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# A study of environmental disclosures practices in Chinese energy industry

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## Abstract

In 2016, China increased sustainability practices among companies listed on China's stock market, making environmental regulations one of their integral policies. This states that highly polluting industries like the energy industry are required to comply with the sustainability requirements set. Concerning this event, research was conducted in 2016 to 2017, on the development of environmental disclosure (ED) practices in China and the impact of different variables on environmental disclosure index (EDI). Focusing on 150 energy companies listed on the Shanghai and Shenzhen stock exchange, the findings show that if the company had a better ROA, firm size, leverage and environmental accreditation certificate, they would like to publish more relevant environmental information.

**Keywords:** Environmental disclosure index, Financial performance, Corporate social responsibility, Energy industry, China

## Introduction

Between 1978 and 2000, China has achieved rapid growth and has been expanding dramatically. Thus, shows that the energy industries play an essential role, both the industrial value-added and the quantities of leading products in China. With the increase of Chinese business ventures with other countries, awareness of environmental problems contributed to the effort of the Chinese government to strengthen its regulatory environment (Jahiel 2006). Ministry of Finance (MOF) released the Regulations on Enterprise Accounting (1993), the Accounting Act of the PRC (1985, revised in 1999), and the Standard of Enterprise Accounting and Issues of Concern (2000), mainly focusing on accounting standards. However, only a few clauses are related to environmental issues (Cai et al., 2016). Since Shell China published the first corporate social responsibility (CSR) report in 1999, there are 26 companies published their CSR report which comprised of 17 state-owned enterprises, 8 multinational enterprises, and 1 private company (Kolk et al. 2010). Unfortunately, there are no such regulations and statutory requirements for the energy companies in China to disclose environmental reporting. So, China's environmental reporting practices have tended to lag behind those of other countries in the region.

At present, the demand for firms to apply environment disclosures (ED) serves as an alternative means of reducing environmental damage by companies (Mathews 1997 p.

491). Lack of CSR reporting may expose a firm to significant additional risk from fines, lawsuits, and may limit its strategic options (McGuire et al. 1988). Moreover, concerns about climate change and global warming have attracted considerable attention from various stakeholders (Matsumura et al. 2014). Although many types of research have already been conducted in different industries and countries, environmental reporting has not been universally recognized given its challenge in providing sufficient, accurate, credible, and transparent information. (Kolk 2008; Baalouch et al. 2019). Given so, this study is set to fill the gap in the prior literature to give solution to the conflicting results such as positive relationship between ED and financial performance as well as negative or no relationship between the two.

In addition, this is also the first study undertaken in China that discusses the relation between ED and financial performance in the energy industry. This research aims to examine the influence of financial performance on ED reporting of China's energy industry including companies producing primary and secondary energy listed in the Shenzhen and Shanghai stock exchange. Moreover, this paper hypothesizes that there is a positive relationship between financial performance and ED in China's energy industry.

In this paper, pertinent literature on the development of ED in China were described in section 2 followed by the previous studies on positive, negative, and no association between ED and financial performance in Section 3. To further support, Section 4 described the hypothesis development and the research methodology explaining the method of the study describing the variables and empirical results in section 5. In the last section, conclusions, discussions, and future were provided in the final section.

## Literature review

### Environmental disclosure (ED)

ED is under the concept of environmental accounting. According to Craighead and Hartwick (1998), disclosure strategy is an essential value-create tool. The score and scale of disclosure strategy can broaden from financial information disclosure to other information disclosure such as environmental, corporate governance, and technology. Li (2001) thought that environmental accounting used the basic theory and methodology of accounting, management, environmental science to make a combination between currency measurement and non-currency measurement. It can confirm, quantify, and report the environmental attributes which were involved in the company's daily operation activity. From an economic point of view, ED can be regarded as a reflection of the company's calculation of potential costs and benefits related to ED information (Cormiera and Magnan 2007).

ED was defined by The Association of Chartered Certified Accountants (ACCA) as "a description of objectives, explanations and numerical information such as emissions, resources consumed by enterprises in specific environments for environmental impacts" (Ong et al. 2016 p. 462). Nola (2002) argues that to establish an excellent environmental image, companies must have to disclose environmental accounting information. Beer and Friend (2006) believe that to meet the investment decisions of stakeholders and to be able to win competitive advantages in the market place, firms have to disclose environmental accounting information actively. In China, the regulatory requirements of the EDs have developed in the previous years. However, there is still no standard or guidelines on corporate environmental reporting and disclosure in China (Feng et al. 2018; Li et al. 2019).

### The development of ED in China

China is facing immense pressure to meet environmental protection. For instance, during the period 1997 to 2004, over eight thousand Chinese companies were investigated and audited regarding their social business practices from their foreign partners (Gaoguan Information 2009). In 2001, there is still no standard or guidelines on corporate environmental reporting and disclosure in China. But the Chinese government has launched environmental policy due to several reasons (Gang 2009 p. 119): First, the Chinese leaders realized that environmental concerns might hamper China's growth in the long run. Second, public discontent concerning pollution has been growing, which increasingly became a focus of domestic and foreign media. Finally, pressure from the international organization in China to adopt stricter environmental policies is increasing.

As stated by Welford 2005, the contents of the environmental policy can be divided into three kinds. First, the statement of corporate environmental policy and the impacts on the business of government environmental policy. Second, it is associated with the costs and benefits of environmental aspects of monetary values. Lastly, it is the introduction of principle pollutants and the solutions on how to deal with them. There are many ways to disclose corporate environmental details. Some companies have used the yearly financial report, the board of directors' reports, corporate brochures, and some have used the local press and other media. Based on the survey conducted by the Japanese Institute in 2004 in China from 61 listed companies, the results show that one-third of the listed companies in China published a number of corporate environmental information but most of them only submit environmental information to the government when they are forced to do so.

As stated by Xiao (2006), before 2004, companies in China were required to prepare a mandatory corporate environmental report known as Format A to local environmental protection administration and local statistics bureau. And these companies were encouraged to publish their environmental reports online. However, Format A reporting did not lead to an increase of companies submitting environmental accounting since no financial information was required (Xiao 2006). So apart from Format A, there is another environmental report known as Format B, which is required to be prepared by companies who are identified as "dirty companies" by the China State Environmental Protection Administration.

