The impact of environmental management accounting on environmental and financial performance: empirical evidence from Bangladesh

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3 authors, including:

Md. Mominur Rahman
BGIFT Institute of Science and Technology

Muhammad Shajib Rahman
Comilla University

The impact of environmental management accounting on environmental and financial performance: empirical evidence from Bangladesh

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Bishawjit Chandra Deb
Department of Accounting and Information Systems, Comilla University, Comilla, Bangladesh

Md. Mominur Rahman
Department of Accounting and Information Systems, Comilla University, Comilla, Bangladesh and Department of Business Administration, BGIFT Institute of Science & Technology (BIST), Gazipur, Bangladesh, and

Muhammad Shajib Rahman
Department of Accounting and Information Systems, Comilla University, Comilla, Bangladesh

Abstract

Purpose – This study aims to investigate the impact of environmental management accounting (EMA) on manufacturing companies' environmental and financial performance in Bangladesh. Thus, this research recognizes essential factors such as EMA, environmental performance (EP), financial performance (FP), environmental information systems (EIS), knowledge management (KM), green innovation and energy efficiency (EE).

Design/methodology/approach – This research uses a quantitative approach and uses 323 responses from the manufacturing firms. This research tests the study model through the "Partial Least Square-Structural Equation Modeling" (PLS-SEM) technique using Smart PLS v3.3 software. This research uses

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AMOS v24 and 40% sample consideration to check the robustness. The study passes various model fit measures, i.e. reliability, validity, factor analysis and goodness of fit.

Findings – The research finds that EMA is positively and significantly associated with EP and FP. The study also finds a substantial relationship between recognized factors with EMA and EP. This research connects the stakeholder theory and institutional theory to the EMA model and shows the pressures from stakeholders and institutions reassuring the manufacturing firms to implement EMA. This research evidences that EMA enhances EP and FP.

Originality/value – The policymakers, regulators and government can consider these findings to formulate policy regarding companies' EP and FP. Particularly, company executives can focus on KM, EIS, green innovation and EE factors for EP and FP.

Keywords Energy efficiency, Environmental management accounting, Environmental performance, Green innovation, Environmental information systems

Paper type Research paper

1. Introduction

The international economy has grown fast in the twenty-first century, owing to population increase and industrial expansion; meanwhile, environmental degradation has become extremely severe (Wu *et al.*, 2020). Environmental concerns such as changing climate, carbon emissions, waste disposal, landfills usage, land and water contamination, resource consumption and material recycling have enhanced managers' awareness (Saeidi *et al.*, 2018). Additionally, "Increased regulatory demands and public concern are compelling corporations to broaden their corporate obligations to incorporate environmental and social considerations into all aspects of their operations," according to Baah *et al.* (2021, p. 103). Environmental issues are becoming increasingly important to many stakeholders, including shareholders, consumers, workers, suppliers and governments (Baah *et al.*, 2021; Chiou *et al.*, 2011; Gholami *et al.*, 2013). Because of this, many firms are incentivized to improve environmental mitigation measures and report on the ecological impacts to fulfill their customers' and shareholders' requirements (Iredele *et al.*, 2020; Jinadu *et al.*, 2015). As a result of these expectations, businesses have been pushed to experiment with various environmental management strategies, bringing environmental sustainability into the realm of strategic management. Thus, this research established a holistic link for environmental management accounting (EMA).

Gunarathne *et al.* (2021, p. 831) argued, "Companies have recently started to face growing worries about the environmental and social impact of the company as it is increasingly recognized that each operational procedure has the potential to affect environmental and societal systems adversely." Nowadays, governments, businesses, the general public and other international organizations have started to accept the notion of sustainable development, asserting that economic growth and environmental preservation are possible. Therefore, these bodies are working to encourage enterprises to focus on their financial success and the environment and society (Jinadu *et al.*, 2015). Thus, the manufacturing companies focus more on environmental and economic performance. The previous studies stated that the company's financial performance (FP) is the ultimate success (Aigbedo, 2021; Christine *et al.*, 2019), but environmental performance (EP) cannot be ignored any more (Mayndarto and Murwaningsari, 2021). Considering these issues, the authors develop an association between "Environmental performance" and "Financial performance." The study's main aim is to evaluate the effect of EMA on EP and FP. The following questions are to meet the study's purpose:

Q1. Does environment management accounting affect energy efficiency (EE), environmental information systems (EIS), green innovation and knowledge management (KM)?

Q2. Do EE, EIS, green innovation and KM enhance EP?

Q3. Does the EP of manufacturing companies affect their FP?

There is a gap in the literature on the relationship of EMA with EP and FP in South Asia, specifically in Bangladeshi manufacturing companies. Further, KM, EE, EIS and green innovation have not been linked in the previous literature in South Asia. A limited number of studies were found that linked EMA and EP, but those studies focused on developed countries (Al-Tuwaijri *et al.*, 2004; Alaeddin *et al.*, 2019; Christine *et al.*, 2019; Jinadu *et al.*, 2015; Liu *et al.*, 2018; Mayndarto and Murwaningsari, 2021). Further, the relationship between EP and FP has not been established in Bangladeshi manufacturing companies (Horváthová, 2010; Iwata and Okada, 2011; Nakao *et al.*, 2007; Niu *et al.*, 2017; Ong *et al.*, 2019). These gaps in the literature suggest two directions for future research.

First, existing scholars call for further investigation to recognize the associations between EMA, EP and business performance. Second, they emphasize the importance of considering other aspects of EMA in the organization to have a complete picture of the EMA implementation. Thus, to fill these gaps, the authors evaluate the relationship of EMA with EE suggested by Alaeddin *et al.* (2019); Dakwale *et al.* (2011) and Jermsittiparsert *et al.* (2020); EIS suggested by Günther (2013); Mandal and Bagchi (2016) and Meacham *et al.* (2013); green innovation suggested by da Rosa *et al.* (2020); Kraus *et al.* (2020) and Zandi *et al.* (2019) and KM suggested by Kapiyangoda and Gooneratne (2021); Mansoor *et al.* (2021). Further, whether EE, EIS, green innovation and KM have associations with EP or not have been examined in this study. Finally, the authors develop a framework considering the relationship of EMA, EP and FP to recommend the manufacturing companies of Bangladesh.

This study contributes at least three ways. First, this research extends the debate on the association between EMA and EP by integrating FP into existing studies (Agyemang *et al.*, 2021; Aigbedo, 2021; Alaeddin *et al.*, 2019; Baloch *et al.*, 2020). Second, the study investigates that EMA is positively associated with environmental KM, green innovation, EIS and EE. Thus, manufacturing companies can significantly consider these factors to practice EMA. Third, some previous studies have concentrated their attention on developed nations and a few developing nations (Danso *et al.*, 2019; Latif *et al.*, 2020; Solovida and Latan, 2017) while overlooking expanding economies in South Asia, such as Bangladesh; this research adds the evidence from developing economies.

The rest of the paper includes Section 2: theoretical background and hypothesis, Section 3: methodology, Section 4: results, Section 5: discussion and Section 6: conclusion.

2. Theoretical background and hypotheses

2.1 Theoretical foundation

Stakeholder theory grew in popularity as the global economy became so interdependent that ripple effects may be seen across far-reaching distances (Baah *et al.*, 2021). Stakeholder theory works for sustainability and society's well-being while making decisions regarding FP. This theory supports ethical judgments on how well the organization incorporates stakeholders' input (Hadj, 2020). Further, the theory implies that stakeholders' positive commitments can enhance FP through cost savings. Using stakeholder theory, existing researchers suggested that companies improve product and services maintenance

(Elijido-Ten, 2007), retain qualified staff (Baloch *et al.*, 2020; Bennett *et al.*, 2002), enhance companies' reputations (Anthony, 2019), improve customer satisfaction (Chen, 2008), sustain competitive advantages (Rao and Holt, 2005; Singh *et al.*, 2019), reduce environmental risk (Hadj, 2020) and enlarge market opportunities (Danso *et al.*, 2019; Rao and Holt, 2005). In this study, stakeholder theory argues that while companies relate stakeholders to EP, they may capitalize on competitive advantage (Grekova *et al.*, 2013).

