Corporate Determinants of Environmental Management Accounting Practices and its Impact on Corporate Environmental Performance: The Case of Egypt

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Abstract

The main objective of this study is to examine the impact of three corporate characteristics (environmental sensitivity of industry, environmental strategy, and company size) on the adoption of Environmental Management Accounting Practices (EMAPs) and the effect of those accounting practices on the corporate environmental performance of the Egyptian listed manufacturing companies. Data were collected using a survey of Egyptian Manufacturing listed companies on the Egyptian Stock Exchange. Using simple and multiple regression models, the empirical results show that the selection of a business strategy that takes into consideration the environmental issues affect the EMAPs adopted in the Egyptian manufacturing companies. However, both environmental sensitivity of industry and company size has no significant impact on the Egyptian companies' EMAPs. The results also find that EMAPs directly affect environmental performance. This study could be considered an important aid to managers and practitioners in the Egyptian industrial environment to implement effective EMAPs that help in improving and enhancing environmental performance.

Keywords: Environmental Management Accounting Practices (EMAPs), Environmental Sensitivity of Industry, Environment Business Strategy, Environmental Performance, Egypt.

JEL Classification: M19, M49, Q560

Introduction

During the past few decades, Environmental Accounting (EA) has gained increasing interest from environmental practitioners and researchers (Parker, 2005 and Yongvanich and Guthrie, 2006). This is due to the pressures exerted by stakeholders on firms to pay more attention to environmental problems and environmental performance evaluation to protect the environment from pollution and to utilize environmental resources more effectively (Rodrigue *et al.*, 2013; Christ and Burit, 2015; Latan *et al.*, 2018; and Danso *et al.*, 2019). Stakeholders are increasingly interested in how the firms measure, evaluate, and report their environmental issues, especially, when those issues affect the firm's performance (O'Dwyer *et al*., 2005). To achieve this objective, many companies consider the use of EMAPs to attain superior environmental performance (Wagner and Schaltegger, 2004; Burritt, 2005; Gunarathne and Lee, 2015; and Lisi, 2015).

EMA consists of a group of tools and practices that are used in the management decision-making process related to reducing environmental impact and enhancing environmental and financial performance (Burritt *et al.*, 2019). International Federation of Accountants IFAC (2004) stated that EMA is: "The management of environmental and economic performance through the development and implementation of appropriate environment-related accounting systems and practices". In other words, EMA is concerned with identifying, measuring, analyzing, and reporting information related to the environmental consequences of companies' activities.

EMAPs implementation becomes vital to all companies as conventional management accounting systems tend to track environmental costs inadequately by treating environmental costs as overhead costs or hidden costs rather than assigning them directly to the processes, products, or activities that generated the cost (Burritt, 2004). EMAPs provide companies with tools that help them measure the environmental impacts of their activities and allocate environmental costs or earnings gained from

these activities (Mokhtar *et al.*, 2016). In addition, creative and proactive implementing of EMAPs would help companies attain superior economic growth and environmental sustainability.

However, despite its values and advantages, EMAPs' adoption level is currently low, especially in developing nations, such as Egypt. Most companies did not recognize the importance of reducing environmental harm and therefore improving environmental performance (IFAC, 2005). This is due to several reasons including, low environmental awareness, lack of effective role of professional bodies, lack of stakeholders' pressure, as well as weak environmental legislation and penalties imposed on firms (Burrit, 2004). This weakness is clearer in developing countries where the capabilities and expertise to develop new strategic management accounting practices are less likely to exist. In addition, customers nowadays become more demanding for companies to be more responsible for environmental problems.

Moreover, according to contingency theory, the design of any Management Accounting System (MAS) may be affected by companies' external environment (Otley, 1980). The factors that may affect EMAPs include company size, ownership status, the nature or type of industry, Environmental Management System (EMS) adoption, environmental strategy, top management commitments, and the proportion of non-executive directors (NEDs) (Otley, 1980; Christ and Burritt, 2013; and Latan *et al.*, 2018). Therefore, the researcher conducts this study to examine the effect of three corporate factors that may affect the adoption and implementation of EMAPs. These factors are environmental sensitivity of industry, environmental strategy, and company size.

Although EMA is considered a vital management accounting tool, which is used to enhance the environmental performance of firms (Schaltegger and Burritt, 2017), the EMAPs among Egyptian companies have not given considerable attention from researchers. Therefore, there is a lack of empirical studies that examine Egyptian manufacturing companies' adoption of EMAPs and pinpoints corporate factors that may

affect its level of implementation as well as examining the effects of EMAPs on corporate environmental performance. This study narrows this gap by determining corporate factors influencing EMAPs and tests the effect of EMAPs on corporate environmental performance in the Egyptian context.

