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Exploring Environmental Performance and the Competitive Advantage of Manufacturing Firms: A Green Supply Chain Management Perspective

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ABSTRACT

The influence of Green Supply Chain Management (GSCM) on the Environmental Performance (EP) and competitive advantage of manufacturing firms is the latest bone contention, and unfortunately, existing literature offers narrow explanation, and, occasionally offers conflicting findings. This study, based on the RBV theory, advances insights into the current debate by examining the direct influence of GSCM practices and Internal Environmental Management (IEM) on EP and the indirect influence of GSCM activities on competitive advantage. Using 229 data sets, this study addresses the lapses in the previous literature on the possibility of applying GSCM to enhance EP and eventually generate competitive advantage for manufacturing firms. The findings revealed that GSCM activities indirectly influence firms' generation of competitive advantage through the full mediation of environmental performance. Similarly, the IEM moderates the effects of green design, green manufacturing, and green distribution and packaging on EP. This research contributes to the understanding of how GSCM drives EP, and the mechanism by which GSCM activities generate competitive advantage. As there are limited studies on linking GSCM practices and competitive advantages, this research focuses on GSCM activities and proves its significance in improving EP and creating competitive advantage for manufacturing firms in a developing economy perspective.

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INTRODUCTION

Global warming, poor waste management, rapid resource depletion, and decline in biological diversity are environmental issues that lead to the deteriorating of environmental balance. Due to the rapid surge in environmental challenges, measures such as monitoring the environmental performance (EP) of companies, governments, individuals, and communities were implemented (Cankaya and Sezen, 2018). A critical outcome of EP is increased competitive advantage due to its significant connections with firm's competitiveness (González-Benito and González-Benito, 2005). Environmental performance enables companies to save on inputs, energy and resource consumptions, and costs (Lopez-Gamero et al., 2009). The competitive advantages emerge from increasing demands of environmentally sensitive customers (Galdeno-Gomez et al., 2008). Moreover, EP increases firms' reputation (Miles and Covin, 2000), promotes sales and raise the values of firms' products (María et al., 2015). Owing to the diverse pressure from various stakeholders, such as customers, communities and governments, organizations contributing to the environmental pollution are now forced to review their business processes, including supply chain management system. Also, with the emergence of organizational responsibilities from supply chain-related jobs, the importance of green supply chain management (GSCM) has increased in environmental performance (Al-Sheyadi et al., 2019). Excluding green issues in the supply-chain system results in unnecessary waste creation, system loss, inefficient utilization of resources, and emergence of various eco-problems (Rivera, 2019; Zhu et al., 2008). In addition to gain sustainable advantage, effective implementation and adoption of eco-initiatives in the context of supply chain management of firms are very crucial (Pourjavad and Shahin, 2020).

The GSCM is a multidimensional concept that aimed at developing pro-environmental organizational activities in the field of supply chains (Eltayeb et al., 2011). According to Srivastava (2007), GSCM emerged with the view of integrating environmental issues with the mainstream supply chain management (SCM). GSCM is defined as "green concerns in supply chain activities such as design, purchasing, production, logistics, packaging, marketing, and reverse logistics" (Kazancoglu and Sagnak, 2018). It consists of several steps, including ecological product design, raw materials and input sourcing, manufacturing process, distribution and packaging of product, green marketing, and managing life-cycle of products (Cakaya and Sezen, 2018). GSCM decreases life cycle effects of products, lessens the utilization of eco-unfriendly materials and resources in manufacturing processes and improves ecological performance. Additionally, GSCM has emerged as a part of strategies to attain green visionary goals, sustainable profitability, and healthier reputation, better operational efficiency through cost reduction and resource utilization (Kazancoglu et al., 2020). Furthermore, incorporation of green ideas into supply chain process attracts several economic benefits by increasing market share, enhancing brand image, and improving financial performance (Dawei et al., 2015). Thus, as indicated in the previous studies, the concept of GSCM has a widespread application in improving organization's environmental performance and competitive advantage.

Previous studies investigated the impact of GSCM on business performance (Abdallah and Al-Ghwayeen, 2019), firm performance (Agyabeng-Mensah et al., 2020), environmental performance (Bae, 2017; Laari et al., 2018; Le, 2020), environmental awareness (Chen et al., 2018), closed-loop and reverse supply chain problems (Nahr et al., 2020), and sustainable performance (Foo et al., 2018). Recent literature has also examined the trends and future challenges of GSCM (Tseng et al., 2020). Moreover, numerous studies in this field have discussed the barriers GSCM practices in other industries and from developed country's perspective. Notably, most recent studies on GSCM have been conducted in various countries, such as China, Vietnam, Uganda, and in the Europe and America but there are limited in the South-Asian context. However, South-Asian counties like Bangladesh is characterized by greater environmental challenges due to the climate change, which results in the occurrence of several natural disasters that have claimed the lives of hundreds of inhabitants and left a devastating effect on the ecology. Every year many people in Bangladesh lose their properties and other valuable resources due to cyclone, floods, and other natural disasters. Considering the detrimental effects of manufacturing firms on the ecology, it is imperative for manufacturing firms to adopt operational procedure that eco-friendly (such as as GSCM) to improve their environmental performance. However, adoption of this green practice would be ineffective without understanding the underlying mechanism behind the influence of GSCM practices on EP and competitive advantage for firms, which necessary for the formulation of favorable policies and proper initiatives by the policymakers and practitioners of manufacturing sectors.

To the best of our knowledge, only studies of Islam et al. (2018), which examined GSCM using fuzzy importance and performance approach and, Chowdhury et al., (2016), which assessed GSCM approach in the construction industry, have been reported from Bangladesh. On the other hand, Uddin (2020) analyzed EP via human resource management practices in the ready-made garment industry. However, there is a dearth of studies on how GSCM activities influence EP and generate competitive advantage in the manufacturing industries of emerging economies. Although there are numerous studies exist on green supply chain, their findings might not be duly applicable in this regard due to the distinct features of manufacturing in emerging countries. Hence, there is a need for further studies to explore the relationship between GSCM practices and EP, and also the mechanism through which GSCM practices generate competitive advantages for manufacturing firms.

In order to address the deficiency mentioned above, this study, using the RBV, aims to investigate the role of GSCM practices on the environmental performance of manufacturing organizations in Bangladesh. Moreover, due to conflicting and inconclusive evidences provided by theoretical and empirical studies on the influence of EP on firms' competitiveness, this study also examines the influence of EP on competitiveness. Furthermore, previous studies stated that GSCM practices greatly influence the environmental performance of manufacturing enterprises in the presence of internal environmental practices (IEP) (Abdullah and Al-Ghwayeen, 2019). More so, the influence of GSCM practices in generating competitive advantage for manufacturing firms is the current topic of debate, and unfortunately, no concrete diretions were provided by an issue of existing literature. Therefore, this study advances better understanding of the relationship between GSCM practices and competitive advantage of manufacturing firms. This study is also essential for developing countries in the South-Asia such as Bangladesh where adverse ecological effects of manufacturing firms are existent, albeit the reluctance of the firms to apply GSCM practices due to the perceptions of ambiguous environment and competitive advantage implications (Majumdar and Sinha, 2019).