The institutional theory conceptualizes activities and behaviors of an organization such as physical activity, reduction of consumption and stewardship of the environment (Bennett *et al.*, 2002). Also, companies are influenced by legal and regulatory systems, social and cultural standards and industry and value norms (Roos *et al.*, 2020). Thus, these factors create pressure to demonstrate positive EP (Iredele *et al.*, 2020). Conversely, companies might be financially lost if they are proved by negative ecological performance. Therefore, institutional theory suggests developing EMA practices to address environmental issues (Bennett *et al.*, 2002).

There are three distinct forms of institutional forces (coercive, mimetic and normative) that helps to recognize various pressures an organization faces (Al-Mawali *et al.*, 2018). Government or nongovernment groups exert coercive pressure on manufacturing enterprises to adopt different environmental legislation and standards (Bennett *et al.*, 2002). As a result of coercive pressures, Bangladeshi manufacturing companies need to focus on EP. The authorities impose no major penalties or fines as BSEC does not mandate specific guidelines on environmental protection to manufacturing firms. The Environment Conservation Act 1995, the Environment Court Act 2010 and the Bangladesh Water Act 2013 pressurize manufacturing enterprises to operate sustainably. The government highly encourages and supports EMA implementation in countries except for Bangladesh. If industrial firms are under pressure to maintain EP, EMA adoption will gain government support and economic rewards. Normative pressure is a driving force by which customers and suppliers notice a company's functions.

Due to these constraints, manufacturing industries can apply EMA practices to be socially responsible (Chen, 2008). By adopting EMA, manufacturing companies can control public perception through communication and management methods. The image and reputation of manufacturing companies can be harmed if they ignore these factors. Bad reputations substantially negatively impact the competitive position, leading to financial loss for companies (Danso *et al.*, 2019). Mimetic pressure occurs when a company competes for better outcomes (Chuang and Huang, 2018). EP in Bangladesh may be improved through enlarged firm competitiveness. So mimetic pressure can be a tool for ensuring better environmental outcomes. Thus, EMA can be a better choice for manufacturing companies to get a competitive edge.

2.2 Environmental management accounting in the manufacturing settings

Bangladesh is one of the world's most susceptible countries to environmental degradation (Danso *et al.*, 2019). Without an efficient legislative framework and its execution, it will be impossible to tackle the rising environmental requirements in Bangladesh. A significant portion of Bangladesh's environmental issues stems from the country's manufacturing sectors. Toxic gas emissions from manufacturing factories are causing more harm to people's health and the environment. Carbon dioxide and methane are among the gases burnt in industries and released into the environment hampered badly to the environment (Chapman *et al.*, 2006). In addition, the manufacturing business disperses several substances harmful to the environment in Bangladesh. Environmental issues include overgrazing, deforestation, desertification, the import of hazardous waste and the collapse and pollution of land and water resources. Bangladesh Securities and Exchange Commission (BSEC) stated that manufacturing companies must do all possible to preserve and safeguard the environment to avoid global catastrophes, citing the importance of the environment in society and business. Several manufacturing companies such as cement, ceramics, food and allied, pharmaceuticals and chemicals, paper and printing and textile are listed on Dhaka Stock Exchange and Chittagong Stock Exchange. Notably, these manufacturing companies are more hazardous to the environment as they directly deal with natural resources.

Environment pressures from industrial activity include emissions to the atmosphere and aquatic ecosystems, trash creation and resource use. In this regard, Bangladesh is concerned about the damage to its environment. According to Frost and Wilmshurst (2000), the environment is no longer a given factor but one that manufacturing businesses should consider. A product, service or process's environmental impact can be analyzed to determine its environmental impact. As a result of this and other factors, environmental expenses go up. As a result, conventional accounting systems cannot account for these environmental expenditures, which are often assigned to general overhead accounts. Therefore, a kind of environmental accounting known as EMA has been developed to understand these environmental costs better. Financial and nonfinancial data are used to assist internal management in EMA. According to Bennett (2016), EMA is a complimentary management accounting method to the financial accounting approach. EMA aids in identifying and allocating environmental costs and seeks to design plans that are acceptable in this regard. As a result, EMA is the top choice for Bangladesh's manufacturing firms. This research targets some identical concepts of EMA, i.e. EIS, KM, green innovation and EE, to associate with the EP and FP of the Bangladesh manufacturing companies.

2.3 Environmental management accounting, environmental and financial performance

This section reviews the existing studies regarding EIS, KM, green innovation, EE, EP and FP.

EIS are the core of modern environmental management systems and a prerequisite for stakeholders' accurate and timely information (Anthony, 2019). With EIS, the efficiency of companies' operations and supply chains are improved, resulting in a better environmental impact. Furthermore, by boosting the usefulness of IT infrastructure resources, EIS integration in organizations can contribute to cost savings (Günther, 2013). EIS and IT can help systems, goods and processes consume less energy, recycle and reuse materials, minimize waste, water and pollution, protect natural resources and enhance environmental sustainability (Gholami *et al.*, 2013). EIS improves environmental and economic performance by helping organizations be more sustainable. However, IT implementation in enterprises may have various adverse effects on the natural environment, resulting in environmental deterioration. As a result, it has become clear that climate change is altering the ecosystem, health impacts, institutions and social activities throughout time (Liu *et al.*, 2018). Therefore, companies must use EMA procedures to integrate the EIS with biodiversity conservation and natural resource management.

On the other hand, EIS is envisioned as a synergic word for IT with better EMA procedures than traditional accounting processes. As demonstrated in Figure 1, EMA should be implemented to improve EIS throughout a business and society. Past studies call for further studies for EMA and EP due to mixed findings and also for finding other factors that may exist in this relationship (Meacham *et al.*, 2013; Yang Spencer *et al.*, 2013). Based on the literature, this research includes EIS in this relationship. As the association of EMA with EIS and EMA is novel in the literature of the Bangladeshi manufacturing setting, therefore, the authors developed the following alternative hypotheses:

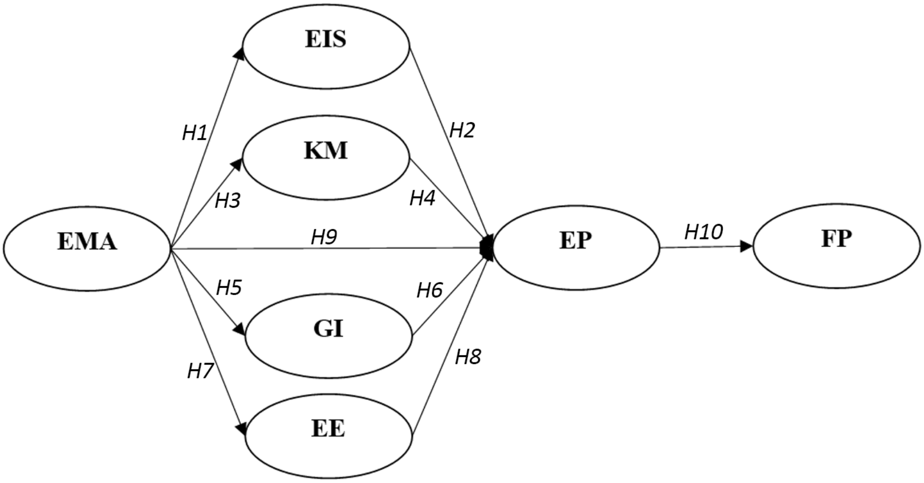


Figure 1. Conceptual model of the study with hypotheses developed by the authors

H1. EMA influences EIS.

H2. EIS influences EP.