In this paper, three research questions are addressed: first, "To what extent do Egyptian companies implement EMAPs?", second, "Do corporate characteristics influence the extent of EMAPs implementation?", and third, "Does EMAPs implementation affect Corporate Environmental Performance? A survey of Egyptian manufacturing companies is drawn on to help in answering the previous questions.

This paper is conducted due to the lack of empirical studies related to EMAPs in the Egyptian context and discovers the corporate factors that may affect EMAPs and how EMAPs could affect the environmental performance of companies especially in developing countries like Egypt. Therefore, the main objective of this study is to improve the environmental performance of Egyptian manufacturing companies. This objective could be achieved by understanding the effect of the three corporate characteristics on the implementation of EMAPs and investigating the effect of EMAPs on the companies' environmental performance.

This study contributes to the literature in several ways. First, this study is one of few surveys that examined EMAPs in Egypt. The current study narrows this gap by determining the corporate characteristics that affect EMAPs and investigates the effect of those practices on the Egyptian firms' environmental performance in the same model. Corporate characteristics include environmental sensitivity of industry, environmental strategy, and company size. Therefore, this study answers the call for studies by Christ and Burritt (2013) and Mokhtar *et al.* (2016) to extend the investigation of the impact of several corporate characteristics on EMAPs in different contexts, especially in developing nations. Second, this study attempts to reconcile the conflicting results on

the relationship between environmental strategy, as one of the corporate characteristics examined in this study, and EMAPs. Finally, it is vital to conduct this study with experienced, highly qualified professionals, such as company managers due to their responsibility for making decisions and implementing environmental initiatives than others in their companies.

This paper is structured as follows: Section 2 presents a summary of the literature related to EMAPs. Section 3 discusses the development of the hypotheses, then details of the research methodology are presented in section 4. Subsequently, the results are presented in section 5, and sections 6 and 7 consist of a discussion of the results, limitations of the study, and suggestions for future research.

Theoretical Background

In most companies, traditional management accounting is the main information system for management. Accounting is concerned with gathering, classifying, analyzing, and communicate information to users (internal and external users). However, traditional management accounting does not treat environmental costs and benefits accurately. Therefore, there is a critical need for establishing EMA system that incorporates environmental costs and benefits into the decision-making process of the company in a routine manner. This section presents the literature related to the historical development of EMA, its main definition, types of information used, its objectives, and the classification of environmental costs.

Empirical Research on Environmental Management Accounting

Since the mid of 1980s, environmental information has been a topic of growing interest for firms, practitioners, academic communities, and professional associations, among others. The growing interest results in increased academic publications focusing on analyzing social and environmental reports to justify environmental practices.

The main objective of accounting is to provide useful information to internal users (managers) and external users (shareholders, investors, creditors, etc.) of the firm. Generally, accounting is classified into financial

accounting and management accounting. Financial accounting is responsible for the preparation of financial statements to provide useful information for external stakeholders. In financial accounting, environmental costs reporting is limited to those items that can be separately identified such as equipment of pollution control, fines, penalties, etc. However, these costs cannot be fully presented in the financial statements. This would lead to misleading calculations of costs of enhancing environmental performance (UNDSD, 2001). Therefore, financial accounting could not provide relevant information to solve the social and environmental issues while considering reducing costs.

On the other hand, management accounting is responsible for providing information for internal managers of the firm. Management accounting is a custom-made system to treat specific organizational cultures and to fulfill specific organizational needs. However, conventional management accounting ignored how environmental costs could be attributed to a firm's operations (Epstein, 1996; UNDSD, 2001; and Deegan, 2003). Burritt (2004) stated that conventional management accounting failed to collect and evaluate environmental costs effectively. This failure appeared as a result of allocating environmental costs to overhead costs, misallocating, and underestimating environmental costs, and the miscommunication between accounting and environmental management functions.

Due to financial accounting and conventional management accounting failure to adequately treat environmental costs, the development of environmental accounting become necessary. Environmental accounting provides useful environmental information to both internal and external users, which could discharge the accountability of the organization. Environmental accounting is responsible for considering the consequences of the organization's activities that could have environmental effects (Burritt *et al.,* 2002).

Environmental management accounting (EMA) is a subset of Environmental Accounting (EA). Bouma and Correljé (2003) defined EMA as: "accounting systems and techniques that provide decision-

makers and management with financial and non-financial information about the firm or organization and its environment". EMA consists of specific procedures that improve material efficiency, decrease the undesired effects on the environment, and reduce environmental protection costs and risks. This is achieved through gathering data from financial accounting, cost accounting, and material flow balances (Mokhtar *et al.,* 2016).

In addition, The United Nations Division for Sustainable Development (UNDSD) suggested that: "EMA is simply doing better, more comprehensive management accounting while wearing an environmental hat that opens the eyes for hidden costs" (UNDSD, 2001).

