangladesh

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Abstract
This study aims to examine the relationship between green supply chain management (GSCM) practices and environmental performance (ENP) in Bangladesh's manufacturing industry. Data were gathered from 220 managers using survey methods. The results show that GSCM techniques have a beneficial impact on ENP. The findings also show a strong correlation between green marketing and ENP. Additionally, this study will support the implementation of GSCM methods by supply chain managers, policy makers, and practitioners in order to enhance ENP. The implications of GSCM are examined, along with suggestions for further study.

Keywords: Green purchasing (GPU), Green manufacturing (GMF), Green distribution and packaging (GDP), Green marketing (GMK), Environmental performance (ENP)

Introduction
In recent years, researchers and professionals have been paying more and more attention to sustainability. Rapid industrial change has resulted in harmful environmental effects, such as the release of greenhouse gases, noxious pollutants, and chemical spills (Peng & Lin, 2008). Sustainability is likely to become a crucial component of commerce and supply chain since stakeholders are becoming more concerned about the environment and society (Golicic & Smith, 2013). In this environment, the idea of GSCM is growing and becoming more well-known (Zhu & Sarkis, 2004). In light of the supply chain, GSCM is based on environmental management best practices (Eltayeb et al., 2011). It contributes significantly to preserving ENP. Many businesses are using GSCM to satisfy stakeholder needs for environmentally sustainable goods and services, and doing so improves environmental performance (Green et al., 1998; Mirhedayatian et al., 2014). Therefore, in order to reduce emissions of greenhouse gases and solid waste, each company should be required to do GSCM assessments (Cote et al., 2008).

Bangladesh is growing economy country. Some rapidly expanding manufacturing industries of Bangladesh are ready-made clothing, steel, and pharmaceuticals. These industries, sadly, contribute to industrial pollution. The practice of GSCM is urgently required in light of Bangladesh's increasing environmental pollution rate today. The GSCM procedures can assist in meeting the needs of domestic and foreign customers as well as in preserving the environment. Although the importance of GSCM in decreasing pollution is well acknowledged (Eltayeb & Zailani, 2010), it is still not widely used, especially to reduce waste in the industrial sector. Many academics have already studied the relationship between GSCM and corporate performance (Green et al., 2012; Novitasari & Agustia, 2021; Cankaya & Sezen, 2018). A little amount of research has, however, been done in relation to Bangladesh. As a result, the primary objective of this study is to look at how GSCM and ENP interact in manufacturing firms. This study investigates the relationship between GSCM and ENP based on RBV. We add to the prevailing literature by analyzing how GSCM affects ENP in Bangladesh's manufacturing sector.
Literature Review

Green SCM

A supply chain is described as a group of businesses cooperating to accomplish a common objective (Chan & Chan, 2010). According to Srivastava (2007), the term green supply chain management (GSCM) encompasses “green design, green purchasing, green production, green distribution, logistics, marketing, and reverse logistics”. The GSCM techniques assist to not only assure ENP but also to cut costs and eliminate waste (Rao & Holt, 2005). GSCM evolved as “an essential new model for firms to accomplish profit and market share objectives by reducing their environmental risks and consequences while boosting their ecological efficiency” according to (Zhu et al., 2005, p. 450).

Green Purchasing (GPU)

GPU is defined as “encompass all environmental considerations regarding supply management decisions, along with traditional purchasing factors such as product price and supplier location” (Yook et al., 2018, p.1). GPU that lessens waste sources and encourage recycling and reuse of materials (Min & Galle, 2001). It may be characterized as incorporating ecological issues and concerns into the purchasing process (Rao & Holt, 2005). It is described as the practice of purchasing environmentally friendly goods or materials and cultivating trustworthy connections with suppliers (Green et al., 2012). A firm manager cannot ensure proper GSCM without GPU.

Green Manufacturing

The main focus of GSCM operations is green manufacturing. According to (Maruthi & Rashmi, 2015, p. 3351), “Green manufacturing is a method for manufacturing that minimizes waste and pollution through product and process design. It aims to create environmentally friendly goods with a minimum amount of resources and waste (Routroy, 2009).