KM is managing, creating, sharing, coding, retaining and acquiring knowledge based on the active organizational environment (Zandi *et al.*, 2019). Ensuring that accounting information is easily accessible and valuable requires a KM system to be integrated into an EMA function. In today's dynamic competitive climate, manufacturing services have grown increasingly complicated and knowledge-intensive (Zandi *et al.*, 2019). Knowledge assets have become increasingly crucial for production organizations to fulfill performance objectives (Tseng, 2010). To establish ecologically friendly service plans, it is thus necessary to use the KM strategy. There has been a significant expansion of KM research and application in recent years. To begin with, in the face of this shifting landscape, how the manufacturing sectors respond to the themes of EMA and KM could be of interest.

Because of the crucial role of manufacturing enterprises in domestic and worldwide markets, it would be good to see how this field uses KM to achieve its environmental objectives. More specifically, this study is interested in adopting KM techniques that support and improve manufacturing organizations' EP. Evangelista and Durst (2015) call for further studies on EMA and EP due to new factors in this relationship. Based on the literature, this research includes KM in this relationship. The association of EMA with KM and EP is wide-ranging in the manufacturing setting of Bangladeshi literature; therefore, this research develops the following alternative hypotheses:

H3. EMA influences KM.

H4. KM influences EP.

"Green innovation is divided into three categories: green process innovations, green product innovation, and green management innovation," according to Ferreira *et al.* (2010, pp. 923–30). Saeidi *et al.* (2018) revealed that the invention of greener products and greener manufacturing processes is positively associated with the competitive advantage of manufacturing companies. Somjai *et al.* (2020) later proposed the notion of core competencies. Chen (2008) and Somjai *et al.* (2020) demonstrate that green core competencies, which include a firm's collective capacity to use innovation to create environmentally conscious products and processes, are associated with a company's number of green innovation projects. Green innovation, in turn, benefits a company's green image and overall competitiveness. As the association of EMA and EP is mixed other factors like green innovation can be included to get thorough findings (Hadj, 2020; Huang and Li, 2017). Thus, this research develops green innovation (GI) in this relationship. As there exists a novel association of EMA with GI and EP, the authors propose the following alternative hypotheses:

H5. EMA influences green innovation.

H6. Green innovation influences EP.

The literature highlights the link between being proactive in EMA and EE as confusing. Long-term EE-EP association research has been examined extensively during the past two decades, and comprehensive assessments of this body of work are available (Grekova *et al.*, 2013; Ingrao *et al.*, 2018). A significant amount of work has been dedicated to rigorously testing the link between EP and EE (Agyemang *et al.*, 2021; Christine *et al.*, 2019). The existing academics use distinct concepts and measurement strategies for measuring EP (Al-Mawali *et al.*, 2018). On the other hand, the academics in this group use several measurements for EP, diverse research approaches and examine national economy sectors that are quite varied. Ingrao *et al.* (2018) compare and contrast various studies based on sample size, environmental factors, performance factors and study methods. Past studies call for further studies for EMA and EP due to mixed findings (Agustia *et al.*, 2019; da Rosa *et al.*, 2020; Ferreira *et al.*, 2010; Ingrao *et al.*, 2018; King and Lenox, 2001). Therefore, this study includes EE in the association between EMA and EP. The authors develop the following alternative hypotheses:

H7. EMA influences EE.

H8. EE influences EP.

EMA is described as ecological and financial management by developing and implementing adequate sustainability reporting systems and procedures (Chiou *et al.*, 2011; Elijido-Ten, 2007). EMA is different from other traditional accounting systems in identifying environmental information, measuring ecological data and interpreting environmental information in the accounts. It takes environmental concerns into account. Adopting EMA may save expenses and lead firms to enhance "Environmental performance" and "Financial performance" (Horváthová, 2010; Latan *et al.*, 2018). Furthermore, EMA implementation can lessen the expenses of environmental regulation while also improving the company's image in terms of environmental stewardship (Salama, 2005; Solovida and Latan, 2017). EMA addresses information about the environment that has ecological consequences and improves the sustainability performance of an enterprise. EMA may indeed be separated into two components: the monetary component as well as the physical component. The economic parts of EMA are focused on a company's operations that affect the environment and are stated in financial terms (Mansoor *et al.*, 2021; Zandi *et al.*, 2019). The monetary units mentioned here fascinate decision-makers since they give pertinent information. EMA's physical element is founded on natural environmental data presented in physical units (Al-Tuwaijri *et al.*, 2004; Dakwale *et al.*, 2011). These two information platforms enable senior management to make more informed decisions that benefit the environment and the economy.

Past EMA research focuses on relevance of environmental accounting (King and Lenox, 2001; Roos *et al.*, 2020), significance of environmental management systems (Salama, 2005), role of EMA but focused on developed countries as well as nonmanufacturing firms (Le and Nguyen, 2018; Zeng *et al.*, 2020), EMA and cost advantage (Christine *et al.*, 2019; Grekova *et al.*, 2013), green accounting disclosure and corporate social responsibility (Hadj, 2020; Horváthová, 2010; Ingrao *et al.*, 2018), problems and prospects of EMA implementation (Iwata and Okada, 2011), institutional pressures and EMA (Latan *et al.*, 2018; Setthasakko, 2010), environmental management strategy and organizational performance (Omran *et al.*, 2021; Rao and Holt, 2005), green production and FP (Chiou *et al.*, 2011; Huang and Li, 2017), barriers to the development of EMA (Setthasakko, 2010; Solovida and Latan, 2017), green environment system and EP (Mansoor *et al.*, 2021; Meacham *et al.*, 2013), management support and EMA (Singh *et al.*, 2019; Yang Spencer *et al.*, 2013), meta-analysis on EP and FP (Le *et al.*, 2019; Sari *et al.*, 2020) and environmental strategy and EP (Christine *et al.*, 2019; Chuang and Huang, 2018).

EP is a growing issue for various stakeholders worldwide, including governments, businesses, legislators and customers (Nakao *et al.*, 2007; Solovida and Latan, 2017). Changing is viewed as a danger to ecological sustainability; thus, sustainable environmental activities such as greenhouse gas emission reductions are critical components of climate change mitigation (Anthony, 2019; Gholami *et al.*, 2013). According to the literature, EP encompasses internal and external efforts, environmental ethics and values surrounding development concerns (Chuang and Huang, 2018; Wu *et al.*, 2020). They have shown that ecological performance measures address environmental concerns, including internal systems, diverse stakeholder interactions, limiting external consequences and compliance with environmental rules. Emphasizing the integration of environmental effectiveness by stakeholders, it was said that environmental accounting offers organizations a beneficial way of informing their green policies and accomplishments. However, past studies call for further studies for EMA, EP and FP due to mixed findings (Chuang and Huang, 2018; Gholami *et al.*, 2013; Iwata and Okada, 2011; Latan *et al.*, 2018; Mansoor *et al.*, 2021). Based on the literature on EP, EMA and FP in Bangladesh, therefore, authors developed the following alternative hypotheses:

H9. EMA influences EP.

H10. EP influences FP.

The relationship between these variables (EIS, KM, GI, EE, FP, EP and EMA) and the structural model of the study is depicted in Figure 1.

3. Empirical methodology of the study

3.1 Data and survey design

According to the recommendations of Pons *et al.* (2013) and Le and Nguyen (2018), this research considers Bangladeshi manufacturing companies as the unit of analysis of this research. According to the comment of Baah *et al.* (2021), mostly environmentally harmful industries are cement, ceramics, food and allied, pharmaceuticals and chemicals, paper and printing and textile companies that are listed on the Dhaka Stock Exchange [1] (DSE) and Chittagong Stock Exchange [2] (CSE) of Bangladesh. This research considers DSE and CSE listed companies as the population because listed companies are aware and concerned about complying with the BSEC's guidelines. Thus, this study collects contact information from the DSE and CSE's websites and proceeds to collect data. Considering the convenience of data collection like location, cost, time and Covid-19 (Sarstedt *et al.*, 2018), the authors contacted 50 manufacturing firms in Table 1. But 34 firms agreed, welcomed the research team, and fixed the data collection date with a specified time.