In 2004, the Guangdong Environmental Protection Bureau (GEPB) released a list of 33 companies that use or produce harmful or poisonous materials (Guo 2005). These companies were required to undergo cleaner production auditing. Companies who are not compliant with the Cleaner Production Promotion Act, Article 28, will be given a warning and should improve in a given period; otherwise, they will need to pay a fine of no more than 100,000RMB (Welford 2005). Since 2004, the listed companies are required to report their environmental performance information of the previous year by March 31st every year. On the other hand, non-listed enterprises can report their environmental performances on a voluntary basis.

In December 2004, China's primary environmental enforcer, State Environmental Protection Administration (SEPA), implemented stiffer procedures and punishment of 68 accredited Environmental Impact Assessment (EIA) organizations, eight of which were suspended. For example, in the case of Sichuan Chemistry Co. Ltd., a fertilizer plant discharged a large amount of chemicals into a local river, which was the local drinking source in early 2004. The company was fined 1,000,000RMB, which illustrates the importance of corporate ED.

From 2001 to 2005, Chinese authorities received more than 2.53 million letters and 430,000 visits by 597,000 petitioners seeking environmental redress (Wang 2006). In response, the Chinese government proposed the 'Harmonious Society' as a vision for the country's future socio-economic development. It highlighted some problems that required a long-term strategy such as environmental degradation, sustainability, energy consumption, and environmental conservation including the targets of the 11th five-year-plan from 2006 to 2010 (See 2009). In 2006, the Chinese government established a series of guidelines for enterprises to take significant steps as a follow through to the initiative. For example, guidelines of state-owned enterprises perform social responsibilities and guidelines about enhancing the supervision of listed companies' social responsibilities. However, these guidelines are not mandatory to provide environmental reporting and disclosure (Guo 2005).

In 2006, Shenzhen Stock Exchange published *The Guide of Social Responsibility of the Public Company in Shenzhen Stock Exchange*. In 2008, AEGON-Industrial Fund Management Co. Ltd., a sustainable investment pioneer in China, has offered the first socially responsible investment retail fund (Lane 2009). In the same year, the Shanghai Stock Exchange (SSE) and China Securities Index Co., Ltd. issued the SSE Social Responsibility index (Situ and Tilt 2012). The diversified and inconsistent format and lack of guidelines on corporate environmental reporting and disclosure increase the freedom of the companies to choose what kind of information to disclose. As a result, companies often fail to provide the information which is critical to stakeholders and mostly provide information that of less importance. In 2007, SEPA issued the *Measures on Open Environmental Information*, which required mandatory disclosure for companies whose pollutants surpasses the standard of local, regional, and national governments (Cai et al. 2016). In 2008, the government launched the *Green Securities Policy* to increase and encourage sustainability practices among companies listed on stock markets. One of the integral components of the policy is the ED regulation in 14 highly polluting industries to report required environmental information (Wang and Bernell 2013).

In September 2010, SEPA established the *Guide to the Disclosure of Environment Information in Listed Companies* to increase the transparency in the disclosure of enterprise environment information. The Guide requires that 16 heavy polluting industries, such as the thermal power electricity industry, steel industry, cement industry, and the electrolysis aluminum industry to release an annual environment information report about the emission of pollutants and other environmental aspects. As stated by SynTao 2015, there are more than 2000 companies publishing CSR reports in China which is approximately 30% of the reports followed the international reporting standards such as GRI Guidelines and the UN Global Compact principles (Cai et al. 2016). In 2015, Environmental Protection Law (EPL) had been in effect. Compared to the past, local governments have given unprecedented attention to environmental issues brought by companies and have significantly strengthened environmental regulation enforcement in terms of government responsibility, corporate compliance, public participation, and environmental information disclosure.

Despite long-standing attempts of the government to control the situation through laws and regulations, the country's environmental problem remains severe. Blacconiere and Patten (1994) suggest that the absence of proper EDs will be perceived as a negative signal from the stakeholders regarding companies' exposure to future environmental challenges. Chinese firms can, in some cases, moderate the backlash through EDs. In general, firms are expected to be more willing to provide detailed information about

these activities, especially when economic performance is good (Freedman and Jaggi 1988).

Based on the study of Teoh et al. (1998), firms with better prior financial performance make greater subsequent EDs. However, when the firms are experiencing hard times, they may fear stakeholders' adverse reactions, so they are cautious in including EDs in their annual report. Also, firms' EDs increase when environmental problems are the focus of media attention (Maigness 2006). Public media spreads faster and impacts the image of the companies, making them more cautious and active in protecting their firms' bottom line. With this, firm ED is expected to be more constant over time.

Ullmann (1985) argues that when stakeholder power is high, companies with an active strategic posture make greater social responsibility disclosure. Chinese companies that bypass the importance of environment disclosure could incur a loss of stakeholders' confidence, and these can affect the entire industry and extend to other countries. Most of the Chinese companies neglect the benefits of EDs in their financial performance (Yu et al. 2011). Expenses on being socially responsible will deteriorate profitability in the short-term but will lead to a competitive disadvantage in the long-run (Alexander and Buchholz 1978).

There were many discussions about environmental accounting (EA) and environment reporting (ER) theories among Chinese scholars and researchers since 1992. Based on the study of Xiao (2006), there is a total of 324 studies in China in the period from 1992 to 2003. Most of the studies on the ED of Chinese enterprises have been written in the Chinese language. With the increasing number of green initiatives taken by China to meet the environmental challenges of the country, research started expanding in 2006. Numerous studies have assessed the level, quality, and attribute of environmental information disclosed by Chinese corporations. Their financial performances, industries, ownership structures, and locations have reviewed,

Based on the findings of Li et al. (2019), there is an uneven dispersion of environmental practices because different industries have different strategies and formats for CSR disclosure in China. Although Chinese companies adopted CSR projects between 2006 and 2013 with increasing rates, there is a decreasing trend of CSR projects after 2013 which was associated with the increase in the costs of the projects and the decrease of financial support from the government and other sources (Li et al. 2019, 5). For example, companies in Tier I regions (e.g., Shanghai, Beijing, Guangdong, Shenzhen provinces) have either more resources or more substantial incentives from the government to undertake CSR projects than companies in less-developed regions. However, there is no agreement on whether financial performance has a significant (positive, negative, or neutral) impact on the levels of environmental disclosures reported by the firms.