Green Marketing
Green marketing is a strategy used by businesses to offer clients with eco-friendly goods and services that have minimal negative social effects (Grewal & Levy, 2008). Menon and Menon (1997) state that “green marketing refers to the process of conceiving and conducting entrepreneurial and ecologically advantageous activities with the purpose of earning revenue by delivering exchanges that fulfill firm's economic and social performance objectives” (p. 54). GMK entails meeting human needs while having as little of an adverse impact on the environment as possible (Singh & Pandey, 2012). It is a system that guarantees all-around sustainable development.

**Green distribution and Packaging**

The performance of GSCM is ensured by the strategic function that green distribution plays. It covers all initiatives to reduce environmental harm and waste through shipping (Gao et al., 2009). Green distribution entails providing the goods to the appropriate customers at the appropriate locations, primarily individuals who are ecologically conscious (Yazdanifard & Mercy, 2011). Green packaging is a crucial element of the value chain since it directly impacts the environment and is interconnected with the other parts of the chain (Sarkis, 2003). The concepts of green packaging include “simple packaging, biodegradability, no unnecessary packaging, the use of paper wrappings, decreased amounts of polystyrene, sterilized wrapping materials, easy disassembly, and the use of simplified packaging materials,” according to (Kung et al., 2012, p.115).

**The environmental performance**

It often focuses on energy conservation as well as lowering waste, pollution, and emissions. The environmental performance also includes lowering air emissions, water wastes, and solid wastes, as well as lowering consumption of hazardous materials, while combining supply chain performance with industrial sectors (Zhu, et al., 2005). Measures of ENP included indications of energy conservation including lowering emissions, waste, and pollution (Zhu et al., 2005; Lee et al., 2012). Reduced air emissions, wastewater generation, solid waste generation, consumption of hazardous products, and the frequency of environmental mishaps are all ways that a business might improve its environmental performance (Ninlawan et al., 2010).

**Research Hypothesis**

**Green Purchasing and Environmental Performance**

Green purchasing is the practice of buying environmentally friendly goods and establishing stronger relationships with green suppliers (Green et al., 2012). The collaboration with the supplier is intended to create ecologically beneficial items (Zhu et al., 2008). Green purchasing refers to the use of environmentally friendly raw materials, the certification of suppliers' environmental performance, and the fulfilment of environmental goals (Min & Galle, 2001) Additionally, green buying is necessary for efficient GSCM since it ensures eco-friendly products and services (Yang & Zhang, 2012) By utilizing long-lasting, recyclable, and reusable components, it seeks to minimize any harmful environmental effects throughout the production and shipping processes (Sarkar, 2002). Previous research suggested that a supplier for ecological products might help a company operate better (Qin et al., 2017). Therefore, we may claim that H1: GPU has a positive influence on ENP

**Green manufacturing and environmental performance**

In order to improve production efficiency, a company must be able to use modern manufacturing technologies, consume less energy, and utilize less toxic chemicals and hazardous materials (Größler & Grüner, 2006). GMF standards provide for as little environmental harm as possible, waste recycling, and waste disposal during the production process (Gao et al. 2009). The use of green manufacturing techniques can result in less waste, less energy and resource use, and less environmental contamination. According to prior research, GMF can assist the company in enhancing ENP (Sezen & Cankaya, 2013; Cankaya, & Sezen, 2018). Consequently, we can suggest that H2: GMF has a positive influence on ENP
Green distribution and packaging and environmental performance
The goal of green distribution is to prevent environmental harm and destruction during shipping (Gao et al., 2009). By minimizing environmental harm, GSC will enable businesses to project a more favourable image to stakeholders, customers, society, community members, and the government (Cankaya & Sezen, 2018). On the other hand, “simple packaging, biodegradability, no superfluous packaging, the use of paper wrappings, etc.” is among the green packaging principles (Kung et al., 2012, p.115). Previous research reveals a beneficial relationship between GDP and ENP. (Zhu & Sarkis, 2007)