However, to calculate the sample size required for the analysis and ensure the validity of the data, the formula below is adopted (Marcoulides and Saunders, 2006) as follows:

$$\mathrm{n} = \frac{Z^2\ \sigma^2}{e^2}$$

Hair *et al.* (2012) indicated that the sampling size rule to be as follows the above formula, for many of the most significant number of paths directed of a specific construct in a particular structural model, the number of the sample size should be ten times greater or equal to that. Moreover, based on a tenfold guideline requirement for minimum sample size (Hair *et al.*, 2016), more than 300 valid respondents should suit. Therefore, we adopted a seven-point-scale questionnaire for the survey; sampling assessment was adopted as follows: Assuming $\boldsymbol{e} = 5\%$ $\mathbf{Z} = 1.96$, $\boldsymbol{\sigma} = 1.25$, then the estimated number of samples is expected to be:

$$\mathrm{n} = \frac{1.96^2 1.25^2}{(7*0.02)^2} = 306$$

According to Ferreira *et al.* (2010), Pons *et al.* (2013) and Le and Nguyen (2018), finance controllers, chief executing officers, management accountants, departmental managers of the top level and senior officers of a firm are directly connected to the business environment and are appropriate participants in EMA research. Eleven questionnaires (one for the finance controller, one for the chief executing officer, one for the management accountant, four for departmental managers of the top level and four for the senior officers) have been sent to each firm with the research team. Initially, the authors planned that the sample was 374 (11 respondents multiplied by 34 firms). However, the authors use the pretesting and pilot testing method before administering the questionnaire suggested by Saunders *et al.* (2019). The field survey period lasted 68 days (parts of November in 2020, full of December in 2020 and parts of January in 2021). Out of 374 questionnaires, 37 questionnaires were entirely blanked, 11 responses were partly completed and three responses were unmatched (filled up by other than target respondents). Finally, the research team obtained 323

	DSE listed		CSE listed	
Manufacturing firms	Total	Chosen	Total	Chosen
Cements	7	1	7	1
Ceramics	5	1	5	1
Food and allied	20	3	12	2
Pharmaceuticals and chemicals	31	5	27	4
Paper and printing	4	1	6	1
Textile	56	8	52	6
Total	*123*	*19*	*109*	*15*

Source: Self-developed

Table 1.
Number of selected manufacturing firms

responses, with an 86% response rate (323/374). Table 2 shows the details of the profiles of the respondents.

3.2 Construct measurements

This research survey arranges four sections of the survey items. Section one includes the demographic profile of the respondents, for instance, the nature of the manufacturing firm, firm age (operating years), firm size (number of full-time employees), gender, age, year of experience and designation of the respondents. Section two includes statements regarding

Particulars	Classes	Frequencies	(%)
Respondent profile (Total 323 respondents)			
Gender	Male	209	65
	Female	114	35
	Total	*323*	*100*
Age	Below 30 years	97	30
	30–40 years	149	46
	41–50 years	54	17
	Above 50 years	23	7
	Total	*323*	*100*
Year of experience	Below 5 years	87	27
	5–10 years	104	32
	11–20 years	83	26
	Above 20 years	49	15
	Total	*323*	*100*
Designation	Finance controller	29	9
	CFO	27	8
	Management accountant	31	10
	Departmental manager	107	33
	Senior officer	129	40
	Total	*323*	*100*
Firm profile (Total 34 Firms)			
Type of manufacturing concern	Cement	2	6
	Ceramics	2	6
	Food and allied	5	15
	Pharmaceuticals and chemicals	9	26
	Paper and printing	2	6
	Textile and clothing	14	41
	Total	*34*	*100*
Firm age (year of operation)	Below 5 years	7	21
	5–10 years	12	35
	11–20 years	9	26
	Above 20 years	6	18
	Total	*34*	*100*
Firm size (no. of employees)	Below 100	4	12
	100–250	6	18
	251–500	11	32
	Above 500	13	38
	Total	*34*	*100*

Source: Self-constructed based on the responses

Table 2. Demographics of the companies and participants

EMA. Section three consists of EIS, KM, GI and EE statements. Finally, section four has been developed using the statements of EP and FP. According to Ghauri *et al.* (2020), seven-point Likert scaling is more accurate than five-point, considering a better reflection of the respondents' true evaluation. Thus, the authors measured all the questionnaire statements using a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Further, the nature of the manufacturing firm, firm age and firm size have been considered the control variables. Christine *et al.* (2019) stated that these control variables might affect any firm's EMA, EP and FP.

To measure the EMA, the authors use the statements of Le *et al.* (2019), Iwata and Okada (2011), Zandi *et al.* (2019) and Mohd Fuzi *et al.* (2019) by adopting four questions while adding two questions given by Ramli and Ismail (2013) and Christine *et al.* (2019). The EIS is measured by using eight statements, in which three questions were adopted from Yang Spencer *et al.* (2013) and Mandal and Bagchi (2016), two questions from Günther (2013) and three questions from Mohd Fuzi *et al.* (2019). Finally, KM is measured using three statements from the questions developed by Zandi *et al.* (2019) and Mohd Fuzi *et al.* (2019), who built on the prior work of Ramli and Ismail (2013) and Ramli and Ismail (2013). In addition, the authors use one question from Mandal and Bagchi (2016).

To measure the GI, the authors use the statements of Ong *et al.* (2019), Chen (2008) and Chiou *et al.* (2011) and by adopting two questions while adding three questions given by Zandi *et al.* (2019) and Grekova *et al.* (2013). The EE is measured by using four statements, in which two questions are adopted from Alaeddin *et al.* (2019) and Baloch *et al.* (2020) and the other two questions from Wu *et al.* (2020) and Dakwale *et al.* (2011). Adopting three statements from Al-Tuwaijri *et al.* (2004), Ong *et al.* (2019), Alaeddin *et al.* (2019) and Baloch *et al.* (2020) and two statements from Yang Spencer *et al.* (2013), Christine *et al.* (2019) and Mandal and Bagchi (2016), the authors measured the five statements of EP. This research considers the statements of Elijido-Ten (2007), Le and Nguyen (2018), Mohd Fuzi *et al.* (2019) and Al-Tuwaijri *et al.* (2004) by adopting three questions while adding one question given by Rao and Holt (2005) and Christine *et al.* (2019) for measuring FP. Following the study of Ferreira *et al.* (2010) and King and Lenox (2001), the authors use the manufacturing firm's type, size and firm's age as control variables. Detailed categories of the control variables have been presented in Table 2.

4. Results

This research uses Smart PLS version 3.3 to test all the hypotheses (*H1* to *H10*) through the "Partial Least Square Structural Equation Model" (PLS-SEM). Baah *et al.* (2021), Hair *et al.* (2016) and Khan *et al.* (2019) suggested using PLS-SEM as it is suitable for multiple hypotheses testing and is advanced to test a theory as well as the goodness of fit measure and is also capable to examine the associations among multiple latent variables concurrently. As Figure 1 indicates multiple testing relationships, PLS-SEM is very suitable for analyzing the data. Model reliability, convergent validity, discriminant validity, nonresponse bias, common method bias, the goodness of fit, model performance, hypothesis testing and robustness check have been detailed in the succeeding subheadings.

4.1 Reliability and validity

Hair *et al.* (2016), Kline (2015) and Khan *et al.* (2019) argued that "Composite reliability (CR), average variance extracted (AVE), Cronbach alpha (α), and RhoA of each latent variable, together with mean, standard deviation, and factor loadings for every statement of the variable, is the important measured to test the reliability and validity"; thus, these measures are used, and results are presented in Table 3.