IFAC developed another definition for EMA: "EMA is the management of environmental and economic performance through the development and implementation of appropriate environment-related accounting systems and practices. While this may include reporting and auditing in some companies, environmental management accounting typically involves life-cycle costing, full-cost accounting, benefits assessment, and strategic planning for environmental management" (IFAC, 2005).

EMA includes two types of information, namely, physical and monetary environmental information (Tsui, 2014). Physical environmental information is related to the flow of energy, water, materials, and wastes, such as the total amount of freshwater consumed and the total volume of wastes and energy consumed (Burritt *et al.*, 2002; and Schaltegger and Burritt, 2017). Tsui (2014) stated that physical environmental information is important to identify different environmental issues and helps the company to evaluate and report the physical aspects of its environmental performance. In other words, physical environmental information reflects the relevant environmental costs of the company.

On the other hand, monetary environmental information is concerned with environmental costs and benefits, such as the material costs of the product and non-product output, waste and emission control costs, environmental research and development costs, sales from scrap and

wastes, and recycling subsidies (Burritt *et al.*, 2002; and Schaltegger and Burritt, 2017). Both physical and monetary environmental information is essential to the company, due to their role in facilitating measuring the size and impact of the company's environmental practices (Schaltegger and Csutora, 2012 and Mokhtar *et al.*, 2016). Therefore, a lack of environmental information may prohibit managers from making important decisions related to their company's environmental practices.

The primary objective of EMA is to provide relevant and reliable information used in measuring, analyzing, and reporting environmental costs (Ong *et al*., 2016). This objective can be achieved using physical environmental information, which provides the basis for quantifying environmental costs (Jasch, 2009). De Beer and Friend (2006) classified environmental costs into two categories, namely, internal costs and external costs. Internal costs are those costs related directly to the goods produced or services provided, and for which the company is liable. On the other hand, external costs also referred to as externalities, are those costs that companies are not legally liable for because they are financially immeasurable. External costs are more difficult to be measured than internal, and some companies consider these costs as costs of their environmental accounting systems. EMA helps organizations in estimating their environmental costs (Ong *et al*., 2016). In addition, it supports managers' decisions related to product design, capital investments, cost determination, and performance evaluation.

Parker (1997) was the first study that applied contingency theory in the formulation and assessment of environmental strategies. Parker (1997) suggested that EMAPs implementation depends on the firm's environmental strategy. In addition, Qian *et al*. (2011) found that organizational factors have major impacts on EMAPs such as waste operations, wastes and recycling management changes and uncertainties, and the board of directors' decisions related to wastes management.

Moreover, based on contingency theory, Christ and Burritt (2013) developed a framework to determine the conditions under which EMAPs are more likely to be implemented, now and in the future. The results suggested that EMAPs are affected by environmentally sensitive industries, environmental strategy, and organizational size.

However, inconsistently with Christ and Burritt (2013), Mokhtar *et al.* (2016) surveyed to examine the effect of five corporate factors (environmental sensitivity of industry, company size, ownership status, Environmental Management System (EMS) adoption, and the proportion of non-executive directors (NEDs)) on the extent of EMAPs adoption among Malaysian firms. The results revealed that no corporate characteristics affect EMA implementation except ownership status. This was justified due to the early stage of EMAPs in Malaysian firms. In addition, companies were interested in reducing the environmental costs of their activities rather than measuring and integrating environmental information into their current MASs.

Hypotheses Development

This paper classified the EMA literature into two groups: the first group consists of the studies that examine the factors that affect EMA. The second group presents the studies that investigate the relationship between EMA and environmental performance.

Factors affecting Environmental Management Accounting

Previous studies that examined the effect of corporate factors on EMA implementation have many directions, including Jamil *et al.* (2015), Mokhtar *et al.* (2016), Ferdous *et al.* (2019), Mohd Fuzi *et al.* (2019), and Wang *et al.* (2019). This paper examined corporate determinants of EMAPs discussed in prior studies concerning the Egyptian environment.

Environmental sensitivity of the industry

The degree of environmental sensitivity of the industry in which the company operates has a vital role in the design and implementation of its MAS (Abdel-Kader and Luther, 2008). Mokhtar *et al.* (2016) classified industries according to their environmental sensitivity into sensitive

industries and less sensitive industries. Environmental sensitive industries consist of companies that have a significant impact on the environment, either directly or indirectly, such as chemical, mining, and resources, petroleum, and construction industries (Alrazi *et al.*, 2009; Buniamin, 2010; and Mokhtar *et al.*, 2016). On the other hand, environmentally less sensitive industries include companies that have less impact on the environment, either directly or indirectly, such as service, retail, and banking industries.