## **Research proposition**

### **Previous studies on positive association between ED and financial performance**

Many researchers find that there is a positive relationship between ED and financial performance (e.g., Barth et al. 1997; Russo and Fouts 1997; Hai et al. 1998; Stanwick and Stanwick 2000; Murray et al. 2006; Samy et al. 2010). Murray et al. (2006) study shows that the UK's largest companies with consistently higher returns are likely to have consistently higher levels of total and voluntary social and environmental disclosure. Based on the study of Moneva and Ortas (2010) on 230 European companies, the results support the idea that

enterprises that obtained higher rates of the environmental performance show better financial performance levels in the future. They used accounting-based indicators such as return on assets (ROA), return on equity (ROE), profit margin (PM), earnings per share, which are relative magnitudes, and cash-flow (CF) and operating profits (OP) which are absolute magnitudes. Yusoff et al. (2013) study on Malaysian firms shows that efficient financial performers were those who increased the coverage of CSR disclosure to multiple stakeholders.

Endrikat et al. (2014) used meta-analytic review to find the relationship between corporate environmental and financial performance integrating the findings of 149 studies and found that a firm's environmental activities increase the firm's internal efficiency and have positive impacts on its accounting-based measures. Friede et al. (2015) analyzed 2200 empirical studies that determined the relationship between environmental, social, and governance (ESG) criteria and corporate financial performance (CFP) since 1970. He found that roughly 90% of studies find a nonnegative ESG–CFP relation, and the rest of 10% papers showed that there is a negative relationship between ESG and CFP. So, the actual cost of a firm's ED is minimal because it can serve as an enterprise strategy where there is a linkage between its values and strategy, which can result in substantial gains.

Based on the study of Ullmann (1985) on 11 research studies on the correlation between social disclosure and economic performance, he found that seven studies have positive associations (e.g., Cochran and Wood 1984; Moskowitz 1972; Sturdivant and Ginter 1977; Bowman and Haire 1975; Bragdon and Marlin 1972; Spicer 1978a, 1978b; Parket and Eilbirt 1975), one studies found negative correlation (e.g., Vance 1975), and the remaining studies reported no associations (e.g., Alexander and Buchholz 1978; Chen and Metcalf 1980; Kedia and Kuntz 1981). However, this was a descriptive literature review, and no empirical evidence was offered to support his argument.

#### **Previous studies on negative or no association between ED and financial performance**

Despite the number of studies that support the findings of a positive linkage between ED and financial performance, Ullmann (1985) argued that the linkages between social performance and financial performance are ambiguous due to the following reasons: (1) lack of theory, (2) inappropriate definition of key terms, and (3) deficiencies in the empirical data. There is several evidences that showed ED does have a negative relationship with financial performance. For example, Zauwiyah et al. (2003) result that the decision to disclose environmental information is negatively correlated with companies' financial leverage. It was also concluded that a positive accounting perspective might not be entirely applicable to voluntary disclosures in Malaysia. The study of Waworuntu et al. (2014) on the top listed companies in the ASEAN region; the result shows that there is a negative relationship between CSR and financial performance in the energy sector.

Some studies found a weak relationship between social performance and financial performance. For instance, Balabanis et al. (1998) studied 56 large corporations in the UK, found that there is a weak and lack of overall consistency relationship between CSR and economic performance. Samy et al. (2010) study 20 selected British Companies; there was a weak positive causal relationship between social performance and earning per share. Oeyono et al. (2011) study on the relationship between social and financial performance in Top 50 Indonesian Listed Corporations, and there was a weak positive relationship between CSR and profitability.

Empirical study like Aupperle et al. (1985 p. 446) argue that previous studies on the positive relationship between CSR and profitability, it has frequently reflected either an ideological bias or limited methodological procedures. Because they used an elaborate, forced-choice instrument administered to corporate CEOs, and they did not find any relationship between CSR and profitability. Their study was supported by McWilliams and Siegel (2000) that the inconsistency views on the positive, negative, and neutral impact of CSR on financial performance may be due to flawed empirical analysis. Freedman and Jaggi (1986) found no relationship between pollution disclosure and financial performance indicators. Similar to their study (1988), they also found no correlation, but if the sample companies were segmented by industry-type, there is a positive correlation for the oil refining industry.

Also, Haslinda et al. (2002) investigated 40 companies from 8 different industries listed on the Kuala Lumpur Stock Exchange (KLSE) in Malaysia. They concluded that the relationship between environmental reporting and performance is still inconclusive since only two out of the 19 items of environmental information examined showed a positive correlation with the profitability of the reporting companies. Connelly and Limpaphayom (2004) studied a sample of 200 public companies in Thailand by using the Porter hypothesis to examine the relationship between corporate environmental reporting and firm performance. The results failed to find a relationship between environmental activity reporting and accounting performance. Cormier and Magnan (2007) investigated firms from Canada, France, and Germany with a design that relied on simultaneous equations to control for the endogeneity between environmental disclosure and firm attributes. Their results suggest that environmental information does not significantly influence the stock market valuation of Canadian and French firm's earnings.

Based on the cross-country study of Rahman et al. (2009) on Malaysia, Singapore and Thailand show that the performance of the companies was not associated with the production of a detailed disclosure, superficial environmental disclosure, or both. In relation to the banking sector, there is no statistically significant link between social performance and financial performance (Soana 2011). Waworuntu et al. (2014) stated that financial services sector like banks provide a minimal amount of ED because they do not directly affect towards the environment, but instead they are very connected to the social and economic variables in the economy. Sun et al. (2010) find no significant statistical association between various measures of discretionary accruals as a measure of earnings management and ED. They stated that firms are in control of decision-making processes; they are motivated to engage in ED in either income-increasing or income-decreasing earnings management for their benefit.

According to Galant and Cadez (2017), the common reason for the diverse and contradictory results of the relationship between CSR and financial performance is the measurement issues such as are researcher subjectivity and selection bias. They argue that a potential solution for the problem is the standardization of CSR reporting and mandatory disclosure of CSR information. This shows that the evidence on the association between ED and financial performance is inconclusive and has been the subject of contradictory views. As a result, a hypothesis was concluded below:

*Research Proposition:* There is a positive association between environmental disclosure and financial performance in China's energy industry.