Achievement of this study's objectives will contribute to the existing literatures on GSCM and competitive advantage. This research precisely addresses the scarce literatures on emerging economies by exploring how and what GSCM practices create competitive advantages for manufacturing firms in Bangladesh, a developing country. Moreover, this study investigates how GSCM practices indirectly improve EP and generate competitive advantages, and the extent to which this relationship is moderated by IEM. The findings of this study may highlight the differences in approaches towards adoption of GSCM practices between developing and developed economies and also pinpoint the dissimilarities between GSCM practices of manufacturing industries and that of other sectors in developing economies. Existing literature in the context of other sectors or developed countries are more conclusive that those from the perspective of South-Asia's emerging countries, which is characterized by conflicting evidences on the influence of GSCM practices on EP and limited findings on competitive advantages. This necessitates the importance of further and in-depth investigation of GSCM practices in terms of their impact on EP and competitive advantage to depict reliable findings in the context of manufacturing industry. Furthermore, the study contributes to existing knowledge by examining the mediating role of EP on the relationship between GSCM practices and competitive advantages. Finally, this research advances more outputs by exploring the moderating influence of IEP on the relationship between GSCM practices and EP. In other words, it examines whether IEP (low vs. high) might increase or decrease the role of GSCM on EP.

THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

Theoretical Background

The resource-based view (RBV) theory, which is the main theoretical lens for this study, postulates that organizational sustainable abilities may create competitive advantage by preventing pollution arising from minimizing wastage and emission, and by adopting greener practices (Hart, 1995). RBV also suggests the integration and inclusion of stakeholders in the process of greening organizational activities towards environmental sustainability (Hart and Dowell, 2011). Previous studies suggest that RBV stimulates the establishment of a shared environmental vision corresponding with organizational goal of achieving sustainable competitive advantage (Hart and Dowell, 2011). It can be said that the integration of firm's environmental and competitive goals persistently motivate employees towards adopting green practices. The

key to attaining competitive advantage stems from organizational skills and resources (Barney, 1991). Available evidence proved that GSCM is a specific management skill and valuable resource needed to reduce costs, gain brand image, and attain higher reputation in the society (Bowen et al., 2001). Based on the RBV view, recent literature on GSCM and environmental management also emphasized the importance of resources in achieving a desired environmental performance that generate competitive advantage for firms (Han and Huo, 2019; Raitasuo et al., 2018; López-Gamero and Molina-Azorín, 2015).

Green Supply Chain Management

The significance of environmental performance and operations within and beyond the organizational boundaries is now being acknowledged by companies across the globe (Zhu et al., 2005). Additionally, previous efforts to increase effectiveness were hindered by lack of efficiencies in energy usage and problems in pollution (Jaggernath and Khan, 2015). Consequently, the evolvement of GSCM presents an ultimate approach to improve environmental performance and in turn generates competitive advantage for firms. GSCM is defined as "the set of SCM policies held, actions taken, and relationships formed in response to concerns related to the natural environment with regard to the design, acquisition, production, distribution, use, reuse, and disposal of the firm's goods and services" (Zsidisin and Siferd, 2001, p. 69). Green SCM includes various steps such as designing, production, distribution, and products usage by consumers and disposal of the products at the end of its lifecycle. It incorporates green practices into the traditional SCM process, which include: material sourcing, products development, logistics, manufacturing, inventory, packaging and distribution, disposal, and management of products at the end of its lifecycle (Kim and Min, 2011).

The process of GSCM practices begin with raw materials procurement, followed by product development, which include input and energy utilized, and the resultant pollution during production, packaging, distribution, recycling, and reuse of the products. Zhu et al. (2010) classified GSCM activities into following: warehousing, distribution, logistics, development of green capacity, reverse logistics, green design, and investment recovery. On the other hand, Younis et al. (2016) and Kalyar et al. (2019) categorized GSCM activities into green purchase, eco-design, distribution and packaging, green marketing, and green manufacturing. Similarly, Al-Sheyadi et al. (2019) highlighted distribution and packaging, purchasing, green-design, green marketing, investment recovery and cooperation with customers as key GSCM activities for EP. Sequel to the above discussion, this study adopted the most cited GSCM activities, namely green design, purchasing, manufacturing, distribution and packaging, and marketing (Sharma et al., 2017; Alshura and Awawdeh, 2016; Tuni et al., 2018; Kalyar et al., 2019; Al-Sheyadi et al., 2019). These activities were included in the study due to their ability to minimize the negative impact of supply chain systems on the environment (Yu et al., 2017) and ultimately promote a firm's competitive advantage. Moreover, previous studies revealed that IEM influences GSCM activities in order to generate a stronger effect on EP (Heras-Saizabitoria et al., 2020; Tuan, 2019). This is due to the fact that the extent of SCM's deployment of greener activities in the organization is mainly facilitated by IEM.

Environmental performance

Environmental Performance includes the outcomes of organizational strategic plans that control the effect of pollution on natural environment (Walls et al., 2012). According to Younis et al. (2016), EP is defined as "ability of an organization to minimize air emissions, effluent, and solid wastes, to reduce consumption of toxic and hazardous material and reduce environmental accidents". The outcomes of EP encompass the positive impacts of GSCM interventions on the broader ecology. Recent studies proved EP to be a significant source of sustainable firm performance and competitive advantage.

Previous studies on GSCM and EP used various metrics due to persistent variations in relation to companies and sectors (Bocken et al., 2013). For example, environmental performance indicators (EPI) core environmental metrics were suggested by the organization for economic cooperation and development (OECD), while the European Union environmental indicators were reviewed by Blass et al. (2016). Additionally, scholars have divided EP metrics into environmental condition indicators, management performance indicators, and operational performance indicators (Shaw et al., 2010). However, this study used indicators such as improvement of environmental condition, reduction of waste in water and soil, reduction of air emission, consumption of hazardous inputs or materials, and environmental accidents due to their

extensive widespread application in the literature (Sharma et al., 2017; Jabbour et al., 2015; Zhu et al., 2010; Tuni et al., 2019; Diab et al., 2015; Yang, 2018).

Hypotheses Development

This study is mainly based on the depicted framework in Figure 1. The framework presents the impact of GSCM on EP, the influence of EP on competitive advantage and the moderating impact of internal environmental management on the relationship between GSCM activities and EP.