Constructs and items	Code	Mean*	SD*	FL***	VIF
*Environmental Management Accounting***	EMA	4.382	1.125		
α 0.80; rho: 0.80; CR: 0.86; AVE: 0.54					
"Trace environmental information by detailed accounts"	EMA1	4.26	1.423	0.715	1.366
"Determine environmental costs by modern method"	EMA2	4.957	1.787	0.745	1.604
"Estimating environmental cost"	EMA3	3.771	1.629	0.676	1.462
"Assessing environmental cost report"	EMA4	4.641	1.487	0.840	2.043
"Developing environmental performance indicators"	EMA5	5.003	1.577	0.701	1.414
*Environmental Information System***	EIS	4.581	1.211		
α 0.84; rho: 0.86; CR: 0.88; AVE: 0.52					
"Environmental accounting information can be obtained immediately upon request in our organization"	EIS1	4.907	1.318	0.731	1.780
"Our organisation quantifies the likelihood of future environmental events occurring, such as probability estimates"	EIS2	4.895	1.343	0.741	1.798
"Non-economic information, such as stakeholder opinion, employee attitudes, government regulations on environmental issues, is collected in our organisation"	EIS3	4.483	1.557	0.566	1.330
"Information on broad factors external to our organisation, such as the greenhouse effect, global warming, pollution, is gathered in our organisation"	EIS4	4.793	1.35	0.729	1.591
"Non-financial information that relates to the production, such as waste production, gas emission, is recorded in our organisation"	EIS5	4.554	1.414	0.745	1.658
"Targets for the environmental protection activities are specified for all sections/business units in our organisation"	EIS6	5.17	1.429	0.769	2.067
"Information which relates to possible future environmental events is available in our organization."	EIS7	5.146	1.479	0.726	1.941
Knowledge Management	KM	4.536	1.261		
α 0.85; rho: 0.85; CR: 0.90; AVE: 0.69					
"Creation of knowledge through observation of the working environment"	KM1	4.619	1.481	0.830	1.975
"Knowledge is created during group meetings and seminars"	kM2	5.158	1.393	0.809	1.820
"Sharing knowledge through the organisation"	KM3	4.545	1.483	0.862	2.203
"Knowledge acquisition through the organisation"	KM4	4.666	1.321	0.827	1.880
Green innovation	GI	4.632	1.153		
α 0.90; rho: 0.93; CR: 0.93; AVE: 0.73					
"Carried out recycle, reuse, and remanufacturing of material or parts"	GI1	4.728	1.271	0.891	3.148
"The redesign manufacturing process to lower pollution of air, water, and noise"	GI2	4.957	1.271	0.924	1.607
"Redesign manufacturing process to lower solid waste"	GI3	5.303	1.326	0.879	2.693
"Redesign manufacturing process to lower material use"	GI4	4.913	1.486	0.845	2.569
"Use environmentally friendly packaging for existing and new products"	GI5	4.638	1.557	0.705	1.562
Energy Efficiency	EE	5.142	1.316		
α 0.92; rho: 0.93; CR: 0.95; AVE: 0.82					
"Improve waste management"	EE1	5.214	1.356	0.909	2.103
"Budget is available for energy management activities"	EE2	5.146	1.343	0.952	2.072
"Energy effectiveness is huge to offer informative productivity of firm's performance"	EE3	5.115	1.359	0.874	2.506
"Decrease in energy waste"	EE4	5.037	1.422	0.876	2.600
	EP	4.628	1.271		

(*continued*)

Table 3.
Variables and measurement items

Constructs and items	Code	Mean*	SD*	FL***	VIF
Environmental Performance					
α 0.82; rho: 0.83; CR: 0.88; AVE: 0.59					
"Improved environmental performance"	EP1	4.238	1.602	0.779	1.769
"More informed decision-making"	EP2	4.659	1.454	0.796	1.804
"Assisting with internal and external reporting"	EP3	4.136	1.693	0.725	1.592
"Increased competitive advantage"	EP4	3.975	1.347	0.793	1.774
"Improved staff retention and attraction"	EP5	4.362	1.481	0.726	1.496
Financial Performance	FP	4.539	1.173		
α 0.82; rho: 0.82; CR: 0.88; AVE: 0.65					
"Increases in profit margin and sales revenues"	FP1	5.189	1.684	0.715	1.407
"Increases in market share"	FP2	4.331	1.378	0.808	1.796
"Increase in return on investment"	FP3	4.118	1.309	0.834	1.888
"Increase in overall financial performance"	FP4	4.449	1.326	0.850	2.096

Notes: SD: standard deviation, FL: factor loading, VIF: variable inflationary factor. *Scored by 7-point Likert scale, ranging from 1 (Strongly Disagree) to 7 (Strongly Agree). **EMA6 and EIS8 are deleted because FL < 0.50. ***All indicators are significant at $p < 0.01$
Source: Self-constructed based on PLS output

Table 3.

According to Khan *et al.* (2019), "the factor loadings of the measurement instruments should be greater than 0.50". The factor loadings of EMA and EIS measurements are greater than 0.50 except for EMA6 and EIS3. Thus, the authors delete the statements EMA6 (0.476) and EIS8 (0.466) and run the model further. The factor loadings of all KM, EE and FP measurements are greater than 0.80, and all measures of EP are greater than 0.70. In addition, the authors follow the requirements of Kline (2015), where all measurement items in the model are statistically significant at $p < 0.01$.

According to Hair *et al.* (2019) and Fornell and Larcker (1981), "The accepted value for AVE, CR, and α is greater than 0.50, 0.70, and 0.70, respectively". This research finds AVE > 0.60, CR > 0.80 and α > 0.80 and confirms the convergent validity of the SEM (Table 3). Further, besides CR and α, the authors considered the rho (RhoA) of Hair *et al.* (2019) for assessing the data consistency and finding rho > 0.80, which indicates the loaded constructs are reliable.

Following the Heterotrait–Monotrait ratio (HTMT) of Fornell and Larcker (1981), the authors check the discriminant validity, also suggested by Hair *et al.* (2019). This research develops Table 4 to present the square roots of the AVE of the correlation matrix and finds below diagonal values of the correlation matrix are lower than all diagonal values between the latent constructs, ensuring the discriminant validity. Further, this study depicts all the HTMT values above the diagonal value in Table 4 and evidences the discriminant validity as the HTMT values are below the typical mark of 0.90.

4.2 Model performance and goodness of fit

Using "Standardized root mean squared residual" (SRMR), "f-square" (f^2), "Normed fit index" (NFI) and "R-square" (R^2), the authors evaluated the goodness of fit and SEM performance. The R^2 value for the path of EMA to EIS is 0.190, EMA to KM is 0.261, EMA to GI is 0.091 and EMA to EE is 0.143. Further, the R^2 value of the path for EIS, KM, GI and EE to EP is 0.500. Finally, the R^2 value of the path for EP to FP is 0.338. About 33.8% of the variation in FP can be explained by EP. Further, 50% of the variation in EP can be explained by the EIS, KM, green innovation, EE and EMA. Finally, EMA can predict about

	EE	EIS	EMA	EP	FP	GI	KM
EE	**0.903**	*0.580*	*0.429*	*0.435*	*0.419*	*0.296*	*0.479*
EIS	0.504	**0.718**	*0.518*	*0.466*	*0.595*	*0.342*	*0.712*
EMA	0.378	0.436	**0.738**	*0.826*	*0.708*	*0.336*	*0.614*
EP	0.386	0.403	0.672	**0.765**	*0.699*	*0.222*	*0.605*
FP	0.365	0.512	0.570	0.581	**0.804**	*0.267*	*0.739*
GI	0.273	0.301	0.301	0.196	0.230	**0.852**	*0.250*
KM	0.429	0.611	0.514	0.513	0.618	0.225	**0.832**

Table 4.
Discriminant validity with HTMT

Notes: It should be noted that "the square root of AVE" is shown diagonally (in bold), the latent variable intercorrelations are shown below the diagonal, and HTMT is shown above the diagonal (in Italic)
Source: Self-developed based on PLS output

19% variation in EIS, 26.1% in KM, 9.1% in GI and 14.3% in EE. According to Bell *et al.* (2018), more than 5% of the R-square value can be considered in social science research. According to Hair *et al.* (2019), above 20% of R square value is acceptable, and between 25% and 50% of R square values are very good; further, more than 60% of R square value is excellent. Thus, according to these studies, the R square values of the model are satisfactory.