Frost and Wilmshurst (2000) stated that a company that operates in an environmentally less sensitive industry will have different EMAPs than another company in an environmentally sensitive industry. This could be justified due to the significant environmental impact of companies that operate in environmentally sensitive industries, which require the design and implementation of an EMA system that helps them disclose their environmental performance to their stakeholders. Based on the above discussion, the following hypothesis is formulated:

H_1: There is a positive direct relationship between the level of environmental sensitivity of the industry and the extent of EMAPs implementation.

Environmental Strategy

The business strategy represents the ways by which the company can achieve its organizational goals and objectives. Al-Mawali *et al.* (2018) stated that EMA is an important tool in the Management Control System (MCS) of any company which is used to improve efficiency and effectiveness during resource usage. Therefore, a business strategy could affect EMA implementation if it is considered an important part of its MCS (Burritt et al., 2010). There are several classifications for organizational strategies, that are used in contingency-based studies including Product differentiation/ cost leadership strategies, prospectors/ analyzers/ defenders' strategies, and build/ hold/ harvest strategies (Christ and Burritt, 2013). However, Solovida and Latan (2017) stated that it is important for

any company to develop a proactive environmental strategy, to help the EMA system generating intangible assets, which will enhance the firm's environmental performance.

Bansal and Roth (2000) defined environmental strategy as: "A set of initiatives that mitigate a firm's impact on the natural environment. Firms achieve such a strategy by implementing products, processes, and policies that reduce energy consumption and waste, use ecologically sustainable resources, and employ environmental management systems".

Gosslin (1997) revealed that the innovation needed relating to management activities is chosen based on the type of strategy followed by the company. The paper found that those firms which follow strategies are more likely to execute accounting innovations. Moreover, Chang and Deegan (2010) argued that any modification in environmental strategy would need increasing information and reducing environmental uncertainty. This could be achieved through amending the supporting MAS.

Based on the above discussion, it is apparent that the relationship between environmental strategy and EMA is a two-way relationship. In other words, environmental strategy affects the adoption of EMA, as well as EMA, could support the implementation of environmental strategy. Therefore, the following hypothesis is formulated:

H_2: There is a positive direct relationship between the environmental strategy and the extent of EMAPs implementation.

Company Size

The implementation of any new system requires the investment of a considerable amount of resources (Dahlmann *et al*., 2008). The adoption of any new system requires training of existing employees and workers, in addition to hiring experts to run the new system. The implementation of the EMA system requires high costs, in addition to management and employees commitment, to continuous R & D to reform the production process and the purchase of new equipment suitable for the new system

(Mokhtar *et al*., 2016). Thus, larger companies with more resources have greater opportunities to implement highly advanced MAS (AbdelKader and Luther, 2008 and Cadez and Guilding, 2012). Moreover, large companies are more likely to implement EMAPs as they are more visible environmentally. EMAPs would help them in reducing public scrutiny related to their practices and activities, as the EMA system helps companies controlling their environmental performance (Christ and Burritt, 2013 and Mokhtar *et al.,* 2016). Based on the above discussion, the following hypothesis is formulated:

H_3: There is a positive direct relationship between the company size and the extent of EMAPs implementation.

Environmental Management Accounting and Environmental Performance

The manufacturing process worldwide cause a significant impact on the natural environment, in addition to its financial impacts. Therefore, companies became more aware of the social and environmental impacts of their operations and products. Their environmental impacts are related to the three components of the environment: air, water, and soil, however, their financial impacts appear in their financial statements (De Beer and Friend, 2006). However, many companies find it difficult to show the environmental impact on their financial statements (Cartier *et al.*, 2001). This paper is concerned with studying the impact of EMAPs on companies' environmental performance.

Nowadays, most companies' objective is to identify, communicate and enhance their environmental performance. Companies can achieve this objective through effectively managing their activities, products, or services that have a significant impact on the environment (Lo-Iacono-Ferreira *et al*., 2018). Langfield-Smith et al., (2017) defined environmental performance as: "The impact of an organization's activities on the environment, including the natural systems such as land, air, and water as well as on people and living organisms". In recent years, the demand for

environmental performance information has increased due to increasing the importance of environmental issues to stakeholders including investors, suppliers, creditors, government, and the public in general.

Several measures have been developed to evaluate environmental performance. Epsall and Brown (2003) stated that ISO 14031 has classified environmental performance measures into three types: environmental conditions, management performance, and operational performance. Environmental condition measures are concerned with the condition of the environment rather than the organizations' activities. These measures are established since some factors are uncontrollable by the organization and have significant impacts on the environment. These measures are used to evaluate the organization's ability to achieve social and environmental goals. The second category of measures is management performance measures. This category is concerned with measuring the management's efforts to meet environmental objectives. These measures include the extent to which management develops the environmental plan, provides environmental training programs for employees, and environmental-related financial performance measures. The operational performance measures are concerned with the impact of the organization's activities on the environment. These measures include inputs, design of operations, and output of the production process (Marshall and Brown, 2003 and Henri and Journeault, 2008).