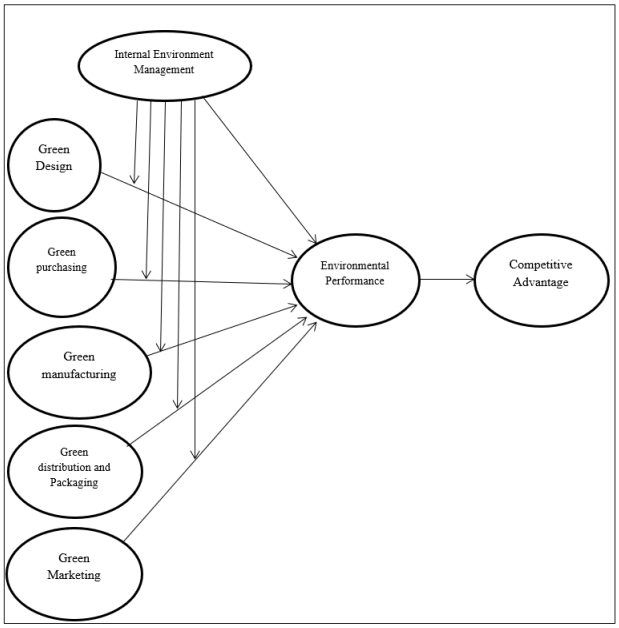

Figure 1 Conceptual Framework

Internal Environmental Management and EP

Internal environmental management is defined as "a systemic process consisting of a set of environmental policies, internal policies, and assessments of environmental impacts, quantifiable environmental targets, and plans of action, responsibilities and checks through regular auditing of these elements" (Jabbour et al., 2015). IEM includes promoting environmental sustainability as part of strategic interventions through managerial commitment and support from top- and mid-level management. It necessitates top-level management cooperation, support, enthusiasm, pro-environmental organizational culture, and collaboration towards improving EP (Choi et al., 2018). Also, IEM facilitates systemic inspection and reviewing of environmental issues, including environmental documentation by the mid- and senior-management (Vijayvary et al., 2017; Kusi-Sarpong et al., 2016).

Various studies reported a positive relationship between IEM and EP. For example, Khan and Qilani (2017) examined environmental sustainability among supply chain-related supervisors, managers, and manufacturing directors, and discovered that IEM significantly affect the EP of Pakistani manufacturing firms. Similarly, El-Kassar and Singh (2018) examined surveyed employees and managers and observed that IEM activities significantly reduce energy usage, emission of pollutants, use of resources, and waste recycling, consequently improving EP. The study of Tuan (2019) reported positive role of green internal climate and crafting, and green leadership practices in promoting green performance of firms. Contrarily, Darnall and Sides (2008) in a meta-analysis reported an insignificant relationship between IEM and EP. A survey among 4187 Spanish manufacturing firms demonstrated a significant improvement in green performance due to IEM interventions (López-Gamero and Molina-Azorín, 2016). In the context of emerging countries, a study in Pakistan reported that IEM operations, such as greater logistics operations reduced environmental problems (Khan et al., 2019). Another study from Asia's emerging economies also observed a positive relationship between intra-organizational green activities and company's performance (Jawaad and Zafar, 2019). However, in terms of promoting EP, the value of IEM lies with the fact that IEM direct employees to deploy

and utilize all resources in a greener fashion, thereby leading to the attainment of sustainable outcomes that improve EP (Gilal et al., 2019). Thus, the study proposes the following hypotheses:

H1: A positive relationship exists between IEM and EP

Green-Design and EP

Green Design entails the proactive implementation of environmental strategies, which necessitates internal cross-functional collaboration among various departments and partners across the supply chain processes inside and outside the organization (Kumar and Chandarker, 2012). Previous literature defined GRD as "the systematic consideration of designing issues associated with environmental safety and health over the full product life cycle during new production and process development" (Amemba et al., 2013). Green efficiency and the demands of stakeholders are achieved when ecological issues are incorporated in designing and production process (Liu et al., 2018). According to Jabbour et al. (2015), GRD is an approach that improves EP of organizations and enhances functionality of products while minimizing the environmental effects of products' lifecycle. GRD also aims to create products that are easy to recycle and disassemble, require less inputs or raw materials, and use little or no hazardous ingredients (Sarkis et al., 2016). It is a vital technique with a significant impact on firm's ecological outcomes. GRD takes cognizance of input amount, energy usage and recycling in the development, production, and consumption of products (Shi et al., 2012). Although a study from the context of an emerging country reported an insignificant impact of GRD on EP (Jawaad and Zafar, 2019). Eco-design facilitates waste reduction and ultimately enhances EP. Hence, the following hypothesis is proposed:

H2: Green design is positively related to EP

Green Purchasing (GRP) and EP

Green purchasing is a firm's pro-environmental purchasing process aimed at conserving natural resources, sustaining the quality of natural environment, preventing pollution, reducing the use of resources, and minimizing the dumping of wastes (Abdallah and Al-Ghwayeen, 2019). According to Eltayed et al. (2011), GRP is defined as "an environmentally conscious purchasing initiative that tries to ensure that purchased products or materials meet environmental objectives set by the purchasing firm, such as reducing the sources of wastages, promoting recycling, reuse, resource reduction, and substitution of materials". Green purchasing encourages suppliers to develop green inputs and raw-materials and promotes the collaboration of purchasing company and the suppliers (Choi et al., 2018). Although the cost of green materials is relatively expensive and may discourage firms from using them in the production process (Nguyen et al., 2017), the demand for eco-friendly products has been increasing owing to increased environmental awareness. Green purchasing plays a vital role in demonstrating successful EP for manufacturing firms through incorporation of eco-objectives in the process of procurement.

The results of previous literature on the relationship between GRP and EP are heterogeneous. For instance, a study on Turkish manufacturing firms reported that, GRP do not significantly EP (Yildiz et al., 2018). This may be attributed to the less emphasis of GRP on better environmental sustainability of suppliers and the poor process of firms (Eltayeb et al., 2011). A study in developing economy found a positive relationship between GRP and EP (Jawaad and Zafar, 2019), which conforms to other studies, such as Chan et al. (2012) and Rao and Holt (2005). Hence, we postulate the following hypothesis:

H3: Green purchasing has a positive influence on EP

Green Manufacturing and EP

Green manufacturing is a key aspect of GSCM process. It is defined as "the adoption and planning of activities that require less energy and resource use in the production process and cause the least environmental pollution" (Gao et al., 2009). Green manufacturing has evolved as an environmental strategy with significant positive impact on the EP of firms. Green production process facilitates continuous improvement in the industrial design and production, which eventually limit and prevent the pollution of water, air, and soil. With the adoption of eco-manufacturing system, firms create and produce eco-friendly products and commodities with the least amount of resources and wastes. Green manufacturing minimizes the detrimental effects of a

firm's production process and the products on the broader ecology. Producing products with the GRMNF system reduces unfavorable environmental incidences and promote community health, thereby driving EP positively EP (Eltayeb et al., 2011). Evidences from a study of small- and medium-sized enterprises revealed that eco-friendly production system uses fewer materials, to consume fewer amounts of water and produce less wastage (Lee, 2009). Similarly, another study (Azevedo et al., 2011) asserted the valuable contributions of environment-friendly production process to the environmental sustainability. A Turkish study also found a significant positive impact of GRMNF on EP (Yildiz et al., 2018). Numerous studies have reported that a positive association exists between GRMNF and EP (Famiyeh et al., 2018; Kung et al., 2012). Thus, the study hypothesized the following:

H4: Green manufacturing positively influences EP

Green Distribution and Packaging, and EP

Green distribution and packing (GRDP) is another significant factor that not only influences GSCM performance of a firm but also affects the environment directly. It encompasses the quantity of fuel consumed by vehicles carrying the products, incidences of transportation, simple packaging, biodegradability, reduction of unnecessary packaging, use of paper wrapping, and reduction in the use of polystyrene, use of shortened packaging substances, and easy reversibility (Kung et al., 2012). Also, GRDP includes all efforts to minimize ecological harms and waste disposal in the process of transportation, shipment, and packaging (Gao et al., 2009). Green-packaging requires firms' modifications of their products packaging to reduce the harmful effects of packaging materials, which sometimes constitutes waste after product purchase (Chuang, 2014). Hence, to reduce the environmental consequence of packaging, it is essential to sue non-toxic, non-hazardous, recyclable, biodegradable or reusable ingredients.