Following the study of Hair *et al.* (2019), the authors use an f-square that measures the variance explained by each exogenous variable in the model. Davies and Hughes (2014) state that f-square > 0.02 is acceptable and f-square > 0.15 is better. Table 5 shows the f-square value and ensures the allowable value of each exogenous variable. Thus, according to effect size, the SEM is satisfactory. Bowen and Guo (2011) argued that for a good model fit in PLS-SEM, the SRMR value should be lower than 0.08 and the NFI value should be closer to 1. The research's SEM model indicates a satisfactory fit as the study got the SRMR value of 0.06 (less than 0.08) and NFI value of 0.81 (higher than 0.80), as suggested by Hair *et al.* (2019).

4.3 Hypothesis testing

Results of the hypotheses on path relationships of the SEM have been presented in Table 5. Table 6 shows β coefficients, test statistics, p-value and decisions of hypotheses supporting. All the alternative hypotheses *H1* to *H10*, except *H2* and *H6*, have been supported in the SEM model. The p values of the supported hypotheses were statistically significant. In the case of *H2* and *H6*, the study found insignificant relationships; thus, the authors reject the alternative hypothesis and accept the null hypothesis. But statistically significant evidence is available in the case of all other eight hypotheses.

Variables	f-square	R square	Adj. R square	SRMR	NFI
EMA	0.100–0.396				
EIS	0.110	0.190	0.188	0.06	0.81
KM	0.041	0.264	0.262	0.06	0.81
GI	0.300	0.091	0.088	0.06	0.81
EE	0.166	0.143	0.140	0.06	0.81
EP	0.511	0.500	0.492	0.06	0.81
FP		0.338	0.336	0.06	0.81

Table 5.
SEM performance and fitness

Source: Self-developed based on PLS output

Path in SEM	Coeff. (β)	t-statistics	p-values	VIF	Decision
EMA → EIS	0.436	8.440	0.000***	1.000	H1 supported
EIS → EP	0.007	0.138	0.891	1.863	H2 not supported
EMA → KM	0.514	10.522	0.000***	1.000	H3 supported
KM → EP	0.194	3.312	0.001**	1.840	H4 supported
EMA → GI	0.301	5.803	0.000***	1.000	H5 supported
GI → EP	−0.042	0.864	0.388	1.160	H6 not supported
EMA → EE	0.378	7.531	0.000***	1.000	H7 supported
EE → EP	0.106	2.104	0.036*	1.437	H8 supported
EMA → EP	0.542	11.957	0.000***	1.484	H9 supported
EP → FP	0.581	13.707	0.000***	1.000	H10 supported

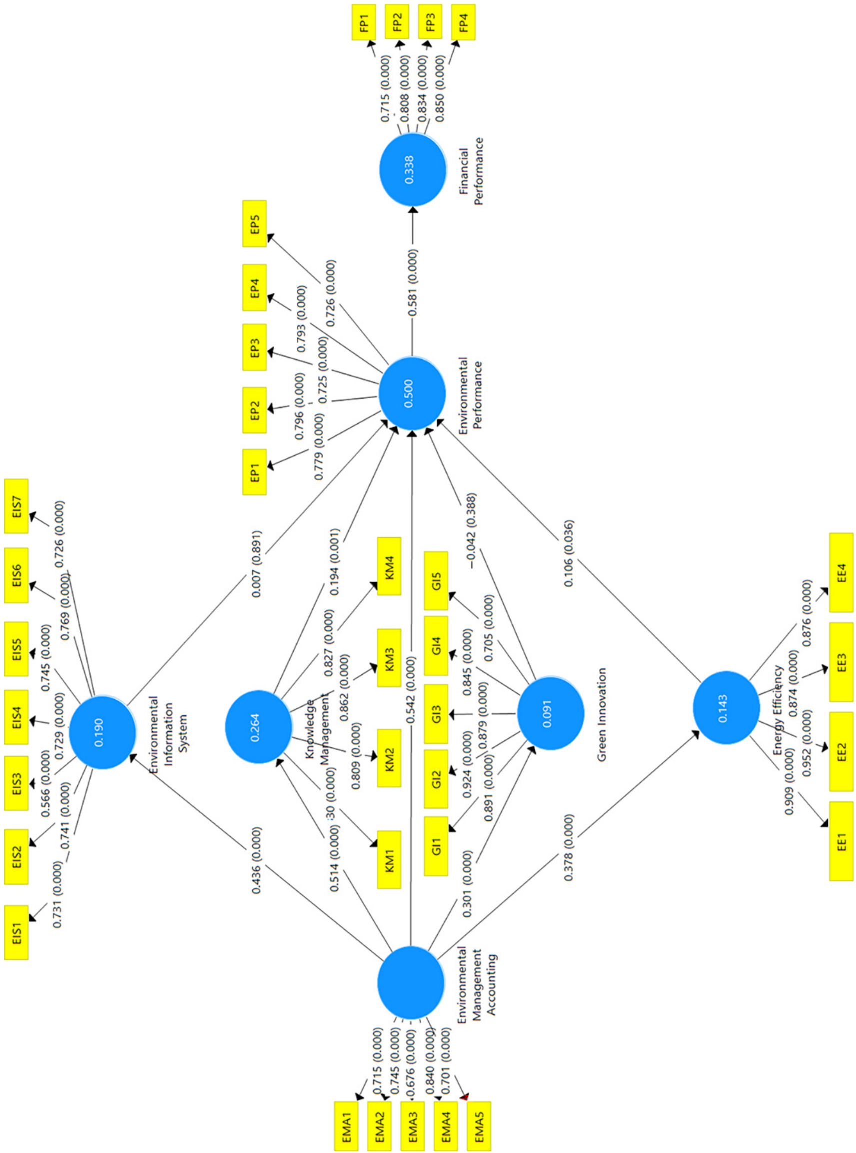
Notes: ***$p < 0.001$, **$p < 0.01$ and *$p < 0.05$
Source: Self-developed based on PLS output

Table 6.
Path analysis and hypothesis testing

According to Table 6, the first hypothesis (*H1*) of this research, that there is a significant positive association between EMA and EIS, has been supported because of having the β coefficient 0.436 p-value is significantly closer to zero ($p < 0.001$). This finding is consistent with prior studies (Latan *et al.*, 2018; Sari *et al.*, 2020; Tseng, 2010), though they did not directly consider the same hypothesis. On the other hand, the second hypothesis (*H2*) of this research, that there is a significant positive association between EIS and EP, has not been supported because its β coefficient is 0.007 and p-value is 0.891 ($p > 0.05$). This finding is the opposite of past studies' results (Liu *et al.*, 2018; Omran *et al.*, 2021). The third hypothesis (*H3*), based on Table 6, is that the KM of the firm is positively affected by EMA, as the β coefficient is 0.514, and the p-value is very close to zero ($p < 0.001$). This result confirms *H3*, which is consistent with previous studies (Scarpellini *et al.*, 2020; Tseng, 2010; Zeng *et al.*, 2020). Furthermore, Table 6 supports a significant positive association between KM and EP because the β coefficient is 0.194, and the p-value is 0.001. The result supports *H4*, which is consistent with the findings of previous research (Evangelista and Durst, 2015; Mandal and Bagchi, 2016) (Figure 2).

According to Table 6, the fifth hypothesis (*H5*) of this research, that there is a significant positive association between EMA and green innovation, has been supported because of having the β coefficient 0.301 p-value is significantly closer to zero ($p < 0.001$). This finding is in line with existing studies (Kraus *et al.*, 2020; Sari *et al.*, 2020), though they did not directly consider the same hypothesis. On the other hand, the sixth hypothesis (*H6*) of this research, that there is a significant positive association between green innovation and EP, has not been supported because its β coefficient is 0.042 (negative value) and the p-value is 0.388 ($p > 0.05$). This finding is the opposite of past research findings (Somjai *et al.*, 2020; Wu *et al.*, 2020). In the seventh hypothesis (*H7*), based on Table 6, the EE of the firm is positively affected by EMA, as the β coefficient is 0.378 and the p-value is very close to zero ($p < 0.001$). This result confirms *H7* and is consistent with previous studies (Agustia *et al.*, 2019; Dakwale *et al.*, 2011). Furthermore, Table 6 supports a significant positive association between EE and EP because the β coefficient is 0.106, and the p-value is 0.036 ($p < 0.05$). The result supports the eighth hypothesis (*H8*), which is consistent with the previous studies (Jermsittiparsert *et al.*, 2020; Niu *et al.*, 2017).

