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How Environmental Information Disclosure Affects Quality of Reporting in China

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Abstract

We live in a time where pollution, smog and environmental protection are paid attention. In the context of increasingly-emphasized integrated reporting, this thesis conduct an empirical research to test whether environmental information disclosure could improve the quality of reporting for listed companies in high-polluting industries in China. Laws and regulation are promulgated to promote environmental protection and to specify the guidance for environmental information disclosure since 2007. In the meantime, in recent years, listed companies in high-polluting industry have paid more attention to environmental information: besides annual reports, CSR (corporate social report) and ER (environmental report) have been increasingly popular role players for disclosure among companies. The channel to disclose has been more diverse and more formal, which demonstrates increasing corporations are not only *profit seekers*, but also becoming social responsibility takers. Does the environmental information disclosed truly meet the information demand of investors for decision-making? Does more environmental information disclosure significantly enhance the quality of reporting? This thesis is intended to give implications of these questions.

Firstly, after research background and research significance this thesis reviews the literature both abroad and domestically. Afterwards, research method, structure and relevant concepts are defined in chapter 3. Chapter 3 mainly focuses on the theoretical analysis of empirical research based on information asymmetry theory and stakeholder theory. Empirical research is introduced in chapter 4. This thesis divides environmental information into two types: financial environmental information and non-financial environmental information. Three environmental information disclosure indexes are established as independent variables based on content analysis method: EDI, FEDI and NFEDI, representing overall environmental information disclosure index, financial environmental information disclosure and non-financial environmental information disclosure. This thesis uses modified jones model to establish the dependent proxy of reporting quality and 4 control variables are employed to execute regression. Three hypothesis are raised: All else being equal, more sufficient environmental information disclosure leads to enhancing reporting quality. All else being equal, financial disclosure is not significantly related to reporting quality which may indicates the incompleteness of the model design. All else being equal, non-financial environmental information disclosure is positively related to reporting quality and has a more significance.

Then, such statistical methods as descriptive analysis, correlation analysis and multiple linear regression analysis are applied to test whether environmental information disclosure could improve the quality of reporting for listed companies in high-polluting industries in China. This thesis collects all the sample data from Shanghai Stock Exchange in 2016. The empirical results show that the although over half of the SSE – listed (listed in Shanghai Stock Exchange) companies in high-polluting industry post environmental information through annual reports in 2016, quality and completeness is inferior; non-financial information is covered in a more comprehensive way; environmental information disclosure is positively related to reporting quality; financial environmental information disclosure is positively related to reporting quality, but not in a significant way; non-financial environmental information disclosure is positively related to reporting quality. The empirical results are consistent with the hypothesis.

This thesis also gives some implications from diverse perspectives but bears limitations. Firstly, in dealing with basic data, this thesis employs subjective content analysis method. Secondly, sample of this thesis source from one-year data, instead of panel data covering several years. Thirdly, this thesis only chooses 4 control variables: ROE, leverage, the share percentage that the top1 shareholder holds, and the ratio of independent member in board of directors which may not be complete. Further research with more rigid derivation and data selection is needed to remedy flaws of this thesis.