## Research methodology and hypothesis development

### Data collection

This study focused on the relationship between ED and financial performance among energy companies listed on the Shenzhen stock exchange and Shanghai stock exchange. The sample of this study comprises of 150 companies in the energy industry, as shown in [Appendix](#). The selection of energy industry in China for this study is based on Feng et al. (2018, p. 3) findings that starting the year 2016, many energy companies have begun to build environmentally friendly and efficient operations to reduce costs and improve profits. Also, in the year 2016, China released the “Guiding Opinions on Establishing a Green Finance System,” which said that polluting companies like energy and manufacturing were required to disclose environmental information (McGregor 2018).

This paper collected the information about each companies’ environmental disclosure and financial performance from the company’s annual report and CSR report for the year 2016 to 2017. The annual report is commonly used for communicating financial information and financial performance to stakeholders (Tilt 1994). On the other hand, the CSR report can help us to find relevant information about company environmental disclosure. Considering our samples are all 150 energy companies listed in Shanghai stock exchange and Shenzhen stock exchange, their annual report and CSR report are available and easy to get from their official website or the stock exchange website. In this study, we used STATA analysis software to process data.

### Environmental disclosure index

Environmental disclosure index is used to examine whether companies engage in environmental disclosure practices of particular information in annual company reports (Marston and Shrivs, 1991; Ragini, 2012). The classification of environmental disclosure index items is based on the study of Ragini (2012) and Chaklader and Gulati (2015) (as shown in Table 1).

As mentioned by Ragini (2012), the environmental disclosure index can be measured using weighted or unweighted scores. Previous studies (e.g., Williams 2001; Ragini 2012; Chaklader and Gulati 2015) used the unweighted index in which all disclosure items are given equal importance to reduce subjectivity. Each reader or user of the company’s annual report will weigh the disclosure items based on their subjective view, which item is more important than the others. So, this study used the unweighted dichotomous index. The scoring of environmental disclosure item is as follows: one (1) if it is disclosed in the annual report or CSR report, or zero (0) if it is not disclosed in the annual report or CSR report. The total EDI disclosure score can be calculated as follows:

$$\frac{\text{Total number of items appearing in the annual report}}{\text{Maximum number of items which should appear in annual reports}}$$

### Variables definition

Previous studies utilize stock market-based performance, and most researchers use accounting-based measures to measure the relationship between financial performance and CSR. The different methods lead to contracting results and discussions. For example, stock market measures mainly focus on market performance, so they are less susceptible to different accounting procedures and represent primarily the investor’s

**Table 1** Environmental Disclosure Index

Environmental Disclosure Index	Description
1. Environmental commitments	The approach, responsibilities, and roles as well as the principles, rules, systems, and procedures adopted by the company to manage and prevent environmental impacts in their operations and value chain.
2. Environmental disclosure	It refers to the text reported in the Environmental Reports, which includes the attachments.
3. Environmental expenditure	It refers to the capital and current expenditures related to activities and facilities specified in classifications of environmental protection activities.
4. Environmental initiatives	It refers to the commitment to responsible natural resources and protection of soil, water, and climate.
5. Environmental management framework	A transparent and integrated governance framework to manage environmental aspects for the design, construction, and operational phases of the environmental project.
6. Products and technologies contributing to environment	It refers to the product and technologies for sustainable development.

Source: Ragini (2012); Chaklader and Gulati (2015)

(Moskowitz 1972; Vance 1975). However, it has been the subject of contradictory views in the past. Alexander and Buchholz (1978) found that there seems to be no significant relationship between stock risk levels and the degree of social responsibility. It suggested that the interpretations of Moskowitz (1972) and Vance (1975) are invalid. So, this study adapted the accounting-based measures.

#### ***Return on asset (ROA)***

According to McGuire et al. (1988) and Mitchell and Hill (2009), accounting-based measures, particularly (ROA), proved to be better predictors of CSR than stock market-based measures. Because if perceptions of CSR are firm-specific, accounting measures of return, it should be more sensitive, which reflects systematic market trends than stock market returns, which are more variable over time since they respond to unexpected changes. Zhang et al. (2014) stated that ROA could illustrate how executives are utilizing the assets of their shareholders and creditors, so it is widely accepted by more scholars (Feng et al. 2018; Li et al., 2010; Norhasimah et al., 2016). ROA equals net profit divided by average total assets, and it reflects the ability of the company to produce a profit during a fiscal year. So, we have considered ROA as a proxy for profitability, which we calculated as net profits before tax divided by total assets.

*H1*: Return on asset has a positive impact on ED for the energy companies in China.

#### ***Firm size (SIZE)***

Numerous research papers found that company size is a significant variable and it is positively associated with EDI (Baalouch et al. 2019; Brammer and Pavelin 2008; Chaklader and Gulati 2015; Clarkson et al. 2011; Cormier and Magnan, 2007; Magness 2006; Suttipun and Stanton 2012; Wu et al. 2010; Yang and Zhang 2014; Zeng et al. 2012). Firm size is measured as the natural logarithm of total assets. They concluded that large firms tend to be more visible to society as they attract public scrutiny, political, and regulatory pressures. So, they intend to disseminate environmental information

and driven to address environmental concerns. Hence, size was considered as an independent variable in the conceptual model of this study.

*H2:* Firm size has a positive impact on ED for the energy companies in China.

#### ***Firm leverage (LEV)***

Wu et al. (2010) findings show that better-performing firms and highly-leveraged firms tend to have lower environmental disclosures. It implies that these firms may have better compliance with environmental laws and regulations. Also, Baalouch et al. (2019) results show that leverage has a positive and significant association indicating that highly-leveraged firms tend to disseminate better quality and high amounts of ED information in order to reduce negative impact from investors. Therefore, environmental disclosure depends on the degree of firm leverage.

*H3:* Firm leverage has a positive impact on ED for the energy companies in China.

#### ***Multinational characteristics (MNC)***

Multinational companies that are listed in the stock exchange disclose more environmental reports to boost their ability to attract external capital to run their business (Ledoux et al. 2014). Companies listed on the stock exchange put much reliance on external sources of finance, which is a major motivating factor that influences firms to engage in environmental disclosure (Meng et al. 2013; Hahn and Kühnen 2013). Another reason is pressure from the government, political, social, regulatory, and customer (Brennan and Merkl-Davies 2014), which tends to influence corporate environmental disclosure. MNC is considered as another dummy variable and assigned as one (1) if the company is a multinational company and assign as zero (0) if the company is not.