H3: GDP has a positive influence on ENP

Green marketing and environmental Performance
In order to lessen or prevent negative environmental effects, green marketing is a crucial component of environmental management practices (González-Benito & González-Benito, 2005). Companies implement green marketing strategies to provide clients with environmentally friendly products that are also good for society (Grewal & Levy, 2008). GMK might result in the development of new goods and procedures that help the environment be cleaned up, heal, and recover (Rehman et al., 2021). Green marketing techniques improve ENP results (Yu & Ramanathan, 2015). Consequently, we can suggest that

H4: GMK has a positive influence on ENP

Research Methodology

4.1 Population and sampling
The data were obtained from the manufacturing firm Bangladesh. The respondents of the study were the companies working in the ready-made garments, steel industry and electronics sectors in Bangladesh. By using face-to-face and online surveys, we gathered information from 220 respondents from manufacturing companies in Dhaka and Chittagong. A previous study shown that any sample size greater than 200 for “structural equation modelling (SEM)” based variables is appropriate for any investigation (Sultan et al., 2021). As a result, sample size is not a concern for the current investigation. The information was gathered between September 2021 and April 2022 using a convenience sampling approach. Two academics and two supply chain experts verified the instruments in the beginning in order to comprehend the factor structure. The questionnaire consisted of 22 items, each rated from "strongly disagree" to "strongly agree" on a scale of 1 to 5.

4.2 Measures
Using its 22 items, GPU, GMF, GDP and GMK were adopted from (Cankaya & Sezen, 2018) and ENP was adopted from (Zhu et al., 2008) are all measured on a 5-point Likert scale.

4.3 Common method bias (CMB)
CMB problems are likely to occur since this study obtained information on both independent and dependent components using data from a single source. The single factor test by Harman was used to assess CMB (Podsakoff et al., 2003). It could improve the relationship between the variables being measured (Conway & Lance, 2010). The results show that one factor may account for 31% of the variation, which is less than the maximum criterion of 50% that ensures there are no issues with CMB (Podsakoff & Organ, 1986).

4.4 Sample Characteristics and data collection
A survey was used to gather information on the research hypothesis. The questionnaire was distributed to the management of industrial businesses. Those that responded to the poll were senior executives (Managers, general managers or top executives).
Table-1: Sample Characteristics

| Characteristics of firms | Classifications | Frequency | Percentage |
|--------------------------|-----------------|-----------|------------|
| Firm size (Number of employees) | Less than 100 | 10 | 4.5 |
|                          | 101-500        | 85        | 38.63      |
|                          | 501-1000       | 95        | 43.18      |
|                          | 1001-2000      | 15        | 6.8        |
|                          | Above 2000     | 15        | 6.8        |
|                          | Total          | 220       |            |
| Firm age (year)          | Less than 5    | 20        | 9.09       |
|                          | 6-10           | 50        | 22.72      |
|                          | 11-15          | 75        | 34.09      |
|                          | 15-20          | 45        | 20.45      |
|                          | Above 20       | 30        | 13.63      |
|                          | Total          | 220       |            |
| Job Position             | Purchasing Manager | 45   | 20.45      |
|                          | Plant manager  | 30        | 13.63      |
|                          | Operation manager | 50  | 22.72      |
|                          | Supply chain manager | 70  | 31.81      |
|                          | Logistics manager | 25  | 11.36      |
|                          | total          | 220       |            |

Characteristics of the sample (N = 220)

Table 1 provides a summary of the business size, firm age, and job position characteristics of the research sample's (n = 220) demographics. Notably, 38.63% of the firms had employees in the range of 101-500, while 95 (43.18%) of the organizations had 501-1000 employees. Only 4.5 percent of the company had less than 100 workers. The proportion of firm age between the ages of 11 and 15 that is greatest is 34.09%. Only 9.09% of businesses were under 5 years old. 30 plant managers, 45 purchasing managers, 50 operations managers, 70 supply chain managers, and 25 logistics managers were among the respondents to our study.