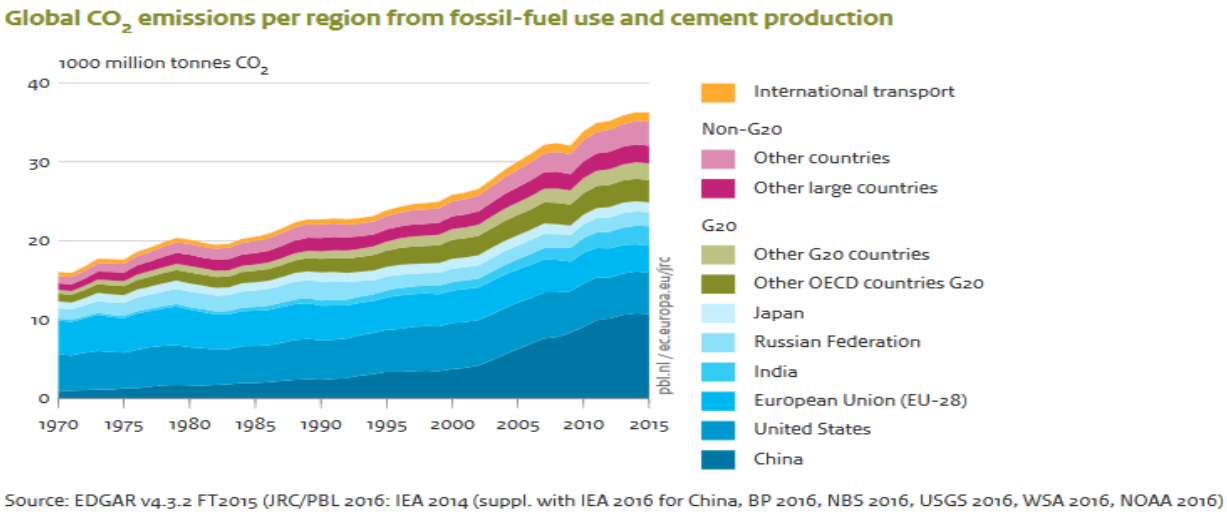
BIBLIOGRAPHY

1. Introduction

1.1 Research Background

International insights of environment have been rising in recent years. Besides Copenhagen Accord announced in 2009, but also Carbon Disclosure Project (CDP) in 2014 led to nearly 2000 business reporting climate change data. Reports have shown that the global CO_2 emissions from fossil-fuel use and cement production doubled from 1970 to 2015 (see graph 1). According to *Trends In Global CO_2 Emissions 2016 Report*, the year 2015 has by far been the warmest year on record and Coal-fired power plants cause one-third of global CO_2 emissions. Among the top 5 emitting countries and European Union, China has ranked the top in CO_2 emissions from fossil-fuel use and cement production. While in China, Financial Times reported that China's rapidly worsening pollution is being driven by a surge in investment in energy-intensive heavy industry caused by cut-throat competition among cities and provinces in 2007[1]. Since 2008, smog has attacked China Mainland every winter and early spring. The 'red alert' air pollution contributes to closing schools, factories and construction sites and ordering half of all private cars off the road. People are more and more concerned about environment and tend to attribute the dense, putty-colored smog to countless cars, coal-fired power stations and steel plants. Besides smog, China has also seen severe water quantity shortages and severe water quality pollution. In some places, water has been polluted by poisonous chemical, trashes, and domestic sewage. Other problems include deforestation, coastal reclamation, land pollution, energy deficiency and etc.

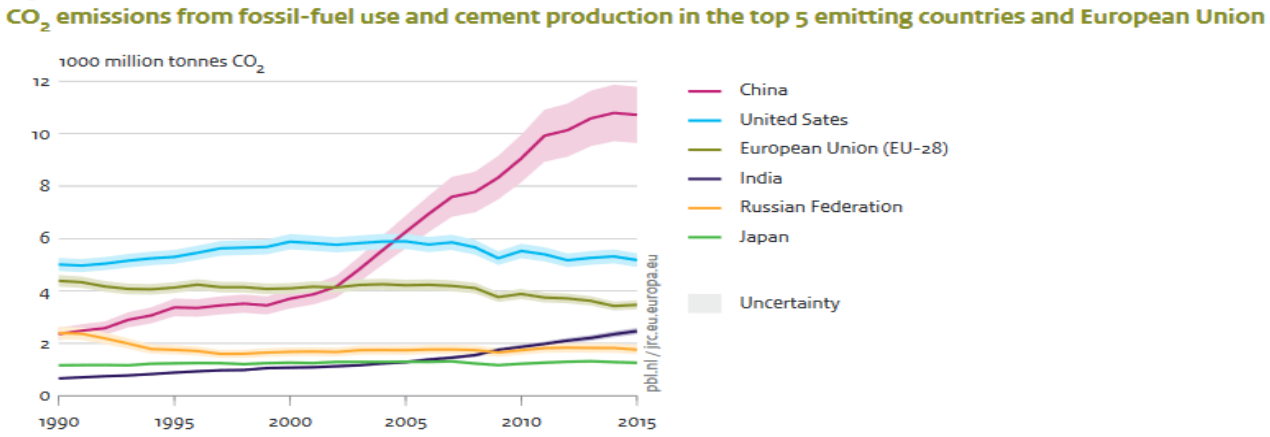
Graph 1



Source: EDGAR v4.3.2 FT2015 (JRC/PBL 2016: IEA 2014 (suppl. with IEA 2016 for China, BP 2016, NBS 2016, USGS 2016, WSA 2016, NOAA 2016)