EMA helps companies in identifying, monitoring, and allocating environmental costs accurately. This would lead to a better decision-making process based on a proper analysis of both environmental costs and quality costs (Venturelli and Pilisi, 2005). Hence, the proper and accurate analysis of environmental and quality costs would make an overall improvement of the companies' environmental performance. In addition, a well-designed EMA helps organizations in identifying, reporting, and improving the environmental impacts of the organizations' activities (Solovida and Latan, 2017). Based on the above discussion, the following hypothesis is formulated:

H_4: There is a positive direct relationship between the extent of EMAPs implementation and environmental performance.

Research Methodology

This section presents the research methodology employed in this paper. Research methodology section presents the tool used in collecting data, the variables measurement, the research models, the statistical package used in analyzing the collected data and interpretation of the results.

Data collection

The data used in this study was collected using a survey approach due to the nature of this study, which is an exploratory study. The questionnaire was selected due to its popularity in the field of environmental strategy, EMA, and environmental performance. The questionnaire was distributed among Egyptian listed manufacturing companies. Listed manufacturing companies were chosen because they are more aware of the problems related to the protection of the environment and they are highly committed to their environmental responsibilities. This could be due to the pressures imposed by stakeholders on companies to put more attention to environmental issues to protect the environment from pollution and to utilize environmental resources more effectively. Respondents consist of general managers, production managers, cost managers, financial managers, and others.

The number of manufacturing firms listed in the Egyptian Stock Exchange Market during 2020 was 88 companies. The questionnaire was distributed over the 88 manufacturing listed companies, a total of 32 questionnaires were completed, yielding a response rate of 36.36%. Table 1 summarizes the number of completed questionnaires in each manufacturing sector.

Table 1: Summary of Sample firms and Sectors

Sectors	Sample Size	Responses	Response Rate
1. Basic resources industries	17	2	11.76%
2. Chemicals, construction, and building materials	11	2	18.18%
3. Pharmaceutical industries	13	4	30.77%
4. Industrial goods and automobiles industries	6	2	33.33%
5. Paper and packaging industries	5	1	20%
6. Food and beverage industries	28	17	60.71%
7. Textile and durables	8	4	50%
Total	**88**	**32**	**36.36%**

Variables Measurement

The questionnaire used to measure the variables of this study consists of three sections. The first section presented the main objective of the study and asking the participants' willingness to participate in this survey. The second section consisted of questions related to participants' demographic information such as years of experience and occupation. The third section asked the participants questions related to the study variables.

Independent variables

The independent variables of this study consist of three corporate factors namely: environmental sensitivity of industry, environmental strategy, and company size.

Environmental sensitivity of industry was measured by asking respondents to choose between seven choices the type of industry in which they operate. The seven industries are basic resources, industrial goods and automobiles, food, beverages and tobacco, textile and durables, chemicals, construction and building materials, health and pharmaceutical, and paper and packaging. Those seven industries are then classified into two categories: environmentally sensitive industries and less environmentally sensitive industries. Environmentally sensitive industries include activities that have a significant impact on the environment. Consistent with Mokhtar et al., (2016), this category consists of chemical, construction,

and building materials, industrial goods, and automobiles, and the pharmaceutical industry. On the opposite side, less environmentally sensitive industries include those industries that have a weak negative impact on the environment, either directly or indirectly. This category of industries consists of basic resources, paper and packaging, textile and durables, and food and beverage industries.

The environmental strategy was measured using four questions adapted from Christ and Burritt (2013). Respondents were asked to answer questions on a five-point Likert scale related to the extent to which their companies integrate environmental issues into their strategic planning, enhancing quality includes reducing environmental effects of their products, efforts are made to link corporate goals with environmental objectives, and environmental; issues are considered when designing and developing new products.

Furthermore, company size was measured using one proxy measure, which is the number of employees. Respondents were asked to indicate the number of employees by selecting one choice from less than 50, between 50 and 250, and more than 250.

Dependent variables

The dependent variables of this study consist of two variables which are EMAPs and environmental performance. EMAPs were measured using 12 questions adopted from Qian *et al*., (2018). These questions were related to specific tools that reflect the implementation of EMAPs. Respondents were asked to determine whether they applied those tools or not (Application= 1 and No application= 0). EMAPs questions were related to material flow, cost accounting, environmental cost accounting, sustainability accounting, environmental audit, sustainability audit, Eco-benchmarking, sustainability benchmarking, Eco- control, environmental information system, sustainability Balanced-Scorecard, and sustainability controls. EMAPs were calculated as the sum of EMAPs tool applications. Therefore, EMA practice values varied between 0 (no application EMAPs) and 12 (full application of all EMA tools).