Previous studies reported positive association between GRDP and EP. For example, a study on Turkish manufacturing firms found that GRDP significantly influence the EP of sampled manufacturing firms (Yildiz et al., 2018). The study also stated that the GRDP is a key variable driving EP. Green distribution and packaging enables a firm to distribute and package products in an eco-sensitive fashion. In fact, a study from emerging economy prespective reported a significant positive relationship between green distribution and economic and operational performance but provided no evidence on EP (Jawad and Zafar, 2019). However, findings also reported that GRDP improves EP by minimizing fuel consumption, using fuel-efficient vehicles, optimizing the transportation routes, and making sure that all the carriers and containers are fully loaded (Kumar et al., 2015). Hence, the following hypothesis is advanced:

H5: Green distribution and packaging has positive role on EP

Green Marketing and EP

Green marketing (GRMKT) is the process of addressing customers' needs and expectations with minimal harmful effect on the sustainability of the environment (Sing & Pandey, 2012). According to Pride and Ferrell (1993), GRMKT includes all activities relating to designing, advertising, promotion, pricing, and distribution of products without causing any harm to the safety of the environment. In congruence with the above discussion, significant role of GRMKT on the EP of manufacturing firms has been reported by previous studies. For instance, a study that surveyed Turkish manufacturing firms reported a significant positive link between GRMKT and EP (Yildiz et al., 2018). In addition, another study in the Taiwanese hotel industry observed a positive relationship between green marketing and safety of the natural environment (Chung, 2019). Similarly, green marketing is a crucial factor of sustainable development strategy, as it highlights the protection of the ecological environment. It aims to fulfill the general interests of stakeholders along with environment sustainable. According to Papadas et al. (2017), eco-marketing meets the requirement of business strategy development in achieving ecological balance. Therefore, the study proposes the following hypothesis:

H6: There is a positive relationship between green marketing and EP

Moderation of IEM

Research based on RBV reported that conformance of firm's IEM with those of eco-supply chain management practices may lead to a positive influence on environmental performance (Han and Huo, 2020). This assumption is supported by other studies (Kalpande and Toke, 2020), which argue that an organization's GSCM activities are determined by IEM interventions, thus it could be conceived that IEM practices influence green behavior. A study of Chinese firms revealed that IEM operations positively drive GSCM integration (Zhou et al., 2019). Accordingly, other studies (Bazzucato, 2016) reported similar findings, stating that IEM activities decrease potential ecological damages, which in turn stimulate the competitiveness of firms. The practices of IEM are essential in integrating corporate policies and culture in order to attain organizational goals of maintaining desired green protection. According to a research by Han and Huo (2020), there is a significant positive impact of IEM activities on organizational SCM-related ecological performance. Organizational IEM activities are naturally pro-social (Choi et al., 2018), which suggest that IEM activities positively affect EP of firms. Organizations are more likely to attain their organizational goals if they integrate organizational IEM and GSCM in their activities (Jawaad and Zafar, 2019). To this end, a study reported that firms' GSCM activities along with IEM interventions would have a relatively stronger contribution towards environmental promotion (Han and Huo, 2020). Hou et al. (2019) also reported that such environmental promotion generates organizational outcomes, such as superior profitability, better reputation, stronger market position, and lower costs. Contrarily, if there is less IEM activities, GSCM would like demonstrate less impact on EP (Han and Hou, 2020). However, if organization improves EP through GSCM activities, it will positively drive organizational competitive advantage potential. This impact would further be strengthened when internal environmental activities are strongly emphasized by organizations. Therefore, the study proposes the following hypotheses:

H7a: The IEM has a moderating impact on the relationship between GRD and EP
H7b: The association between GRP and EP is moderated by IEM
H7c: The IEM moderates the relation between GMANF and EP
H7d: The relation between GRDP and EP is moderated by IEM
H7e: The link between GMKT and EP is moderated by IEM

The above-mentioned hypotheses are such that the positive relationship between GSCM practices (i.e., GRD, GRP, GMANF, GRDP, and GMKT) and EP is stronger when organizations have better IEM.

Mediation of EP

Previous studies revealed that GSCM practices (i.e. IEM, GRD, GRP, GRMNF, and GMKT) primarily and significantly influence EP (Han and Huo, 2019; Jawaad and Zafar, 2019) and consequently generate competitive advantage for firms (Hou et al., 2019). Hence, GSCM practices can produce a favorable organizational goal such as competitive advantage by encouraging green behavior among employees across the organization and preventing ecology degradation. This assumption is supported by previous studies, which suggest that the nature of GSM activities plays a vital role in driving EP and eventually strategic and financial performance (Hou et al., 2019; Laari et al., 2018). On the contrary, a relatively a lower-level EP is associated with reduced reputation, normal rate of returns and lower competitive advantage. This may be due to the fact that EP lowers costs, limits input usage, boosts social reputation, enhances differentiation, promotes higher pricing of products, thereby improving firm's competitiveness and profitability. There is also evidence that GSCM might eventually generate valuable corporate outcomes such as lower costs, differentiation, and relatively higher profitability (Chen et al., 2018). Based on the above, how GSCM activities indirectly contribute to the generation of competitive advantages via EP can be explained using the following hypotheses.

H8: GSCM practices positively relate to competitive advantage through the full mediation of EP

RESEARCH METHODOLOGY

Sample and data collection procedure

Data were collected from manufacturing companies located in Dhaka and Chattogram, the two capital cities of the country, where most of the manufacturing companies are situated. Directory provided by the National Bureau of Statistics of Bangladesh was used in sampling in the selected cities. Each selected company was contacted randomly to determine their eligibility and consequently take their consent to partake in the study. The eligible participants should have an in-depth knowledge of their SCM's eco-initiatives; and thus should be titled, supply chain manager, purchasing/procurement manager, chief marketing officer, vice president, or chief executive officer.

The questionnaire along with a cover letter stating the purpose fo the study and the likely implications of firms' participation was mailed to the respondents. Moreover, the respondents were guaranteed of complete anonymity and confidentiality. However, to increase response rate, follow-up phone calls were made and e-mail reminders were sent to the respondents (Chen et al., 2016). Of the 347 firms contacted, 314 firms agreed to participate in the survey. However, 241 completed questionnaires were received, from which 12 were discarded due to incompleteness, making a final sample size of 229 and response rate of around 73 percent on the basis of responses distributed.

From the sample profile, 41% participants are from textiles and apparels sectors, 17.6 percent of from electrical and electronics sector; and 11.2 percent from building materials sector. Respondents were also recruited from the rubber and plastic (7.3 percent), food and beverage (7.1 percent), mechanical and engineering (6.7 percent), pharmaceutical industries (6.1 percent).