[1] http://www.ft.com/cms/s/0/8c18917a-f937-11db-9b6b-000b5df10621.html?ft_site=falcon&desktop=true

Graph 2



Source: EDGAR v4.3.2 FT2015 (JRC/PBL 2016: IEA 2014 (suppl. with IEA 2016 for China, BP 2016, NBS 2016, USGS 2016, WSA 2016, NOAA 2016)

Time witnesses that market interest in environmental growing, including data produced by Carbon Disclosure Project (CDP).Environmental information, in accounting theory, is a type of nonfinancial information which is plays an important role in today's accounting reseaches. In the worldwide, the International Integrated Reporting Council (IIRC) published "Consultation Draft of the International IR Framework: Integrated Reporting". Since 2002, such companies as AkzoNobel NV (Netherlands) and eni SpA (Italy) , around the world has been piloting the IR framework and disclosed information of the value-creation process through input of 6 capitals—*financial, manufactured, intellectual, human, social and relationship , and natural.* Yet there has been no practice of IR reporting in China Mainland, more and more enterprises have been releasing Corporate Social Responsibility Report (CSR) and Environmental Report (ER). Instances have elaborated that Chinese companies are compensating for the flaws of traditional financial reports by disclosing non-financial information.

In recent years, practices have witnessed the strong will of Chinese government, regulatory institution and departments to enforce companies to disclose environmental information. In 2007, the Ministry of Environmental Protection of People's Republic of China (MEP) formulated "Measures for the Disclosure of Environmental Information (for Trial Implementation)" which came in to force as of May 1, 2008. These measures are meant to promoting Clean Production, the Decision of State Council on Fulfilling the Scientific Development View and Strengthening Environmental Protection and other relevant legal provisions. On May 14, 2008, Shanghai Stock Exchange (SSE) published "Guidelines of Shanghai Stock Exchange for the Environmental Information Disclosure of Listed Companies" which specified environmental information

issued by listed companies. In September 2010, MEP released “Guidance for Environmental Information Disclosure of Listed Companies” which enforced listed companies in high-polluting industries to disclose environmental information precisely, on time and completely by publishing Annual Environmental Report.

Nevertheless, questions concerning the environmental information have sprung up. Have the guidance and regulations come into effect? Does the information disclosed truly meet the satisfaction of investors and stakeholders? Is it reasonable to integrate environmental information into future IR reporting practice in China? Although listed companies in heavy industry are enforced to disclose environment information, does the disclosure enhance the quality of reporting, thus ensuring better information understanding of investors? These issues provide guide for this thesis and need to be tested by empirical research.

1.2 research purpose and significance

This thesis is on the purpose of testing whether environmental information disclosure could improve the quality of reporting for listed companies in high-polluting industries. The result of the research would, on the one hand, clarify whether environmental information disclosure would meet the information needs of investors and stakeholders or not, thus assisting investors to discriminating risk in stock investment. On the other hand, this research constructs a theoretical framework on how environmental information disclosure influences the quality of reporting. Therefore, the result may inspire the practice of IR implementation in China Mainland. This research also provides data for regulatory institutions who may take actions on supervision based on the quality of environmental information. It is beneficial to listed companies to integrate themselves into IR framework.

1.3 Research structure

This thesis contains 5 chapters and is organized as follows. Chapter 1 is introduction which aims to roughly describe the current situation of global environmental issues and raise the questions to be examined in the thesis. Research significance is also mentioned. Chapter 2 reviews the past literature and aims at examining the concept of environmental information disclosure both in the foreign and home context. Moreover, Chapter 3 will introduce research method, structure and framework. Chapter 3 contains the description of the research objectives and design of the analytical process. This chapter is intended to introduce the theoretical prerequisite of empirical research. In the following chapter -- Chapter 4, the data is also collected and analyzed in order to uncover the motivation drivers for embracing environmental

information disclosure and the measurement of reporting quality of Chinese listed companies. Furthermore, the empirical analysis will tackle the key issue of this thesis: the interaction between environmental information disclosure and the reporting quality and how the former influences the latter. Based on the chapters above, Chapter 5 will introduce the limitation and implication for further research which may inspire latter scholars.