To measure environmental performance, 15 questions were adopted from Phan and Baird (2015). Respondents were asked to answer the questions using a five-point Likert scale to indicate the extent to which their EMAPs help their companies in reducing energy consumption, water usage, materials costs, levels of emissions and wastes, production costs, regulatory compliance costs, and fines and remediation costs of cleaning environmental damages. In addition, respondents were asked to express their opinion regarding the extent to which EMAPs help in improving production efficiency, knowledge about effective ways of managing operations, organization-wide learning among employees and workers, their relationships with stakeholders.

Research Models

The impact of corporate factors (environmental sensitivity of industry, environmental strategy, and company size) on EMAPs was examined by estimating the coefficients in the following multiple regression model (Model 1) after all the study variables are considered:

Model 1: Multiple regression of Environmental Management Accounting Practices

$$EMAP = \beta_o + \beta_1 SENSTIVITY + \beta_2 STRATEGY + \beta_3 SIZE + \varepsilon \dots\dots\dots\dots\dots\dots\dots\dots (Model\ 1)$$

Where:

$EMAP$ = Environmental Managment Accounting Practices.

β_o = The intercept of the regression line and it is constant value.

β_1 - β_3 = Coefficients of the independent variables.

$SENSITIVITY$ = Environmental sensitivity of industry.

$STRATEGY$ = Environmental strategy

$SIZE$ = Company size.

ε = Errors of estimate.

Furthermore, the relationship between EMAPs and environmental performance is examined using the following simple regression model (Model 2) which can be expressed as follows:

Model 2: Simple regression model of environmental performance

$$ENVPERF = \beta_o + \beta_1 EMAP + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (Model2)$$

Where:

$ENVPERF$ = Environmnetal performance.

β_0 = The intercept of the regression line and it is a constant value.

β_1 = Coefficient of the independent variable.

$EMAP$ = Environmental Management Accounting Practices.

ε = Errors of estimate.

Data Analysis and Results

Data analysis was conducted using STATA statistical package as follows: first, a reliability test was executed to test for the consistency of the questions used to measure each variable in the questionnaire. Second, descriptive statistics were used to calculate the mean, the median, the range, the standard deviation, the maximum, and the minimum values. Third, Variance Inflation Factor analysis (VIF) was conducted to test the existence of severity multicollinearity between the independent variables in the research model (1). Finally, regression analysis was used to investigate the hypotheses.

Reliability test

As shown in Table 2, the reliability test's results showed that the Cronbach's Alpha for the questionnaire as a whole is about 0.9554, meaning that the questionnaire items have high covariances and the questions are reliable to a high extent (Hair et al., 1998).

Table 2: Study Variables and Cronbach's Alpha

Variables	Cronbach's Alpha
Environmental Sensitivity of the Industry	N/A
Environmental Strategy	0.8588
Company Size	N/A
EMAPs	0.9039
Environmental Performance	0.9626
Overall Cronbach's Alpha	**0.9554**

Descriptive statistics

This section summarizes the descriptive statistics of the research by providing the mean, the median, the range, the standard deviation, the minimum, and the maximum value of all the study variables, as shown in Table 3.

Table 3: Descriptive statistics

	Environmental Sensitivity of the Industry	Environmental Strategy	Company Size	EMAPs	Environmental Performance
Mean	0.25	16.34375	2.65625	8.59375	56.53125
Median	0	17	3	10	58
Standard Deviation	0.4399413	3.798212	0.6015772	3.723157	14.57569
Range	1	16	2	12	58
Minimum	0	4	1	0	17
Maximum	1	20	3	12	75

Based on Table 3, the environmental sensitivity of the industry is a dummy variable with values of 1 (environmentally sensitive industry) and 0 (less environmentally sensitive industry) with mean and median values of 0.25 and 0 respectively. Environmental strategy varies between 20 (full integration of environmental issues in strategy development) and 4 (weak

integration of environmental issues in strategy development) with more than 50 % of the respondents integrate environmental issues in strategy development.

Furthermore, firm size varies between 1 (Small firms) and 3 (Large firms) with mean and median values of 2.65625 and 3 respectively, showing that more than 50% of the sample are large firms, which justify the full integration of environmental issues in their business strategies. More than 50% of the sample implement most of the EMAPs, and they have a high level of improvements in their environmental performance with a median value of 58.

Testing Hypotheses

VIF is first conducted to find out whether there are two or more independent variables in the model (1) that are highly linearly related. According to Table 4, it is clear that the VIF of all independent variables is approximate 1, which means that there are no two independent variables that are correlated.