Analysis and Results

5.1 Measurement Model

In order to ascertain the constructs' reliability, validity, and dimensionality, this study employed (CFA) using IBM AMOS version 24. The factor loadings of all the constructions were over 0.7, according to table 2. Cronbach alpha values of all constructs are found over 0.7, representing the reliability of constructs’ measure (Nunnally & Bernstein, 1967). Convergent validity is ensured by the AVE of each construct being above 0.5 and the composite reliability value of each construct being above 0.7. (Hair et al., 2010, 2017). The square root of the AVE of any latent variable is larger than its correlation with other latent variables, according to testing of discriminant validity. As a result, neither convergent nor discriminant validity was problematic (Hair et al., 2014). The measurement model's unidimensionality is supported by the goodness-of-fit indices (CMIN/DF=2.76, CFI=0.925, GFI=0.826, TLI=0.912, SRMR=0.065, RMSEA=0.056) (Hair et al., 2010; Afsar et al., 2020). Table 3 demonstrates how closely related the constructs are to one another. However, none of the correlations are more than 0.9, probing that these variables are not multicollinear (Tabachnick & Fidell, 2012).
Table-2: Summary of the Measurement Model

| Constructs                        | Items   | FL     | AVE  | CR  | α   |
|----------------------------------|---------|--------|------|-----|-----|
| Green Purchasing                 | GPU1    | .849   | .598 | .851| .850|
|                                  | GPU2    | .709   |      |     |     |
|                                  | GPU3    | .887   |      |     |     |
|                                  | GPU4    | .900   |      |     |     |
| Green Manufacturing              | GMF1    | .948   | .752 | .930| .932|
|                                  | GMF2    | .827   |      |     |     |
|                                  | GMF3    | .876   |      |     |     |
|                                  | GMF4    | .960   |      |     |     |
| Green distribution and Packaging| GDP1    | .930   | .749 | .922| .919|
|                                  | GDP2    | .909   |      |     |     |
|                                  | GDP3    | .839   |      |     |     |
|                                  | GDP4    | .893   |      |     |     |
| Green Marketing                  | GMK1    | .813   | .750 | .937| .937|
|                                  | GMK2    | .893   |      |     |     |
|                                  | GMK3    | .896   |      |     |     |
|                                  | GMK4    | .980   |      |     |     |
|                                  | GMK5    | .837   |      |     |     |
| Environmental performance        | ENP1    | .950   | .759 | .940| .942|
|                                  | ENP2    | .835   |      |     |     |
|                                  | ENP3    | .837   |      |     |     |
Table-3: Descriptive statistics and correlation matrix for the study constructs from CFA

| Construct                               | Mean  | SD    | GMK | ENP    | GDP    | GMF | GPU   |
|-----------------------------------------|-------|-------|-----|--------|--------|-----|-------|
| Green Marketing                         | 0.937 | 0.750 | 0.866 |        |        |     |       |
| Environmental performance               | 0.940 | 0.759 | 0.453*** | 0.871 |        |     |       |
| Green distribution and packaging        | 0.922 | 0.749 | 0.235** | 0.434*** | 0.865 |     |       |
| Green manufacturing                    | 0.923 | 0.752 | 0.409*** | 0.398*** | 0.248*** | 0.867 |       |
| Green Purchasing                       | 0.862 | 0.616 | 0.146* | 0.335*** | 0.247** | 0.205** | 0.774 |

***Correlation is significant at p < 0.001, ** p < 0.01, * p < 0.05

Legends: “GMK=Green marketing, ENP= Environmental performance, GDP= Green distribution and packaging, GMF= Green manufacturing, GPU= Green purchasing”.

5.2 Hypothesis assessment

In order to evaluate the study framework and hypotheses, we employed structural equation modelling. Table 4 displays the outcomes for the structural model. According to the measurements of overall fit, the structural model fit was satisfactory (CMIN/DF=2.75, CFI= 0.925, GFI= 0.826, TLI= 0.912, SRMR= 0.065) (Hair et al., 2010). Table 4 demonstrates that GPU positively influence on ENP (β= 0.231, CR=3.078) and green marketing is strongly associated with ENP (β= 0.334, CR=4.443), again GDP is positively related to ENP (β= 0.313, CR=4.459) and finally GMF is significantly linked to ENP (β= 0.163, CR=2.69). Thereby, hypothesis H1, H2, H3 and H4 are supported.