2. Literature Review

2.1 Environmental information: a definition

Environmental information has a broad, plausible and inexplicit definition. Some researchers base environmental information disclosure on a legal forum or accounting standards. Some are focused on the philosophy that any information disclosure that is related to environment, such as toxic releases, food safety, environmental protection and etc. Li (2005) supposes traditional legal forums for CSE disclosure are in areas such as labor, occupational safety, product safety, environmental protection, and consumer protection law. Ashcroft (1999) argues that according to Statement of Financial Accounting Standards (SFAS), a comprehensive analysis of the information provided in firms' annual reports related to environmental costs, policies, strategies, pollution effects of regulation and current and future actions to respond to environmental concerns is needed to understand firms' environmental disclosure decisions The University of Edingurgh (2015) gives environmental information a wider scope: environmental information is recorded information, in any form, in any of the following areas[2]:

(1) the state of elements of the environment and their interaction (air, water, soil, land and landscape, natural sites, flora and fauna)
(2) discharges, emissions, noise, radiation, waste
(3) measures and activities affecting the environment (e.g. policies, legislation, plans, activities)
(4) reports on implementation of environmental legislation
(5) cost benefit and economic analyses
(6) effects of the environment on conditions of human life (including food, buildings)

In China, most researches of environmental information are based on the legal or regulation context. According to *Measures for the Disclosure of Environmental Information,* companies are encouraged to release the following environmental information voluntarily:

(1) the vision of environmental protection, the goal of annual environmental protection and its effects
(2) the annual consumption of resources
(3) the progress of environmental investment and environmental research and development

[2] http://www.ed.ac.uk/records-management/freedom-of-information/about/environmental-information/environmental-info

(4) the type, amount, concentration and flow of pollution

(5) the progress of environmental facilities' construction and operation

(6) the progress of disposing, cycling and comprehensive utilizing the waste or discharges

(7) the agreement on environment improvement signed with environmental regulatory institutions

(8) the progress of taking social responsibility

(9) other information that companies are willing to disclose

While in 2010, based on the rules in *Guidance for Environmental Information Disclosure of Listed Companies*, listed companies are encouraged to disclose the following environmental information:

(1) the environmental concerns of the listed entity

(2) the structure of environmental management structure and goals in environment protection

(3) the progress in environment management

(4) the progress in environmental performance

(5) other environmental information, including promoting environmental education, progress in planting, protection of bio-diversity and etc.

2.2 International literature

2.1.1 Legislation and regulation of environmental information disclosure

Environmental information disclosure is underpinned by legislation and regulation system. Since 1980, the US's environmental disclosure regime has almost inserted environmental information disclosure requirement in any environmental legislation, such as the National Environmental Policy Act, the Resources Conservation and Recovery Act, Comprehensive Environmental Response, Compensation and Liability Act, Clean Water Act and so on. [3] Meanwhile, beginning from 1971, the SEC (Securities and Exchange Commission) imposed a duty on companies to disclose actual or potential environmental liabilities under certain circumstances. After 1990 when Pollution Prevention Act was published, reporting requirements were expanded beginning in 1991 to include source reduction and recycling information.

Efforts also have been taken by European countries. Netherlands required enterprises to disclose environmental information periodically with "Carrot and Stick" policy. In 1995, Demark integrated mandatory environmental reporting into "Environmental Protection Act" and the first law on green accounts

[3] https://gelr.org/2016/05/18/environmental-disclosure-in-china/

was passed. Other countries such as Sweden and Norway also issued legislation and requirements on disclosing environmental information. In 1997, the EU committed itself to draw up a 'national' strategy for sustainable development by 2002. The Commission published a Communication on a European Union Strategy for Sustainable Development in 2001 which was discussed at the Göteborg European Council. [4]Such conventions as Aarhus Convention and its guidance also have been issued.