Table 4: Variance Inflation Factor (VIF) Analysis of Model (1)

Independent Variables

Independent Variables	VIF	1/ VIF
Environmental Sensitivity of the Industry	1.28	0.784307
Environmental Strategy	1.22	0.819350
Firm Size	1.07	0.931547
Mean VIF	**1.19**	

Accordingly, ordinary least square regression is conducted to test the relationship between EMA, the dependent variable, and each of the corporate characteristics (environmental sensitivity of industry, environmental strategy, and company size). Therefore, simple regression (Table 5) was used to examine the extent to which environmental sensitivity of industry, environmental strategy, and company size could explain the variation in EMAPs.

Table 5: Simple Regression of the Relationship Between Corporate Characteristics and EMAPs

Independent Variables	R^2	Adjusted R^2	Std Error
Environmental Sensitivity of the Industry	0.1088	0.0316	1.458611
Environmental Strategy	0.323	0.001	0.1471624
Firm Size	0.301	-0.032	1.129236

Dependent Variable: EMAPs

Table 5 showed that the environmental sensitivity of the industry explains 10.88% of the variation in the EMAPs, the environmental strategy explains 32.3% of the variation in EMAPs, and firm size explains 0.1% of the variation in EMAPs.

Testing the Relationship Between corporate characteristics and EMAPs

A multiple regression model was conducted to evaluate the predictive power of the regression model in which all the independent variables of research model (1) exist (Table 6). The multiple regression model explains 33.77 % of the changes in the EMAPs. This is considered an acceptable level of R^2 values. Table 6 reveals that the environmental strategy has an impact on the EMAPs of the Egyptian companies at the significant level of 5%, with P> |t| of 0.004.

In addition, the environmental strategy has a positive effect on the Egyptian companies' EMAPs with (β>0). Therefore, the second hypothesis that there is a direct association between the environmental strategy and the extent of EMAPs implementation, is accepted. This finding is consistent with Gosslin (1997), Bansal and Roth (2000), and Chang and Deegan (2010) who revealed that the type of strategy executed by any firm affects the adoption and implementation of innovative management practices such as EMAPs.

However, the environmental sensitivity of the industry and firm size have low statistical significance in the multiple regression model, showing no impact on the EMAPs with P> |t| of 0.531 and 0.803 respectively.

Consequently, the first hypothesis that there is a direct association between the level of environmental sensitivity of the industry and the extent of EMAPs implementation., and the third hypothesis that there is a direct association between the company size and the extent of EMAPs implementation, both are rejected. These findings are inconsistent with previous studies conducted in developed economies, except Mokhtar *et al*. (2006) who found that the company size affects the degree of implementation of EMAPs.

Table (6): Multiple Regression Model of the Relationship between EMAPs and the Three Corporate Characteristics

Panel A: Model Summary				
Model	**R^2**		**Adjusted R2**	
1	0.3377		0.2668	
Panel B: Coefficients [a]				
Independent Variables	**Unstandardized Coefficients**		**T**	**P> |t|**
	β	**Std Error**		
Constant	1.043301	3.586565	0.29	0.773
Environmental Sensitivity of the Industry	-0.9322929	1.469659	-0.63	0.531
Environmental Strategy	0.5166696	0.1665484	3.10	**0.004**
Firm Size	-0.2487705	0.9861898	-0.25	0.803

[a] **Dependent Variable:** EMAPs

Testing the Relationship Between EMAPs and Environmental Performance

A simple regression model is conducted to test the relationship between EMAPs and environmental performance and to explain to what extent EMAPs could justify any change in environmental performance.

The regression model results summarized in Table (7) showed that the EMAPs explains 27.73% of the variation in the environmental performance of Egyptian manufacturing companies. The results reveal that the EMAPs have a positive direct effect on the environmental performance at the significant level of 5% with P> |t| of 0.002. hence, the fourth hypothesis that there is a direct association between the extent of EMAPs implementation and environmental performance, is accepted. This result is consistent with Venturelli and Pilisi (2005) and Solovida and Latan (2017) who found that EMAPs helps companies in improving their environmental performance.

Table (7): Simple Regression Model of the Relationship between EMAPs and the Environmental Performance

Panel A: Model Summary				
Model	**R^2**		**Adjusted R2**	
2	0.2773		0.2532	
Panel B: Coefficients [a]				
Independent Variables	**Unstandardized Coefficients**		**T**	**P> |t|**
	β	**Std Error**		
Constant	38.81441	5.676654	3.39	0.000
EMAPs	2.061596	0.6076198	6.84	**0.002**

[a] **Dependent Variable:** Environmental Performance

Discussion of Findings

The objective of this paper is to examine the impact of three corporate characteristics, namely environmental sensitivity of the industry, environmental strategy, and company size, on the adoption of EMAPs in the Egyptian listed manufactured firms, and the effect of those practices on the corporate environmental performance.