Instrumentation

Before developing the instrument, five academics and five SCM practitioners were asked to determine the dimensions to be included as GSCM constructs. Based on their suggestions, sux dimensions of GSCM (i.e., internal environmental management, green design, green purchasing, green distribution and green packaging, and green marketing) were included in the study. A validated measurement scale was developed by adopting items from previous studies. Since all the items were developed in English and the data would be collected from Bangladeshi companies, the measurements were translated into Bengali using the parallel-translation procedure and then translated back to English by two bilingual experts. The scale was further pre-tested prior to sending it to the participants. Sequel to the above, 10 interviews were conducted (i.e., six practitioners and four academics). The measurement was reviewed by the experts to check its structure, clarity, readability, and completeness (Dillman, 2000). The study clarified some of the items in the scale.

Finally, a pilot test was run with 25 firms to refine the instrument. Considering the response of the firms, minor corrections were suggested by the SCM professor and professional and modifications relating to revisions, filtering, and deletion were brought into the measurement. This process would facilitate the clarity, relevance, and understanding of the words and their meaning. The final instrument was designed according to the responses obtained from the participants surveyed in the pilot test.

All the constructs were adapted because of their conformity with high consistency, completeness, and understandability. We adapted the six-item GRP construct proposed by Zhu et al. (2013). A sample item for the construct includes "providing design specification to suppliers that include environmental requirements for purchased item". The study adopted a six-item GRD construct developed by Zhu et al. (2010). A sample item of GRD is "Design of products for reduced consumption of material/energy". The five-item IEM construct was adapted from Zhu et al. (2013). An example of item for IEM includes "Cross-functional cooperation for environmental improvements". The six-item green marketing scale was developed taking items suggested by Shang et al. (2010). The GRDP construct was adopted from Perotti et al. (2012). Furthermore, the environmental performance scale was adapted from Chien (2014). Finally, the competitive advantage measurement was developed adopting items from López-Gamero and Molina-Azorín (2016). All the items were measured using the five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The Cronbach's α scores for the constructs are 0.88, 0.861, 0.895, 0.912, 0.879, 0.784, 0.903, and 0.807 for IEM, GRD, GRP, GMNF, GDP, GMKT, ENVP, and CA respectively, confirming adequate reliability of the constructs.

Non-response and common method bias

Two techniques were adopted by this study in checking the potential for non-response bias. First, T-test was applied to estimate the means of underlying constructs for the first and the last 30 samples (Armstrong and Overton, 1977). Major differences were not reported in the findings. Furthermore, information about responding and non-responding firms' characteristics as number of employees, types of ownership, assets, age of the firm were compared using t-test (Schilke, 2014). Similarly, no substantial variations were found in this regard, thereby implying that non-response bias is not a major factor.

The common method bias (CMB) might be an issue to be addressed, due to the study's use of cross-sectional data. First, while designing the model, this study ensured the order of relevant items and distanced conceptually distinct variables to minimize consistent tendency of respondents (Podsakoff et al., 2003), which decreases CMB to certain extent. Furthermore, Harman's single-factor test was conducted by applying exploratory factor analysis (EFA) to address CMB. The results revealed six underling constructs with eigenvalues greater than 1.0, which accounts for 67.34 percent of the total variance, wherein the first factor explained 41.38 percent of variance, which was less than 50 percent Moreover, the result of CFA model presents a relatively poor model fit, with $\chi 2$ (*df*)=1037(92), CFI=0.80, GFI=0.76, NFI=0.77, and SRMR=0.075. These results indicate that CMB may not be a serious concern in analyzing the data set. Although, there is no direct solution to CMB due to its diverse sources and complexity, researchers suggested *ex ante* as the most practical remedy (Guide and Ketokivi, 2015). Additionally, this study also took some initiatives as mentioned above in arranging items, constructs, and conducting survey. Altogether, these results and initiatives may to some extent reduce the concern of CMB.

Validity and Reliability

This section examines the reliability and validity of the constructs. First, reliability of all GSCM, EP, and CA constructs were assessed through Cronbach's alpha (See Table 2). The results showed that all the values exceed the threshold limit of 0.70, thereby confirming the reliability of the constructs.

Furthermore, in order to check the construct validity, confirmatory factor analysis (CFA) was carried out applying AMOS 20. The results of the fit indices (X2=572.83; df=192; X2/df=2.98, CFI=0.964, GFI=0.912; TLI=0.943; RMSEA=0.073; and SRMR=0.042) demonstrate acceptable levels of values (Garver and Mentzer, 1999). These indices revealed an adequate level of uni-dimensionality and convergent validity of the underlying constructs. Moreover, as reported in Table 1, the t-values for all the items were greater than the threshold limit of 1.64, further confirming convergent validity (Anderson and Gerbing, 1988). In addition, the factor loadings of all the items were higher than 0.50. Similarly, the values of average variance extracted (AVE) for all the constructs were above 0.50 (Fornell and Lacker, 1981), and the values of composite reliability scores for the constructs exceed 0.70, thus supporting the reliability of the constructs (Garver and Mentzer, 1999).

Table 1 Reliability and validity of the constructs

Constructs	Items	Loadings	t-values	AVE	CR
Internal Environmental Management	IEM1	0.81	16.37	0.79	0.87
	IEM2	0.92	13.98		
	IEM3	0.73	17.73		
	IEM4	0.84	15.62		
	IEM5	0.76	11.84		
Green Design	GRD1	0.73	15.91	0.73	0.91
	GRD2	0.74	18.27		
	GRD3	0.78	9.64		
	GRD4	0.83	10.89		
	GRD5	0.76	13.57		
	GRD6	0.67	17.26		
Green purchasing	GRP1	0.86	13.84	0.68	0.83
	GRP2	0.81	16.06		
	GRP3	0.78	8.73		
	GRP5	0.75	15.18		
Green Manufacturing	GMF1	0.83	11.52	0.62	0.76
	GMF2	0.84	14.74		
	GMF3	0.68	13.64		
	GMF4	0.71	18.59		
	GMF5	0.79	10.67		
Green Distribution and Packaging	GDP1	0.80	12.43	0.57	0.84
	GDP2	0.87	16.18		
	GDP3	0.86	13.56		
	GDP4	0.76	8.94		
	GDP5	0.72	15.28		
Green Marketing	GMKT1	0.78	10.51	0.72	0.83
	GMKT2	0.71	9.76		
	GMKT3	0.83	11.94		
	GMKT4	0.79	7.69		
	GMKT6	0.89	12.92		
Environmental performance	ENVP1	0.84	16.54	0.69	0.88
	ENVP2	0.87	11.63		
	ENVP3	0.82	9.73		
	ENVP4	0.74	17.89		
	ENVP5	0.78	19.37		
Competitive advantage	COMA2	0.74	15.34	0.73	0.74
	COMA3	0.66	16.84		
	COMA4	0.69	12.64		
	COMA5	0.75	14.09		
	COMA6	0.83	11.07		
	COMA8	0.74	13.84		

Note: Goodness-of-fit indices (N=): X2=384.53 (p-value <0.001); NFI=0.89; NNFI=0.94, RMSEA=0.06; RSMR=0.04.

Additionally, discriminant validity of the constructs was examined by confirming that the square root of each AVE value was higher than the absolute correlations between that construct and those of others. All the constructs under consideration fulfilled the criterion, implying the adequacy of discriminant validity (Fornell and Lacker, 1981).