2.2.2 Research on the relationship between environmental information disclosure and the quality of reporting

The major of the early research assumed that investment of Environmental, Social and Governance (ESG) by nature probably reduced financial return, motivating companies to window-dress their earnings performance and deteriorate quality of reporting. Friedman had provided a widely accepted academic basis for the argument that the costs of behaving in an ethically responsible manner would outweigh the benefits. While in 1998, two journalists Robert Levering and Milton Moskowitz compiled a list of the best practicing companies in the United States with regard to corporate social responsibility and how their financial performance fared as a result (Ballon et al, 2003). Scholars argue that companies which bear CSR (corporate social responsibility) and disclose ESG endeavor draw most of the public attention and benefit from it. Therefore, there has been no incentive to cheat on the reporting as people are more and more concerned about environmental protection. Increasing public awareness of environmental issues prompted firms to voluntarily increase environmental performance information in their annual reports (Carol Ann Leary, 2003). A CICA (Canadian Institute of Chartered Accountants) research study in 1991 said that the environment is everyone's business and environmental responsibility information is essential in the annual report because it enables diverse user groups to better understand the nature of operations of companies in various industries, the potential impact on cash flows and the ability to effectively manage environmental risk. Transparency around ESG performance and policies is used as a proxy for management quality and the potential for the management to grow profitably the business in the future (Eccles et al, 2011). Such information as GHG (Greenhouse Gas) emissions reduction represents a risk exposure to a company, indicating better management quality which includes reporting quality which is measured by earning management.

However, doubts have been arising. In Canada, general descriptions and definition in a statement of basic accounting theory which provides ex ante information do not advise specifically what the role of accounting should with regard to environmental issues (Nola Buhr, 1994). In norm, increasing the quantity

[4] https://en.wikipedia.org/wiki/Environmental_policy_of_the_European_Union

of disclosed information reduces information asymmetry between investors and companies, improving the quality of reporting. Does quantity truly transform to quality? It is argued that corporations adopt CSR to cover up the impact of corporate misdemeanor and managers exhibit their personal values through the exercise of managerial discretion (Hemingway and Maclagan, 2004). Some researches show obscure results. In a research to test the relation between CSR and earnings management, no consistent conclusion was founded in a sample of trans-scale enterprises (Tre'bucq S and Russ R. , 2005). And different measure of quality of reporting exhibits a different result (Chih H et al, 2008).

2.3 Domestic literature

2.3.1 Legislation and regulation of environmental information disclosure in China

Chinese environmental agencies and departments have been devoted to the foundation and perfection of environmental information disclosure system. The State Environmental Protection Administration (SEPA), former MEP, mandated companies applying for IPO or listed companies applying for seasoned offering shall execute verification for environmental protection in 2003. After 4 years, according to a new announcement of SEPA, all the Chinese listed companies in high-polluting industries shall conduct environmental protection verification under a stricter standard by SEPA, instead of provincial environmental agencies. Since 2008, when "Measures for the Disclosure of Environmental Information (for Trial Implementation)" was published, Chinese companies have been encouraged to release relevant environmental information voluntarily. On May 14, 2008, SSE gave specification for listed companies to disclose CSR voluntarily while release annual report compulsorily in an announcement to encourage listed companies to take social responsibility. On September 14, 2010, MEP released "Guidance for Environmental Information Disclosure of Listed Companies". In 2014, according to "Notice of the China Securities Regulatory Commission on Promulgating the Standards Concerning the Contents and Formats of Information Disclosure by Companies Offering Securities to the Public No.2 Contents and Formats of Annual Reports" (amended version), enterprises are encouraged to disclose all the measures they have taken to preventing pollution, protecting ecosystem and etc.

2.3.2 Research on the relationship between environmental information disclosure and the quality of reporting

Few researches have been conducted on the topic of relation between environmental information disclosure and quality of reporting. Taking CSR as a cut-in point, Chen and Ma (2005) found that

information users paid little attention to CSR information. Market showed little interest in CSR in early times in China. Song and Gong (2006) proved by questionnaire research that there was barely value of decision and the value of public relations on social responsibility information. The reason why CSR was not recognized by scholars and capital market is that listed companies tend to hold a negative attitude toward CSR information disclosure (Liu and Kong ,2006) and the arbitrariness and inconsistence of CSR disclosure (Shen, 2006).