Table-4: Hypothesis testing

| Hypothesis   | Path relationships                  | β     | S.E  | C.R.  | P-Value | Decisions |
|--------------|------------------------------------|-------|------|-------|---------|-----------|
| H1           | Green Purchasing → Environmental Performance | .231  | .075 | 3.078 | .002    | Significant |
| H2           | Green Manufacturing → Environmental Performance | .163  | .060 | 2.695 | .007    | Significant |
| H3           | Green distribution and Packaging → Environmental Performance | .313  | .070 | 4.459 | ***     | Significant |
| H4           | Green Marketing → Environmental Performance | .334  | .075 | 4.443 | ***     | Significant |

Discussion

This study examines how GSCM affects ENP based on the resource-based view (RBV) and GSCM literature. In order to assess the performance of the environment, we have looked at several hypotheses. We started by looking at how green purchasing has affected ENP. The findings support this idea, showing that green purchasing significantly and favourably affects ENP. A strong GPU is crucial to ensuring GSCM. A company manager may assure it by working with green suppliers. Managers should retain their connections...
with eco-friendly suppliers and work to improve their relationships with them. Green purchasing is crucial for improving the results of ENP (Green et al., 2012). Second, we looked at how green manufacturing affected ENP. No business can attain eco-sustainability without effective green manufacturing. The results demonstrate that GMF has a favorable impact on ENP. We also looked at the impact of green packaging and distribution on ENP. One important aspect of the GSCM that increases ENP is GDP. Our findings show that GDP and ENP are considerably and favorably correlated. Green packaging is produced using an environmentally conscious packaging approach, which lessens the impact of packaging on the environment (Cankaya & Sezen, 2018). Our findings confirm those of earlier studies. Finally, we looked at GMK impact on ENP. We discover that GMK has a positive correlation with ENP and that it has the strongest influence (B=.334) on environmental performance. The findings of our results are supported by Shang et al. (2010). Previous studies have shown that GSCM enhances ENP (e.g. Geng et al., 2017; Zhu & Sarkis, 2004).

**Theoretical contribution and Managerial Implication**

This study will aid supply chain managers in learning more about GSCM implementation. The results show that GSCM has a good impact on ENP. Therefore, it is imperative that company managers put effective GSCM into place in order to safeguard ENP and preserve the environment. A crucial component of supply chain management is the supplier. Managers of businesses need to choose suppliers carefully. For the corporation to implement GSCM, business managers must select environmentally friendly suppliers. GSCM also uses green manufacturing as a tool. The findings suggest that GMF has to grow via careful planning, which might assist to lessen its impact on the environment.

In order to maintain environmental sustainability, company managers in Bangladesh should improve their relationships with their manufacturers, channel members, and manufacturers. GSCM can be developed if the firm managers arrange seminars, training with stakeholders on the implementation of GSCM. It will help the employees develop their green skills as we as stakeholders gains knowledge on GSCM. To ensure effective GSCM, green marketing is one of the major components so firm managers should take proper initiatives to develop the green marketing to enhance ENP.

**Limitation and Future Research**

The purpose of this study was to investigate the connection between ENP and green supply chain management. The relationship between GSCM and ENP has been explained using a model that has been put out. The results of the study showed the acceptance of all the hypotheses that ensure that GSCM is positively related to ENP. First of all, only the direct impact of GSCM on environmental performance was studied in this study. To further understand the impact of GSCM and ENP, future research can incorporate certain mediating and moderating variables. Furthermore, Bangladesh, a nation with a unique culture, was the location of the current study. Comparable study can be done in the future in other countries to track trends. In light of the use of survey methodologies in this study, it is suggested that future research combine qualitative and quantitative data to reduce the likelihood of method bias.

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