Table 2 Descriptive statistics, correlations, and reliability

Construct	Mean	SD	1	2	3	4	5	6	7	8
1. IEM	3.82	0.713	**0.886**							
2. GRD	4.38	0.827	0.342	**0.861**						
3. GRP	3.73	0.693	0.417	0.252	**0.895**					
4. GMNF	3.63	0.709	0.307	0.383	0.430	**0.912**				
5. GDP	3.87	0.684	0.337	0.471	0.527	0.460	**0.879**			
6. GMKT	3.64	0.816	0.408	0.276	0.431	0.476	0.614	**0.784**		
7. ENVP	3.59	0.708	0.302	0.394	0.542	0.501	0.513	0.519	**0.903**	
8. CA	3.71	0.645	0.281	0.416	0.308	0.318	0.435	0.482	0.428	**0.807**

Table 3 Discriminant validity

Construct	1	2	3	4	5	6	7	8
IEM	**0.729**							
GRD	0.463	**0.738**						
GRP	0.624	0.518	**0.817**					
GMNF	0.536	0.632	0.356	**0.716**				
GDP	0.454	0.570	0.547	0.528	**0.884**			
GMKT	0.537	0.372	0.361	0.436	0.362	**0.703**		
ENVP	0.608	0.393	0.459	0.367	0.539	0.384	**0.807**	
CA	0.419	0.474	0.594	0.485	0.458	0.419	0.506	**0.905**

Dummy coding (Table 4) is a means of converting the categorical variable into a series of dichotomous variables with a value of only zero or one. The reference level is the categorical variable level that is coded as zero in all the new variables. After the creation of new variables, they were entered into the regression equation, using codes (×1, ×2 and ×3) instead of their original variables. However, the output of the regression will include coefficients for each of these variables.

Table 4 Dummy coding

Variables	New variable 1(×1)	New variable 21(×2)	New variable 31(×3)
Job position	1	0	0
Industry Type	0	1	0
Number of employees	0	0	1

RESULTS

This section evaluates the structural model that reveals the proposed hypothesized paths. Table 6 shows the empirical evidence on the hypothesized relationships. The results revealed that five out of the seven proposed paths were statistically significant at 5% (0.05) level with a corresponding confidence interval of 95% (0.95). The following activities were found to particularly influence EP significantly: internal environmental management (β=0.43** p<0.01), green design (β=0.32**, p<0.01), green manufacturing (β=0.37**, p<0.01), and green distribution and packaging (β=0.23**, p<0.01). Accordingly, the results provided evidence on the significant and positive relationship between EP and competitive advantage (β=0.56**, p<0.01). Thus, H1, H2, H3, H5, and H6 were supported by our analysis. However, green purchasing (β=0.03, p>0.05) and green marketing (β=0.04, p>0.05) were found not to have any significant impact on the EP of manufacturing firms in Bangladesh, thereby disproving H4 and H7. This observation may be attributed to differences in sample, measurement, and contexts.

Table 5 Test results of SEM

Hypotheses	**Mediated**	Model A Mediated model	Bias corrected bootstrap 95% confidence interval Lower	Upper
H1	EP → CA	0.56**		
H2	IEM → ENVP	0.43**		
H3	GRD → ENVP	0.32**		
H4	GRP → ENVP	0.03		
H5	GMF → ENVP	0.37**		
H6	GDP → ENVP	0.23**		
H7	GMKT → ENVP	0.02		
H8	GSCM → EP → CA	0.216	0.084	0.437

Table 6 Test of Moderation

	Model 1 Environmental Performance	**Model 2** Environmental Performance
Control Variables		
Job position	0.01	0.03
Industry type	0.02	0.01
Number of employees	0.04	0.03
Antecedents		
Internal Environmental Management	0.27**	0.21**
Green Design	0.19**	0.17**
Green Purchasing	0.04	0.38**
Green Manufacturing	0.35**	0.24**
Green Distribution and Packaging	0.41**	0.18**
Green Marketing	0.02	0.28**
Interaction terms		
Internal Environmental Management* Green Design		0.17**
Internal Environmental Management* Green Purchasing		0.06
Internal Environmental Management* Green Manufacturing		0.23**
Internal Environmental Management* Green Distribution and Packaging		0.16**
Internal Environmental Management* Green Marketing		0.05
Adjusted R^2	**0.34**	**0.36**

Note: **p<0.01; *p<0.05.

With respect to the moderating effects, this study also proved H7a and H7e (i.e., the relationship between GSCM and EP is moderated by IEM). Firstly, post hoc tests were conducted to examine whether key demographics such as job position, industry type, and size of firms could influence the moderating impact in the proposed model. The findings (Table 6) reveal that IEM significantly moderated the relationship between green design and EP, thereby supporting H6a. Consequently, IEM also showed a significant moderating impact on the role of green manufacturing (GMANF) and green distribution and packaging (GRDP) on the EP of manufacturing firms, thereby confirming hypotheses 7Hc and 7Hd. However, IEM did not show any moderating role on the effect of green purchasing (GRP) and green marketing (GMKT) on the EP, and hence, H7b and H7e were not supported. The results indicate that the role of green design, green manufacturing, green distribution and packaging is more significant for manufacturing firms that demonstrated high level of IEM activities compared to their counterparts with low levels of IEM practices. Also, a significant interactions were observed to exist between IEM and green design, IEM and green manufacturing, and IEM green distribution and packaging ($p<0.01$, model 2 in Table 6).

To further clarify the moderating effects of IEM, separate slots were drawn for organizations where I SD below and above the mean. It is seen from the Figure 2, Figure 3, and Figure 4 that for organizations IEM, internal environmental management interacts significantly with GSCM practices such as green design (H7a), green manufacturing (H7c), green distribution and packaging (H7d) to influence environmental performance. The figures suggest that the impact of green design, green manufacturing, and green distribution and packaging is higher when IEM is high than when it is low. Simple slope tests also confirmed that the simple slope was greater for organizations with high IEM than for the organizations with low IEM practices. Figure 2, 3, and 4 demonstrate that IEM strengthened the positive relationship between GSCM practices (i.e., GRD, GMANF, and GRDP) and EP. This confirms that the increasing positive influence of GRD, GMANF, and GRDP is stronger for organizations with high IEM is high than those with low IEM. However, the R^2 for moderation is only 2% for three interactions, which is about 0.4% for one interaction and considering the sample, they are considered significant.