However, there was a switch afterwards. Gao et al (2011) studied that CSR disclosure is positively related to information transparency, but has nothing to do with relevance and reliability. It was tested that the better firms perform on CSR, the more they gain on the stock market and the higher evaluation of market on their earnings, namely the higher informativeness of accounting earnings (Zhu, 2011). But there was no clear definition of Empirical research has shown that companies with social responsibility information disclosure or better CSR performance have lower earnings management and less financial restatement; corporate social responsibility information disclosure assists investors to discriminate the quality of financial reports (Wang et al, 2014).

2.4 Summary

Prior research primarily focused on the following areas:

Back to 1990s, the majority of environmental information disclosure had low quality. Environmental information disclosure is inadequate for socially conscious investors. Companies who took more effort to environment investment or social responsibility tended to benefit less in financial performance and thus were more motivated to fraud on reporting, both abroad and domestically. It is plausible to contribute the relevance between environmental information disclosure and reporting quality to managers' personal intention to project a good image to the public. Afterward, in the 20th century, scholars began to verify the positive relation between CSR disclosure and reporting quality. Thanks to the rising public awareness to environmental protection, environmental information disclosure reduced the information asymmetry and the motivation of earnings management. A good public image counted. However, researches were inconsistent:

(1) No identified standard existed to evaluate environmental information disclosure. A part of scholars employed 'content analysis method' to calculate environmental information disclosure index. Other scholars measured environmental information disclosure by CO_2 or SO_2 emission.

(2) Researches contained different scope or scale. Although most of researches focused on the heavy industry, some researches only tested samples in Oil, Gas, Chemistry and Electricity sector, while others projected in a bigger scope.

(3) Researches were conducted in a different period. Time span made a difference on the topic. Time witnessed the transformation of governmental supervision, disclosure legislation, regulation and public awareness, thus leading to a diversified conclusion at different times.

Based on the analysis above, this thesis will conduct empirical research on the relevance between environmental information disclosure and the quality of reporting using recent data, in order to supplement existing research and enhance the usefulness of accounting information in the decision making of investors.