*H4:* Multinational characteristics of the firm has a positive impact on ED for the energy companies in China.

#### ***Certification (CERT)***

According to the following studies (Chaklader and Gulati 2015; Mitchell and Hill 2009; Sumiani et al. 2007), environmental certification (e.g., Eco-Label; ISO 14000) is positively associated with environmental disclosure performance. Sumiani et al. (2007) stated that companies with ISO14000 show more commitment to comply with all relevant environmental policies and regulations. Firms show continuous improvement in their environmental performance. CERT is considered as a dummy variable in our research model; if the company has any environmental certification such as 'ISO 14000' families, it will assign as one (1). If the company does not have any environmental certification, it will assign as zero (0).

*H5:* Firm environmental certification has a positive impact on ED for the energy companies in China.

#### ***Time (TIME)***

TIME is considered as a dummy variable; company's performance in 2016 represents as zero (0) and the company's performance in 2017 represents as one (1).

*H6:* Time has a positive impact on ED for the energy companies in China.

### Model design

Based on the above literature review, we derive this mathematical equation to test the dependence of EDI (dependent variables) (see Table 1) on the company attributes (independent variables) (see Table 2):

$$EDI = \beta_0 + \beta_1(ROA) + \beta_2(SIZE) + \beta_3(LEVERAGE) + \beta_4(MNC) + \beta_5(TIME) + \beta_6(CERT) + \varepsilon$$

where  $\beta_0$  is the intercept of the equation;  $\beta_1$  to  $\beta_6$  are the regression coefficients;  $\varepsilon$  is the error term.

### Results

The results in Table 3 show that the standard deviation of EDI is 0.117. It indicates that there has not been a huge variation in the ED pattern of the Chinese energy companies under study. For the period 2016 and 2017, the mean value for EDI is 0.412, which means that less than 50% of Chinese energy companies are disclosing environmental information. This result supported the study of McGregor (2018) that there were only 13% and 11% of the listed companies in Shanghai Stock Exchange and the Shenzhen Stock Exchange have equal to or above 50% environment disclosure rates. Also, Li et al. (2019) found that CSR project proportions differ mainly across industry type: manufacturing (60%), followed by finance (9%), energy utilities (8%), minerals (8%), and transportation (6%). So, even that environmental disclosure by Chinese companies increased year-on-year, there is still no push for greater disclosure and transparency in energy companies.

**Table 2** Variables Description

Variable/s	Name	Description	Sources
EDI	Environmental Disclosure Index	Total number of items appearing in the annual report/Maximum number of items which should appear in annual reports	Ragini (2012)
ROA	Return on Assets	Net income/total assets	Feng et al. (2018); Li et al. (2010); Norhasimah (2016); Zhang et al. (2014)
SIZE	Company Size	The natural log of total asset	Baalouch et al. (2019); Brammer and Pavelin (2008); Chaklader and Gulati (2015); Clarkson et al. (2011); Cormier and Magnan (2007); Magness 2006; Suttipun and Stanton (2012); Wu et al. (2010); Yang and Zhang (2014); Zeng et al. (2012)
LEV	Leverage	Debt to assets ratio	Baalouch et al. (2019); Wu et al. (2010)
MNC	Multinational Characteristics	Dummy for multinational characteristics: 1 refers to company that is multinational, 0 if the company is not.	Brennan and Merkl-Davies (2014); Hahn and Kühnen (2013); Ledoux et al. (2014); Meng et al. (2013);
CERT	Environmental Certificate	Dummy for certification: 1 refers to a company who has environmental certification (e.g., Ecolabel, ISO 14000 and others), 0 otherwise.	Chaklader and Gulati (2015); Mitchell and Hill (2009); Sumiani et al. (2007)
TIME	Time	Dummy for time: 0 refers to the company's performance for the period 2016; 1 refers to the company's performance for the period 2017.	

**Table 3** Descriptive Statistics

	N	Min	Max	Mean	Std. Dev
EDI	300	.000	1.000	.413	.272
ROA	300	-.177	.800	.054	.117
SIZE	300	8.209	12.381	10.134	.690
LEV	300	.033	.902	.529	.186
MNC	300	.000	1.000	.484	.492
TIME	300	0	1	.50	.501
CERT	300	.000	1.000	.390	.451

As shown in Table 4, for the period 2016 and 2017, there is a highly significant and positive correlation between EDI and ROA at  $p < 0.05$ . This result is highly consistent with previous studies (Barth et al. 1997; Russo and Fouts 1997; Hai et al. 1998; Stanwick and Stanwick 2000; Murray et al. 2006; Samy et al. 2010). Also, SIZE, LEV, and CERT show significant positive relationship with EDI at  $p < 0.01$  which are consistent with the previous studies (Brammer and Pavelin, 2008; Clarkson et al. 2011; Chaklader and Gulati, 2015; Mitchell and Hill, 2009; Sumiani et al., 2007).

Regression analysis was used on the panel data for the 150 energy companies for the period 2016–2017. Table 5 presents the results of the regression analysis using financial performance and dummy variables as the dependent variables. The results imply that there is a statistically significant and positive correlation between ED and ROA [ $\beta = 0.245$ ,  $t(150) = 1.999$ ,  $p < 0.05$ ]. The results support *H1*, saying that when an energy company has better financial performance, it will likely publish more environmental information on its annual report and CSR report.