Finally, this research tested the ninth hypothesis (*H9*) that the EP of the firm is positively affected by EMA, as the β coefficient is 0.542, and the p-value is very close to



Source: Generated from PLS output

Figure 2.
Structural equation model

zero ($p < 0.001$). This result is consistent with the prior studies (Dakwale *et al.*, 2011; Ingrao *et al.*, 2018; Latan *et al.*, 2018). Furthermore, Table 6 supports a significant positive association between EP and the FP of manufacturing firms because the β coefficient is 0.581, and the p-value is very close to zero ($p < 0.001$). The result supports *H10*, which is consistent with the findings of previous research (Danso *et al.*, 2019; Gunarathne *et al.*, 2021; Salama, 2005).

4.4 Robustness check

To confirm the empirical model and findings of the research, the authors have checked the robustness of several initiatives following past studies (Deb *et al.*, 2020; Rahman and Akhter, 2021; Rahman *et al.*, 2021). First, the study drives the SEM in AMOS 24-version and finds the model fitted similar to the Smart PLS version 3.3; Ong *et al.* (2019) and Sari *et al.* (2020) also applied a similar approach. Further, the path results are identical (Figure A1 in Appendix 1). Thus, AMOS 24-version confirms both the empirical model's fitness and the study's empirical findings. Second, following the investigation of Khan *et al.* (2019) and Latif *et al.* (2020), the study randomly selects 40% (129) of the sample, runs the SEM and finds similar results, except *H8* comes insignificant as the p-value is 0.295 ($p > 0.05$) (Figure A2 in Appendix 2). Thus, the authors confirm the research results as the two approaches of robustness checking ensure similar findings and model fitness.

5. Discussion

The impacts of EMA on EP were explored in this study, and it was discovered that EMA has a favorable and substantial impact on EP. The research has also identified a substantial association between environmental and financial success. The majority of past research have focused only on a single aspect of business performance, either ecological (Aigbedo, 2021; Elijido-Ten, 2007; Jermsittiparsert *et al.*, 2020) or economical (Iwata and Okada, 2011; Saeidi *et al.*, 2018). They looked at performance as a single variable; however, this research examined each variable separately. Nonetheless, this latest analysis demonstrates that environmental and economic gains are derived from the EMA sequentially. This finding helps to resolve the past results of the alliance for both EMA and EP to bolster the idea that it ends up paying to be eco-friendly (King and Lenox, 2001; Mayndarto and Murwaningsari, 2021). It agrees with the statement that the ecosystem is beneficial in terms of environmental initiatives.

Based on prior studies, this research looked at environmental information, KM, green innovations and EE and identified associations favorable and significant for further research into EMA implementation and new factors that impact EMA. However, there are no significant associations between EIS and EP and GI and EP. While most prior research on the environmental impact of green innovation has been conducted in developed nations (Mayndarto and Murwaningsari, 2021), this research expands the analysis to developing nations such as Bangladesh. Due to effective environmental information policies and knowledge dissemination, green product innovation and efficient energy management, businesses in developing countries (such as Bangladesh) are more conscientious about environmental issues and have improved their FP and EP. However, the analysis demonstrates that enterprises may gain from adhering to an EMA, even in emerging nations. This is critical because studies reveal that some commercial organizations in Bangladesh continue to view environmental management initiatives as a separate expenditure or an act of corporate charity rather than incorporating them into company operations and policy (Saeidi *et al.*, 2018). Organizations that use environmental management methods can benefit from higher cost savings through efficient resource management and productivity increases, improved stakeholder associations, improved eco-innovation performance, greater quality assurance and pollution control (Saeidi *et al.*, 2018).

The institutional impacts on environmental management strategies of companies can lead to the advanced dissemination and counter-invention process, whereby businesses develop and adjust their accounting for environmental protection (Christine *et al.*, 2019). Although companies may experience distinct institutional effects, as previous studies have demonstrated, their internal reactions can also be shaped by organization-specific factors. Firms' EMA implementation method can be decided by addressing the EMA issue, whether they want to be reactive or proactive (Horváthová, 2010; Mandal and Bagchi, 2016). As the study demonstrates, EIS, KM, green innovation and EE, such as EMA, can be beneficial when used to provide monetary and physical information on environmental costs and to monitor EP and FP when EMA is implemented (Ferreira *et al.*, 2010).

EMA is a powerful tool for assisting businesses in addressing environmental issues and their financial consequences. First, this research examined the relationships of EMA on the EIS, KM, green innovation and EE and found positive and significant relationships. These results support the studies of (Kapiyangoda and Gooneratne, 2021; Liu *et al.*, 2018; Mandal and Bagchi, 2016; Ong *et al.*, 2019; Tseng, 2010). Second, the study tests other factors of EP, for instance, EIS, KM, green innovation and EE, and found that KM and EE are the significant predictors of EP (Evangelista and Durst, 2015; Ingrao *et al.*, 2018; Wu *et al.*, 2020) while green innovation and EIS are not significant and findings are supplementary to the study of (Kraus *et al.*, 2020; Meacham *et al.*, 2013; Scarpellini *et al.*, 2020). Like other studies, the authors also predict the EP through EMA and found a robust and significant relationship and support the findings (Chuang and Huang, 2018; Elijido-Ten, 2007; King and Lenox, 2001; Latan *et al.*, 2018). The study added other factors together with EMA, as the previous researchers suggested to find them (Mansoor *et al.*, 2021; Salama, 2005; Yang Spencer *et al.*, 2013). Third, this research examines whether EP improves manufacturing firms' FP, which is consistent with prior studies (Aigbedo, 2021; Danso *et al.*, 2019; Saeidi *et al.*, 2018).

6. Conclusions

In reality, government entities should create strict environmental rules and legislation, considering the role of institutional pressures and stakeholders' concerns in implementing EMA. Any business that breaks the rules and laws will be harshly penalized. Meanwhile, the government may urge manufacturers' groups and other media outlets to report on their companies' environmental difficulties. These approaches are beneficial in developing an environment-friendly climate, attitudes and norms throughout society and exerting institutional and stakeholder pressure on businesses. Second, taking into consideration the significant role of KM and EE, green innovation and EIS, government agencies could provide training programs for financial regulators, chief financial officers, management accountants, departmental managers and senior officials of manufacturing firms, instruct them on how to manage knowledge and ensure efficient use of firm energy in instituting EMA, and then let them understand the significance and promising benefits of adopting EMA. Additionally, it is vital to educate employees about which organizations have effectively implemented EMA and the number of advantages realized. Third, it may be feasible that the absence of industry standards and instructions to apply EMA may have an inconsequential influence on the outcome. The professional accounting bodies might, thus, strive to give more specific guidance on EMA implementation to meet the requirements of various companies, such as manufacturing companies. Government agencies and industry groups should also establish national and industrial standards in implementing EMA.

The research contributes to the EMA study, and these findings affect theoretical and practical elements in several different ways. First, theoretically, this research contributes to the existing knowledge on the importance of institutional theory in EMA research and demonstrates that institutional theory is a potential theory for EMA research. Meanwhile, this study adds to the understanding of the effects of various stakeholders on EMA implementation. Additionally, this research revealed that corporations are interested in their interests and relationships. The policymakers and regulators of manufacturing firms can benefit by implementing environmental policy initiatives comprising EIS, KM, green innovation and EE. As environmentally performing firms improve FP, manufacturing firms should implement EMA. The community will be benefited if the firms lessen their negative aspects of the environment. The government will economically benefit, as the firms can pay tax regularly and contribute to the country's gross domestic product as the financial conditions improve.