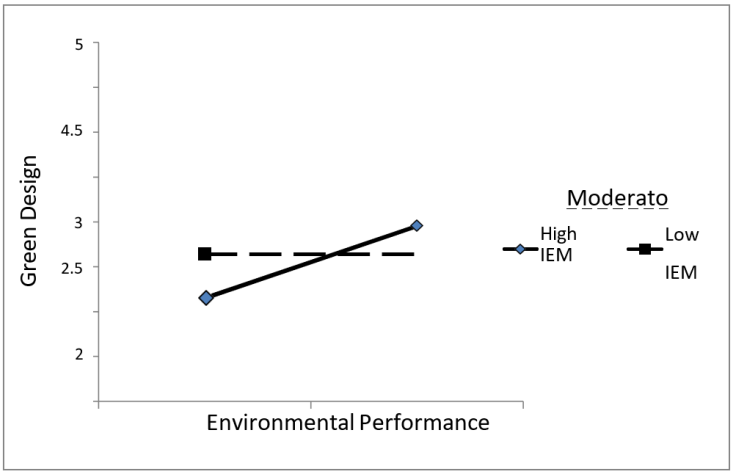

Figure 2 Interaction plot for Internal Environmental Management (IEM) as moderator between Green Design & Environmental Performance

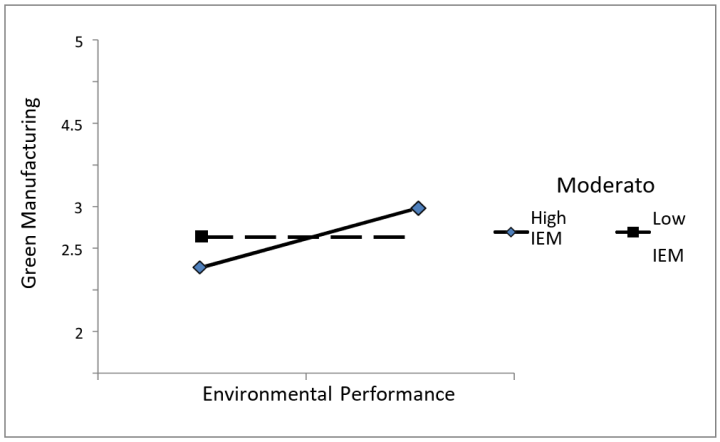

Figure 3 Interaction plot for IEM as moderator between Green Manufacturing & Environmental Performance

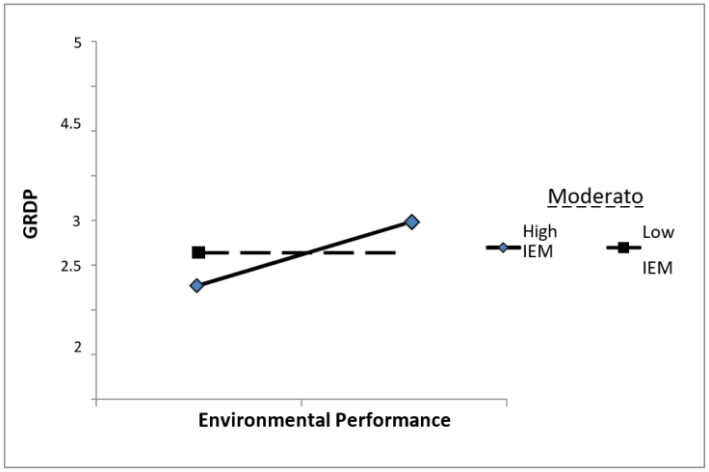

Figure 4 Interaction plot for IEM as moderator between Green Distribution and Packaging (GRDP) & Environmental Performance

Furthermore, in examining the indirect effects of GSCM activities on competitive advantage, bootstrapping resampling system was used (Shrout and Bolger, 2002) as this approach is more suitable in analyzing data with large and small sample sizes and does not require normal distribution of the samples for the analysis (Hayes, 2009). In compliance with the literature of Hayes (2009), mediating effect was tested with the bootstrapping procedure for a sample size of 5000 with 95% bias-corrected confidence intervals. Based on this method, the acceptability of the hypothesis relating to mediation depends on the confidence intervals. If the value (both lower and upper) of confidence intervals is greater than zero, then the indirect effect becomes above zero at 95 percent level of confidence, thereby confirming the alternative hypothesis. However, the results with bootstrapping procedure showed that the indirect influence of GSCM practices on CA via EP is 0.216 at confidence intervals between 0.084 and 0.437. Hence, H7 is confirmed, as the confidence intervals exceed zero.

DISCUSSION

This research proposes valuable understandings that complement existing literature on GSCM practices, EP, and competitive advantage. Specifically, this work suggests that the key antecedents including IEM, green design, green manufacturing, and green distribution and packaging indirectly influence the competitive advantage of manufacturing firms in Bangladesh via the full mediation of EP. Moreover, IEM was found to have a moderating impact on the relationship between GRD and EP, GMANF and EP, and between GRDP and EP. Based on these results, theoretical and practical implications are advanced in the following sections.

The findings also showed that three out of five dimensions of GSCM dimensions (i.e., green design, green manufacturing, and green procurement) have a positive impact on environmental performance, whereas

the green purchase and green marketing have insignificant influence on EP. These results contradict previous studies, which found positive relationships between green purchase and green marketing (Cankaya and Bulent Sezen, 2018; Han and Huo, 2020). Nevertheless, some of our findings conform to the results of Kalpande and Toke (2020). This indicates that the influence of GSCM practices activities on EP varies across countries. These differences might be due to the fact that the current level of green purchase and marketing procedure are extremely poor to improve sustainable performance of manufacturing organizations. It may also be as a result of the lack of resources needed to be devoted to the greening of purchase and marketing activities.

In terms of competitive advantage, the findings revealed that EP is positively related to competitive advantage. This observation may be ascribed to the positive influence of EP on firms' image and reputation, which consequently project the firms' competitive position in the market. In line with the previous studies (Khaksar et al., 2015), this study argues that GSCM activities are valuable source of resources that contribute to the greening of organizational operations, which in turn increases competitive advantage. Perhaps, green activities positively influence firm competitiveness, as they enable firms to carry out their operations in a cost-effective manner, minimize defects, reduce hazards, and ensure that the resources are optimally utilized towards the pursuit of corporate sustainable goals. However, the findings revealed that the GSCM practices are indeed unique and advantageous to manufacturing firms compared to traditional supply chain practices, as they help firms in attaining competitive advantages via environmental protection.

This study provides essential results, which complement previous studies on environmental performance and competitive advantage. Particularly, this study in confirming previous studies identifies three GSCM activities (GRD, GMF, and GDP) as key antecedents; however, unlike previous studies, this study complements IEM as another key predictor that indirectly influence competitive advantage via the full mediation of environmental performance. Additionally, IEM moderates the relationship between green design and EP, green manufacturing and EP, and green distribution and packaging and EP. With these findings, this research advances the following theoretical and managerial implications.

Theoretical Implications

The findings of this study have several theoretical implications. First, this research extends the resource-based view theory in examining the role of GSCM practices and IEM on EP and competitive advantage in a specific model. The findings complement existing literature wherein investigation on GSCM practices in the context of an emerging nation is non-existent (Islam et al., 2018). Contrarily, this study confirms that specific GSCM activities and organizational operation need to be considered to improve EP and predict competitive advantage corroborated by the RBV theory.

Second, although previous studies substantially focused on GSCM practices to measure its direct effect on EP (Kalyar et al., 2019; Al-Sheyadi et al., 2019; Heras-Saizabitoria et al., 2020), no single study to the best of our knowledge has been dedicated to the examination of the mediating effect of EP on the relationship between GSCM and competitive advantages. Therefore, this study is novel in its contribution indicating that a better environmental performance of the manufacturing firms significantly improves their competitive advantage.

Thirdly, this study examines the moderating role of IEM in improving EP. Although previous studies have utilized institutional pressure (Kazancoglu et al., 2018; Fang and Zhang, 2018; Foo et al., 2019) as critical moderator, no research has yet verified the moderating effect of IEM on the relationship between GSCM practices and EP. In contribution to the RBV theory, this research affirms that IEM exhibits a significant moderating impact in the improvement of EP of manufacturing firms, thereby, confirming IEM as a strong indicator of the effectiveness of GSCM practices in developing EP and the possibility of increasing competitive advantage when supported with GSCM.