Also, the results show that ED is highly significant with SIZE [ $\beta = 0.130$ ,  $t(150) = 5.553$ ,  $p < 0.01$ ], LEV [ $\beta = 0.010$ ,  $t(150) = 0.120$ ,  $p < 0.01$ ], and CERT [ $\beta = 0.114$ ,  $t(150) = 3.409$ ,  $p < 0.01$ ]. Therefore, *H2*, *H3*, and *H5* are supported. For firm size, it can be said that large companies have higher environmental information and responsibilities than small companies because, as the firm grows, they tend to be more visible to the public and attract more attention from their stakeholders. In terms of firm leverage, the results show that highly leverage energy firms tend to disclose high amounts of environmental information to gain legitimacy from the investors. Energy companies that have more shareholders will tell to be more able to satisfy their shareholders so that they can continue to operate. Lastly, the company's environmental certification, the results show that energy companies

**Table 4** Correlation Coefficients Among Selective Variables

	EDI	ROA	LEV	SIZE	MNC	TIME	CERT
EDI	1						
ROA	0.115 <sup>a</sup>	1					
LEV	0.174 <sup>b</sup>	-0.02	1				
SIZE	0.379 <sup>b</sup>	-0.051	0.417 <sup>b</sup>	1			
MNC	-0.113	-0.006	-0.036	-0.011	1		
TIME	0.01	-0.029	0.003	-0.027	-0.005	1	
CERT	0.306 <sup>b</sup>	0.142 <sup>a</sup>	0.155 <sup>b</sup>	0.279 <sup>b</sup>	-0.118 <sup>a</sup>	-0.036	1

<sup>a</sup>Statistically significant at the 0.05 level (2-tailed)

<sup>b</sup>Statistically significant at the 0.01 level (2-tailed)

**Table 5** Regression Analysis

	$\beta$	Std. E	Beta	t	p-value
ROA	0.245	0.123	0.106	1.999	0.046 <sup>a</sup>
SIZE	0.130	0.023	0.329	5.553	0.000 <sup>b</sup>
LEV	0.010	0.084	0.007	0.120	0.002 <sup>b</sup>
MNC	-0.047	0.029	-0.086	-1.633	0.866
TIME	0.015	0.028	0.028	0.540	0.590
CERT	0.114	0.033	0.189	3.409	0.010 <sup>b</sup>

<sup>a</sup>Statistically significant at the 0.05 level (2-tailed)

<sup>b</sup>Statistically significant at the 0.01 level (2-tailed)

who have environmental certifications (e.g., ISO14001) tend to show voluntary firm commitment towards environmental improvements.

However, ED is not statistically significant with MNC and TIME. So, hypothesis H4 and H6 were not supported. These findings are inconsistent with previous studies (Brennan and Merkl-Davies, 2014; Hahn and Kühnen, 2013; Ledoux et al., 2014; Meng et al., 2013) on the relationship between MNC and ED.

## Conclusion and discussion

The objective of this study was to analyze if there is a positive association between financial performance and ED in China's energy industry. The findings appear to imply that while the formal institutional rules are in place, ED in the energy industry is still a less prevalent practice in China since they have been adopting various policy measures to control industrial environmental problems.

ED is essential and required by the public in decision-making for various purposes, including investment, lending, consumption, labor supply, and legitimacy. Most China energy companies do realize the importance of ED and use practical measures to regulate environmental problems (Feng et al. 2018; McGregor 2018; Zhang et al. 2014). One hundred fifty energy companies being studied stated their environmental concerns in general statements that were included in their annual report and CSR report. However, most companies do not have a systematic EDI and procedures of reporting to follow. It also shows that energy companies are in control of the type of environmental information they will be revealing to the public. China ED practices will have to move to levels of compliance deemed appropriate by other nations. As mentioned by Feng et al. (2018), Chinese energy companies should pay more attention to improving CSR and ED to maintain excellent financial performance and develop a sustainable competitive advantage.

The empirical results show three findings: First, based on the regression test, the results show that there is a significantly positive relationship between ROA and ED for the company. It may indicate that firms with better financial performance improve their environmental disclosure in their annual or CSR report. These companies which performed well financially wanted to let the public know that they are also committed to give back to society and letting them know their environmental initiatives through ED reporting which is consistent with previous findings (Feng et al. 2018; Li et al. 2010; Norhasimah et al. 2016; Zhang et al. 2014).

Second, the results show that energy companies with bigger sizes, higher leverage, and who are certified with environmental certifications tend to be more committed to showcasing their environmental practices and contributions to their stakeholders. It will also show that energy firms are committed to complying with all relevant environmental regulations and legislation. The findings also suggest that firm size, firm leverage, and accredited environmental certifications are effective mechanisms to facilitate environmental reporting. So, these findings supported previous studies on firms size and ED (Baalouch et al. 2019; Brammer and Pavelin 2008; Chaklader and Gulati 2015; Clarkson et al. 2011; Cormier and Magnan, 2007; Magness 2006; Suttipun and Stanton 2012; Wu et al. 2010; Yang and Zhang 2014; Zeng et al. 2012); leverage (Baalouch et al. 2019; Wu et al. 2010); and certification (Chaklader and Gulati 2015; Mitchell and Hill 2009; Sumiani et al. 2007).

Our results enrich the investigations focusing on understanding the relationship between ED and financial performance of companies, particularly in developing countries. With environmental issues becoming one of the most urgent global issues, China will not be able to avoid them. It forces Chinese companies to become more competitive and innovative in running their business operations. They need to strategize with appealing environmental practices which will attract positive attentions from their stakeholders. The finding of this study is valuable for companies across industries that are considering the adoption of environmental and CSR practices. We believe that our results can be a reference in educating and encouraging policymakers, companies, and investors to promote sustainability and the importance of disclosing environmental information that can promote sustainable economic development. Policymakers should pay more attention to systematizing EDI to engage firms in environmental reporting.

Future studies in this line of research can be performed by consistently monitoring updated guidelines and policies of the government on corporate environmental disclosure in China as mentioned by McGregor (2018) that only in the early year 2016 that Chinese government released the guidelines to required polluting industries like energy and manufacturing companies to disclose their environmental activities. So, it is suggested to conduct a longitudinal study of panel data on a yearly basis to compare the trend of industries or companies' environmental disclosure. Also, to analyze additional EDI indicators to have a better understanding on the influence of financial performance on corporate environmental disclosures practices.

In addition, as mentioned by Feng et al. (2018) that further analysis of unlisted energy companies in China may be warranted in order further to analyze the motivating factors behind environmental disclosure reporting. For example, whether this is a form of public relations of listed companies to build their corporate image, marketing incentives, or pressures from the government. It must be noted that no inferences or generalizations are intended to be made in this study on China's energy companies' environmental reporting practices. The results of this study are only relevant to the sample of companies studied. However, the findings do add to the body of knowledge literature on environmental disclosures and reporting. It also gives significant importance to the environmental management practices of the energy industry in China.