This research has some limitations indicating the study findings. First, this research target only the manufacturing concern as they directly deal with natural environments. Thus, the results from other firms may differ. Future, the study should consider the variation of firm selections. Second, the sample size is small (323 respondents, 15% of the study population). According to Sarstedt *et al.* (2018), the null hypothesis can incorrectly be accepted due to its small size. The study found two hypotheses (*H2* and *H6*) insignificant and rejected the alternative hypotheses. This issue can be caused by the small size (323 respondents). Thus, future studies should consider a large sample to recover this issue. Third, the authors do not consider the structural model's moderation and mediation effects. But these may exist in the study model. Future studies should consider the moderation and mediation effects to make the study more comprehensive. Finally, while causal linkages between the variables are derived through the conceptual model, the cross-sectional data sets cannot be used to assess causal associations thoroughly (Matthews, 2017). In future studies, longitudinal data collection might extensively examine casual associations.

Notes

1. www.dsebd.org/by_industrylisting.php
2. www.cse.com.bd/company/listedcompanies

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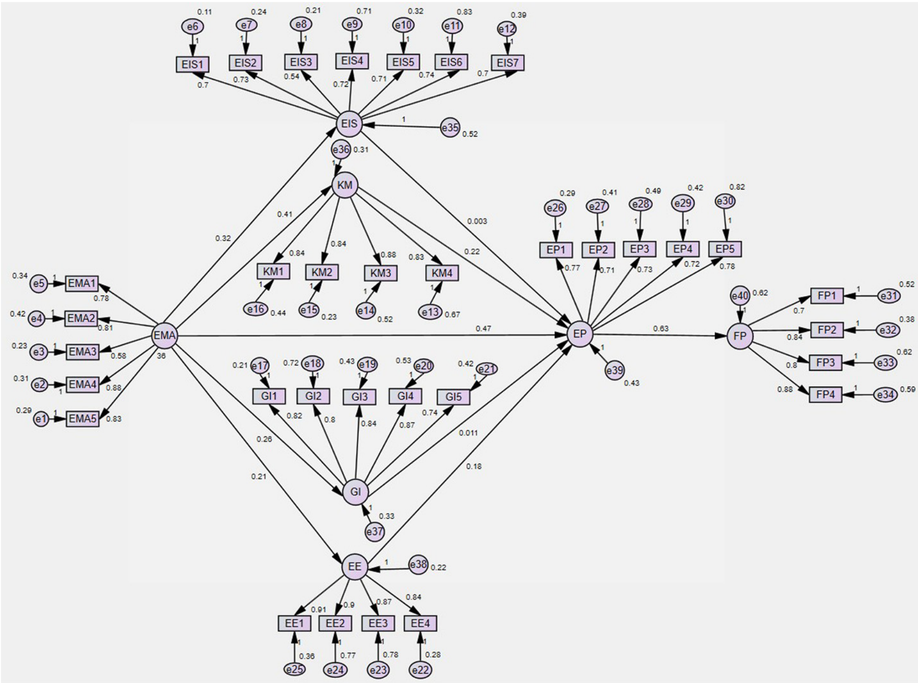
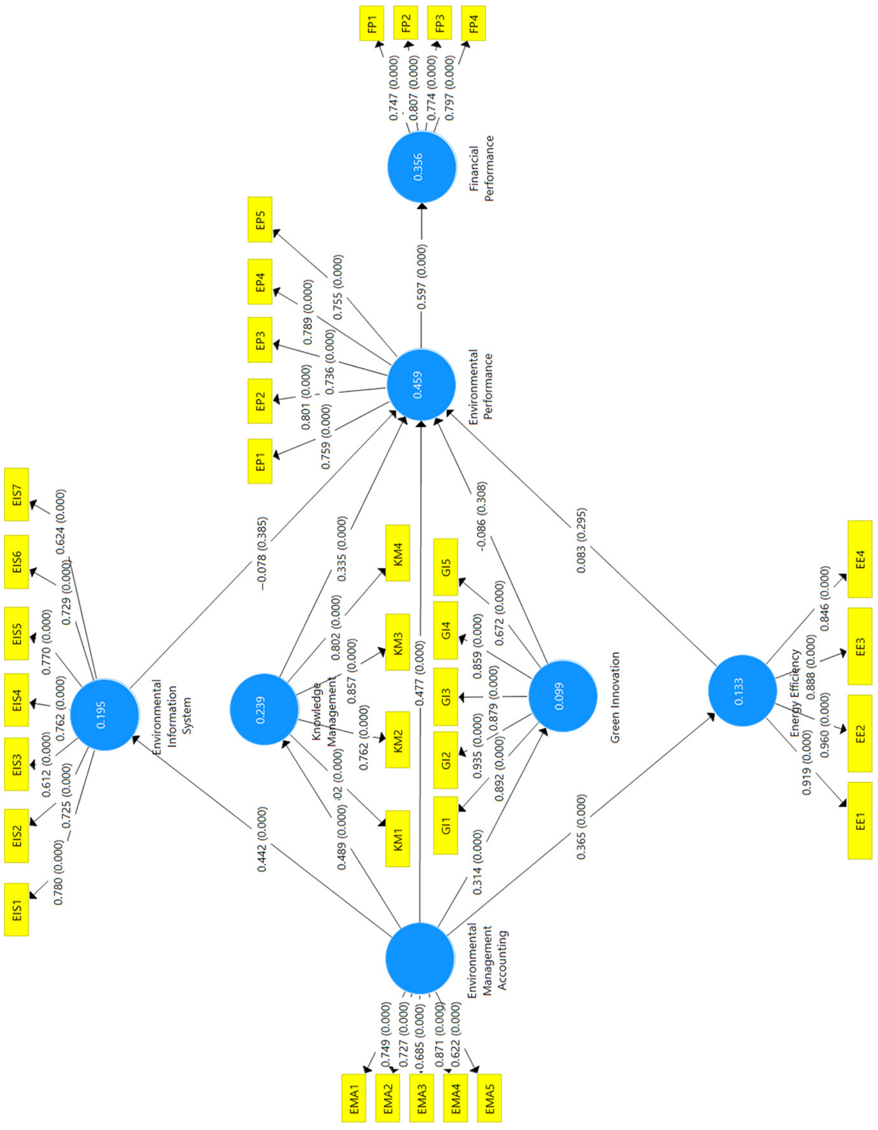
Appendix 1. Robustness check with AMOS



Source: Generated from AMOS 24

Figure A1.
Structural equation model

Appendix 2. Robustness check with 40% sample



Source: Generated from PLS output

Figure A2.
Structural equation model with 40% sample

About the authors

Bishawjit Chandra Deb is the Chairman of accounting and information systems department and Dean of business studies and Director of IQAC, at Comilla University. His primary research interest is in Financial Economics, Risk Management, Corporate Taxation, Corporate Governance, Technology and Innovation, etc. He has published a number of papers in esteemed journals. He is the resource person at Bangladesh Institute of Management (BIM), Chittagong Branch, Britannia University, Primer University, Bangladesh Army International University of Science and Technology, CCN Science and Technology University, The Institute of Cost and Management Accountants of Bangladesh, Comilla Branch, Comilla.

Md. Mominur Rahman is a research associate at Comilla University, and a lecturer in Accounting at BGIFT Institute of Science and Technology. He received his BBA and MBA in Accounting and Information Systems from Comilla University, Bangladesh. He has some articles published in the domestic and international journal. His focal research interests include Business Intelligence, Corporate Governance, International Trade, Human Capital Investment, Corporate Taxation, Tobacco Taxation and Control, Sustainable Development, Renewable energy and Environmental Management Accounting. Md. Mominur Rahman is the corresponding author and can be contacted at: mominurcou@gmail.com

Muhammad Shajib Rahman is serving as an assistant professor in the Department of Accounting and Information Systems of Comilla University. His principal research interest lies in the area of creative accounting practices, sustainability accounting, accounting in automation, Big Data analytics, Public sector accounting standards and Business Intelligence. His teaching interest includes contemporary accounting issues, international financial reporting standards, advanced financial accounting and strategic management accounting.