Finally, our study also complements the existing literature on environmental management and competitive advantage. GSCM activities and effective EP could be viewed as vital approaches to generate competitive advantage. Yet, this study confirmed that the nature and applications of GSCM practices vary across countries. Our study observed that three GSCM practices (green design, green manufacturing, and green distribution) and one organizational practice (IEM) directly contribute to the improvement of EP and indirectly contribute to the increase in competitive advantage. The reason could be that these activities usually exert greater strategic influence on the process of greening supply chain operations of manufacturing organizations.

Implications for practice

First, this study provides necessary promising perspectives for firms struggling to gain competitive advantage via greening their supply chain operations. This study suggests that supply chain managers should undertake concerted efforts to align GSCM activities aligning within their environmental and business objectives. Our findings revealed that implementing GSCM activities in the process does not only improve EP but also provides competitive advantages for firms. Exploring this linkage may serve as an important inspiration for manufacturing firms towards greening supply chain operations. Particularly, in the context of developing countries like Bangladesh where firms are averse to GSCM due to huge costs associated with the practices, this study encourages firms by highlighting long-term benefits of implementing GSCM practices.

Second, to facilitate the implementation of GSCM activities, an inclusive approach at different levels of organizational management is recommended. For example, strategic management level should formulate and implement green strategies and set green objectives for organizational members, functional level of management should communicate and share information about green initiatives among employees across the organization, and at the operational level all employees and other stakeholders should be involved in the process of greening the supply chain.

Third, companies usually lack motivation to greening their operations (Zhu et al., 2005). In other words, companies often tend to "talk the green talk rather than walk the green walk" (Han and Huo, 2020, p. 668), which ultimately limits their capacity to gain competitive advantage associated with adopting GSCM practices. This study provides the motivation for firms to implementing GSCM activities, as it helps firms in sustaining their competitive advantage through better ecological performance. This study also provides insights for decision-makers and managers to properly manage and utilize resources in order to attain desired level of environmental sustainability and business objectives.

Finally, the important association of GSCM with for EP and CA implies the need for HRM managers to develop knowledge, skills, abilities, and other attributes known as eco-supply chain-related KSAOs among employees at the firm level. Top-level managers in Bangladeshi manufacturing firms need to understand that GSCM needs to be integrated with internal eco-interventions to attain competitive advantage. Efforts from the Bangladeshi government are also required to develop necessary infrastructure, provide incentives for greening operations, and formulate rules and regulations about GSCM activities. Moreover, Bangladeshi firms need to make further investment in designing and implementing green system for sourcing materials, inputs, and accessories, as well as marketing of their products. Implementation of the above can provide opportunities for relocation of the firms to the market segments that are eco-sensitive.

Limitations and directions for future research

Despite its robust findings, this research is not bereft of some limitations that may give directions for future research. First, this study surveyed some manufacturing companies located in two cities (Dhaka and Chattogram), excluding others in various cities of the country, which may limit the generalization of our findings to understanding the EP and competitive advantage potentiality in other sectors such as services, hospitality, health, and banking. Second, this study utilized the cross-sectional data, which may hinder the drawing of conclusions on the causal relationships among underlying constructs under study. Additionally, no potential concern for CMB was reported by the analysis, and the results for validity and reliability were confirmed by applying reliable statistical tools. However, future studies may consider applying mixed method to overcome the limitations of quantitative approach.

Third, this study examined the impact of GSCM activities on EP, which is one of the dimensions of sustainable development. Thus, future studies may explore the effects of GSCM practices on other dimensions of sustainable development, such as economic and social performance. Fourth, this study generally examined the moderating effect of IEM, which may not provide on specific IEM activities, such as green work climate, employee green values, and green work culture. Further research may consider these specific activities to explain firm competitiveness in a wider context. Finally, the two unsupported hypotheses in our analysis may be further explored by future researchers.

CONCLUSION

This study explores the significant moderating effect of internal environmental management (IEM) in improving the environmental performance of manufacturing organizations and the complete mediation of environmental performance in generating competitive advantage. Organizations with better ecological performance via greening of supply chain operations tend to generate more competitive advantage, which may enable them to sustain their businesses. The study revealed that IEM is crucial factor, which substantially augments the relationships between GSCM activities and environmental performance. This suggests that if the adoption of GSCM activities does produce effective EP, manufacturing firms should initiate IEM activities and policies to guide employees on their duties and responsibilities towards attaining desired environmental sustainability. Therefore, it can be concluded that GSCM practices are more effective in improving EP when complemented with IEM.

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APPENDIX

Appendix1 Questionnaire

Statements	Strongly Disagree	Neutral	Strongly Agree
Internal Environment Management			
Cross-functional cooperation for environmental improvements			
Established an environmental protection index of recycling, gaseous reduction and energy conservation.			
Environmental management system exists.			
Support for environmental practices from senior managers and mid-level managers			
The company's efforts in relation to environmental matters have exceeded the requirements of the relevant regulations.			
Green Design			
Design of products for reduced consumption of material/energy			
Design of products for reuse, recycle, recovery of material, component parts			
Design of products to avoid or reduce use of hazardous of products and/or their manufacturing process			
Design of product for support regulation			
Design of products to be easy set up for the users in the most energy saving way			
Design usability of part particularly for extend using products, repair easy and increase efficiency			
Green Purchasing			
Providing design specification to suppliers that include environmental requirements for purchased item			
Cooperation with suppliers for environmental objectives			
Choice of suppliers by environmental criteria			
Suppliers' ISO14000 certification			
Environmental audit for suppliers' internal management.			
Green Manufacturing			
The manufacturing process will reduce the noise pollution to the minimum.			
Substitution of polluting and hazardous materials/parts.			
Filters and controls on emissions and discharges.			
Production planning and control focused on reducing waste and optimizing materials exploitation			
Process design focused on reducing energy and natural resources consumption in operations			
Green distribution and Packaging			
Reduction of packaging materials.			
Ecological materials for primary packaging.			
Recyclable or reusable packaging/containers in logistics.			
Selection of cleaner transportation methods.			
Effective shipment consolidation and full vehicle loading.			
Routing systems to minimize travel distances.			
Green Marketing			
Supply to customers and institutions of regular voluntary information about environmental management			
Sponsoring of environmental events/collaboration with ecological organizations			
Use of natural environmental arguments in marketing			
Periodic updating of the website on environmental issues			
Material packages will be labeled for retrieval purposes			
Considered that Eco Products boost the consumers' purchasing willingness			
Environmental Performance			
Improvement of an enterprise's environmental situation.			
Reduction in waste (water and/or solid).			
Reduction in air emission			
Decrease of consumption for hazardous/harmful/toxic materials			
Decrease of frequency for environmental accidents			
Competitive Advantage			
Reduction in insurance premium costs.			
Cost reduction due to the unification of some administrative and/or technical processes			
Reduction in regulation compliance costs (the firm avoids fines for polluting and compensations for damages caused)			
Gaining brand image.			
Achieving greater credibility before the society.			
Job position			
Industry type			
Number of employees			