## Appendix

**Table 6** 150 Energy Companies in China under Study

No.	Company Name in English	In Chinese Name
1	An Hui Wenergy Co., Ltd.	皖能电力
2	Anhui Hengyuan Coal Industry and Electricity Power Co., Ltd.	恒源煤电
3	Anhui Province Natural Gas Development Co., Ltd.	皖天然气
4	Anyuan Coal Industry Group Co., Ltd.	*ST安煤
5	Beijing Haohua Energy Resource Co., Ltd.	昊华能源
6	Beijing Huayuanyitong Thermal Technology Co., Ltd.	华通热力
7	Beijing Jingneng Power Co., Ltd.	京能电力
8	Bestsun Energy Co., Ltd.	百川能源
9	CECEP Solar Energy Co., Ltd.	太阳能
10	CECEP Wind-Power Corporation	节能风电
11	Changchun Gas Co., Ltd.	长春燃气
12	Changchun Sinoenergy Corporation	中天能源
13	Chengtun Mining Group Co., Ltd.	盛屯矿业
14	Chifeng Jilong Gold Mining Co., Ltd.	赤峰黄金
15	China Coal Energy Company Limited	中煤能源
16	China Coal Xinji Energy Co., Ltd.	新集能源
17	China Molybdenum Co., Ltd.	洛阳钼业
18	China National Nuclear Power Co., Ltd.	中国核电
19	China Petroleum and Chemical Corporation	中国石化
20	China Shenhua Energy Company Limited	中国神华
21	China Yangtze Power Co., Ltd.	长江电力
22	Chongqing Fuling Electric Power Company Ltd.	涪陵电力
23	Chongqing Gas Group Corporation Ltd.	重庆燃气
24	Chongqing Three Gorges Water Conservancy and Electric Power Co., Ltd.	三峡水利
25	Dalian Thermal Power Co., Ltd.	大连热电
26	Datang Huayin Electric Power Co., Ltd.	华银电力
27	Datang International Power Generation Co., Ltd.	大唐发电
28	Datong Coal Industry Co., Ltd.	大同煤业
29	Foshan Gas Group Co., Ltd.	佛燃股份
30	Fujian Funeng Co., Ltd.	福能股份
31	Fujian Mindong Electric Power Co., Ltd.	闽东电力
32	Gansu Jingyuan Coal Industry and Electricity Power Co., Ltd.	靖远煤电
33	Gansu Ronghua Industry Group Co., Ltd.	荣华实业
34	GD Power Development Co., Ltd.	国电电力
35	Geo-Jade Petroleum Corporation	洲际油气
36	GEPIC Energy Development Co., Ltd.	甘肃电投
37	Guangdong Baolihua New Energy Stock Co., Ltd.	宝新能源
38	Guangdong Electric Power Development Co., Ltd.	粤电力A
39	Guangdong Electric Power Development Co., Ltd.	粤电力B
40	Guangdong Meiyang Jixiang Hydropower Co., Ltd.	梅雁吉祥
41	Guangdong Shaoneng Group Co., Ltd.	韶能股份
42	Guanghui Energy Co., Ltd.	广汇能源
43	Guangxi Guidong Electric Power Co., Ltd.	桂东电力

**Table 6** 150 Energy Companies in China under Study (Continued)

No.	Company Name in English	In Chinese Name
44	Guangxi Guiguan Electric Power Co., Ltd.	桂冠电力
45	Guangzheng Group Co., Ltd.	光正集团
46	Guangzhou Development Group Incorporated	广州发展
47	Guangzhou Devotion Thermal Technology Co., Ltd.	迪森股份
48	Guangzhou Hengyun Enterprises Holding Ltd.	穗恒运A
49	Guizhou Gas Group Corporation Ltd.	贵州燃气
50	Guizhou Panjiang Refined Coal Co., Ltd.	盘江股份
51	Guizhou Qianyuan Power Co., Ltd.	黔源电力
52	Guodian Changyuan Electric Power Co., Ltd.	长源电力
53	Hainan Mining Co., Ltd.	海南矿业
54	Henan Ancai Hi-tech Co., Ltd.	安彩高科
55	Henan Dayou Energy Co., Ltd.	大有能源
56	Henan Yuneng Holdings Co., Ltd.	豫能控股
57	Huadian Energy Co., Ltd.	华电能源
58	Huadian Energy Co., Ltd.	华电B股
59	Huadian Power International Corporation Limited	华电国际
60	Huaibei Mining Holdings Co.,Ltd.	淮北矿业
61	Huaneng Lancang River Hydropower Inc.	华能水电
62	Huaneng Power International, Inc.	华能国际
63	Hubei Energy Group Co., Ltd.	湖北能源
64	Hunan Chendian International Development Share-holding Co., Ltd.	郴电国际
65	Hunan Development Group Co., Ltd.	湖南发展
66	Hunan Gold Corporation Limited	湖南黄金
67	Huolinhe Opencut Coal Industry Corporation Limited of Inner Mongolia	露天煤业
68	Inner Mongolia Mengdian Huaneng Thermal Power Corporation Limited	内蒙华电
69	Inner Mongolia Pingzhuang Energy Resources Co., Ltd.	平庄能源
70	Inner Mongolia Xingye Mining Co., Ltd.	兴业矿业
71	Jiangsu Guoxin Corp. Ltd.	江苏国信
72	Jiangsu New Energy Development Co., Ltd.	江苏新能
73	Jiangxi Ganneng Co., Ltd.	赣能股份
74	Jilin Power Share Co., Ltd.	吉电股份
75	Jinduicheng Molybdenum Co., Ltd.	金钼股份
76	Jinhong Holdings Group Co., Ltd.	金鸿控股
77	Jionto Energy Investment Co., Ltd. Hebei	建投能源
78	Jizhong Energy Resources Co., Ltd.	冀中能源
79	Kaidi Ecological and Environmental Technology Co., Ltd.	*ST凯迪
80	Kelin Environmental Protection Equipment, Inc.	科林环保
81	Leshan Electric Power Co., Ltd.	乐山电力
82	Liaoning Hongyang Energy Resource Invest Co., Ltd.	红阳能源
83	Luenmei Quantum Co., Ltd.	联美控股
84	Nanjing Public Utilities Development Co., Ltd.	南京公用
85	Ning Xia Yin Xing Energy Co., Ltd.	银星能源
86	Ningbo Thermal Power Co., Ltd.	宁波热电
87	Ningxia Jiaze Renewables Corporation Limited	嘉泽新能