Table 6 shows that there is a direct positive association between environmental strategy and EMAPs, leading to the acceptance of the second hypothesis. This result indicates that the environmental strategy as part of business strategy helps companies in enhancing and improving the adoption of EMAPs by considering environmental problems during the strategic planning process, linking environmental objectives with the organizational goals, and always considering the environmental issues during new product development.

However, the multiple regression model failed to find a significant impact of the environmental sensitivity of the environment on EMAPs and leads to the rejection of the first hypothesis. This could be justified that EMAPs could be adopted equally well in any type of industry. Therefore, less environmentally sensitive industries could adopt EMAPs as well as non- EMAPs. Moreover, environmentally sensitive industries could implement non- EMAPs as well as EMAPs.

The third hypothesis is rejected as the multiple regression model does not find a significant relationship between company size and EMAPs. This means that EMAPs could be implemented in any firm size, whether small, medium, or large firm. This could be justified due to the lack of external competition that large organizations face.

Furthermore, this study found a significant association between EMAPs and environmental performance. Therefore, the fourth hypothesis is accepted. This result reveals that EMAPs helps manufacturing companies in reducing wastes, water usage, levels of emissions, environmental cots. In addition, those practices lead to enhancing production efficiency and improving ways of operations management.

Conclusions, Limitations, and Future Research

Companies in the manufacturing sector become more conscious of the importance of the environmental issues related to their operations and the effect of those issues on their performance. Therefore, EMAPs become a major part of the strategic planning of manufacturing companies in developed countries, however, there is a lack of such practices in

developing countries, such as Egypt. Therefore, this study is conducted to examine the factors that may affect the implementation of EMAPs in an emerging economy, in addition to examining the effect of those practices on the environmental performance of manufacturing companies.

This paper finds that : (1) there is a direct relationship between environmental strategy and EMAPs, (2) there is no impact of the environmental intensity of the industry and firm size on EMAPs, and (3) there is a significant impact of EMAPs on the environmental performance.

In practice, those findings provide more understanding of how Egyptian manufacturing companies could enhance their environmental performance through a better formulation of an environmental strategy that could help in the adoption of EMAPs effectively.

However, this study is subject to several limitations. First, this study limits to the Egyptian manufacturing companies listed in the Egyptian Stock Exchange Market making the sample size relatively small, so the results obtained may not be generalized. Second, only internal factors were considered in determining the factors that may affect the implementation of EMAPs. Third, this study considered the impact of EMAPs on environmental performance only, without testing the financial and operational performance.

Therefore, future research may consider testing the effect of external factors on the adoption of EMAPs. In addition, future research may use longitudinal study to examine the improvements in the environmental performance before and after the implementation of EMAPs. Furthermore, it seems important to apply this research in different economies to support the researcher’s findings and enrich the literature related to EMAPs.

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المحددات المؤسسية لممارسات المحاسبة الإدارية البيئية وتأثيرها على الأداء البيئي للشركات: الحالة في مصر

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الملخص

تهدف هذه الدراسة الى دراسة تأثير ثلاث خصائص مؤسسية (الحساسية البيئية للصناعة، الاستراتيجية البيئية، وحجم الشركة) على تطبيق الممارسات الخاصة بالمحاسبة الإدارية البيئية (EMAPs)وتأثير تلك الممارسات المحاسبية على الاداء البيئي للشركات المصرية المدرجة بالبورصة. وقد تم الاعتماد على قائمة استقصاء تم جمعها من الشركات الصناعية المصرية المدرجة في البورصة المصرية. تم تحليل البيانات باستخدام نماذج الانحدار البسيط والمتعدد، واظهرت النتائج أن اختيار استراتيجية الاعمال والتي تأخذ في الاعتبار القضايا البيئية يؤثر على ممارسات المحاسبة الإدارية البيئية في الشركات الصناعية المصرية. كما توصلت الدراسة الى ان الحساسية البيئية للصناعة وحجم الشركة ليس لهما تأثير معنوي على ممارسات المحاسبة الإدارية البيئية للشركات المصرية. وجدت النتائج أيضًا أن ممارسات المحاسبة الإدارية البيئية تؤثر بشكل مباشر على الأداء البيئي.

يمكن اعتبار هذه الدراسة أداة هامة لمساعدة للمديرين والممارسين في البيئة الصناعية المصرية في تطبيق الممارسات الفعالة للمحاسبة الإدارية البيئية والتي تساعد في تحسين الأداء البيئي وتعزيزه.

الكلمات المفتاحية: ممارسات المحاسبة الإدارية البيئية (EMAPs) ، الحساسية البيئية للصناعة، استراتيجية الأعمال البيئية ، الأداء البيئي ، مصر.