**Table 6** 150 Energy Companies in China under Study (Continued)

No.	Company Name in English	In Chinese Name
88	Petrochina Company Limited	中国石油
89	Pingdingshan Tianan Coal Mining Co., Ltd.	平煤股份
90	Qinghai Jinrui Mineral Development Co., Ltd.	金瑞矿业
91	Rising Nonferrous Metals Share Co., Ltd.	广晟有色
92	SDIC Power Holdings Co., Ltd.	国投电力
93	Shaanxi Coal Industry Company Limited	陕西煤业
94	Shaanxi Provincial Natural Gas Company Limited	陕天然气
95	Shandong Gold Mining Co., Ltd.	山东黄金
96	Shandong Jinling Mining Co., Ltd.	*ST金岭
97	Shandong Shengli Co., Ltd.	胜利股份
98	Shandong Xinneng Taishan Power Generation Co., Ltd.	*ST新能
99	Shanghai Datun Energy Resources Co., Ltd.	上海能源
100	Shanghai Dazhong Public Utilities (Group) Co., Ltd.	大众公用
101	Shanghai Electric Power Co., Ltd.	上海电力
102	Shanghai Hongda Mining Co., Ltd.	宏达矿业
103	Shanxi Guoxin Energy Corporation Limited	国新能源
104	Shanxi Guoxin Energy Corporation Limited	国新B股
105	Shanxi Lanhua Sci-tech Venture Co., Ltd.	兰花科创
106	Shanxi Lu'an Environmental Energy Development Co., Ltd.	潞安环能
107	Shanxi Xishan Coal and Electricity Power Co., Ltd.	西山煤电
108	Shanxi Zhangze Electric Power Co., Ltd.	漳泽电力
109	Shenergy Company Limited	申能股份
110	Shengda Mining Co., Ltd.	盛达矿业
111	Shenyang Huitian Thermal Power Co., Ltd.	惠天热电
112	Shenyang Jinshan Energy Co., Ltd.	金山股份
113	Shenzhen Energy Group Co., Ltd.	深圳能源
114	Shenzhen Gas Corporation Ltd.	深圳燃气
115	Shenzhen Nanshan Power Company Limited	深南电A
116	Shenzhen Nanshan Power Company Limited	深南电B
117	Sichuan Chuantou Energy Co., Ltd.	川投能源
118	Sichuan Datong Gas Development Co., Ltd.	大通燃气
119	Sichuan Guangan AAA Public Co., Ltd.	广安爱众
120	Sichuan Mingxing Electric Power Co., Ltd.	明星电力
121	Sichuan Minjiang Hydropower Co., Ltd.	岷江水电
122	Sichuan Shengda Forestry Industry Co., Ltd.	ST升达
123	Sichuan Xichang Electric Power Co., Ltd.	西昌电力
124	SPIC Dongfang New Energy Corporation	东方能源
125	Tianjin Binhai Energy and Development Co., Ltd.	滨海能源
126	Tibet Huayu Mining Co., Ltd.	华钰矿业
127	Tibet Summit Resources Co., Ltd.	西藏珠峰
128	Top Energy Company Ltd. Shanxi	通宝能源
129	Top Resource Conservation and Environment Corp.	天壕环境
130	Tunghsu Azure Renewable Energy Co., Ltd.	东旭蓝天
131	Western Mining Co., Ltd.	西部矿业

**Table 6** 150 Energy Companies in China under Study (Continued)

No.	Company Name in English	In Chinese Name
132	Western Region Gold Co., Ltd.	西部黄金
133	Wintime Energy Co., Ltd.	永泰能源
134	Xinjiang East Universe (Group) Gas Co., Ltd.	东方环宇
135	Xinjiang Haoyuan Natural Gas Co., Ltd.	新疆浩源
136	Xinjiang Tianfu Energy Co., Ltd.	天富能源
137	Xinjiang Torch Gas Co., Ltd.	新疆火炬
138	Xinjiang Xintai Natural Gas Co., Ltd.	新天然气
139	Yang Quan Coal Industry (Group) Co., Ltd.	阳泉煤业
140	Yantai Yuancheng Gold Co., Ltd.	园城黄金
141	Yanzhou Coal Mining Company Limited	兖州煤业
142	Yunnan Chihong Zinc and Germanium Co., Ltd.	驰宏锌锗
143	Yunnan Wenshan Electric Power Co., Ltd.	文山电力
144	Zhejiang Fuchunjiang Environmental Thermolectric Co., Ltd.	富春环保
145	Zhejiang Zheneng Electric Power Co., Ltd.	浙能电力
146	Zhengzhou Coal Industry and Electric Power Co., Ltd.	郑州煤电
147	Zhongjin Gold Corp., Ltd.	中金黄金
148	Zhongmin Energy Co., Ltd.	中闽能源
149	Zhongrun Resources Investment Corporation	中润资源
150	Zijin Mining Group Co., Ltd.	紫金矿业

**Abbreviations**

ACCA: Association of Chartered Certified Accountants; CERT: Certification; CF: Cash-flow; CFP: Corporate Financial Performance; CSR: Corporate Social Responsibility; EA: Environmental Accounting; ED: Environmental Disclosure; EDI: Environmental Disclosure Index; EIA: Environmental Impact Assessment; EPL: Environmental Protection Law; ER: Environmental Reporting; ESG: Environmental, Social, and Governance; LEV: Leverage; MNC: Multinational Characteristics; MOF: Ministry of Finance; OP: Operating Profits; PRC: People's Republic of China; PM: Profit Margin; ROA: Return on Assets; ROE: Return on Equity; *SEPA*: State Environmental Protection Administration; *SSE*: Shanghai Stock Exchange

**Acknowledgements**

Not applicable.

**Authors' contributions**

CLC carried out the conceptual framework, the literature review, and drafted the manuscript. JZ, ML, and SW helped with data collection, data analysis, and discussion. SX and XC improved the theoretical discussion of the paper. All authors read and approved the final manuscript.

**Funding**

There is no funding applicable to this project.

**Availability of data and materials**

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

**Competing interests**

On behalf of all authors, the corresponding author states that there is no conflict of interest.

Received: 18 October 2019 Accepted: 10 March 2020

Published online: 11 May 2020

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