3. Research method and structure

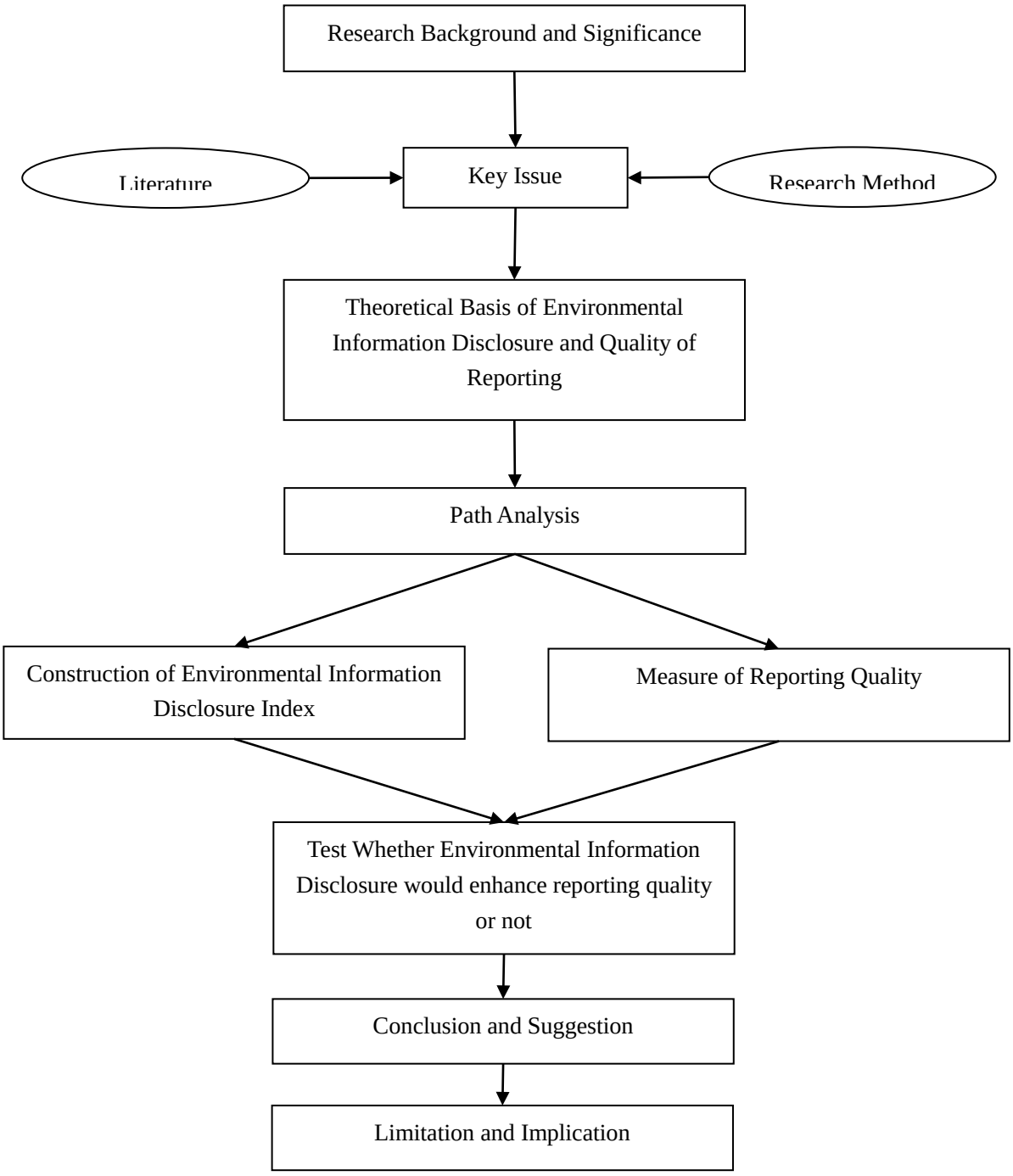
3.1 Research method

Firstly, this thesis reviews the former researches on the topic of environmental information disclosure and the quality of reporting. The research structure and key issues will be underpinned by systematic analysis of papers of scholars both from abroad and China. Secondly, this thesis will employ content analysis method to construct environmental information disclosure index of Chinese listed companies. Furthermore, the index will be classifies into financial index and non-financial index depending on whether the data is monetary or not. Thirdly, this thesis will select and screen listed entities of Shanghai Stock Exchange in high-polluting sectors as sample. With such empirical methods as descriptive analysis, correlation analysis and multiple linear regression analysis, this thesis will clarify whether environmental information disclosure will improve the reporting quality of Chinese listed companies.

3.2 Research framework

Research framework are shown in graph 3 as follows.

Graph 3



3.3 Relevant concept: definitions

To testify whether environmental information disclosure helps improve the quality of reporting., the thesis will firstly define the concepts of high-polluting industry, environmental information disclosure and

its measurement. Afterwards, the thesis will specify the concept of reporting quality and its measurement. On the basis of specifying concepts, the interaction path will be raised.

3.3.1 High-polluting industry

Which companies shall be included in the high-polluting sector? The answer influences sample selection and the scope of the research. It is vital to specify the definition of high-polluting industry. Since 2001, MEP (the Ministry of Environmental Protection of People's Republic of China) and SEPA (the State Environmental Protection Administration) have insisted in conducting verification and supervision of listed entities in high-polluting industry, promoted environmental law, regulations and legitimacy, in order to direct the cash flow of financing, reduce the investment risk related to environmental issue. Shown as follows, MEP and other regulatory department have already announced several documents to define high-polluting sector.

Table 1 Classification of High-polluting industry

Department	**Name of Documentation**	**Time**	**Definition of High-polluting sectors**	**Number of sectors**
SEPA	Notice on Environmental Protection Verification of Listed Companies and Refinancing Listed Companies	June, 2003	Metallurgy, chemical, petrochemical, coal, thermal power, Construction materials, paper making, brewing, pharmaceutical, fermentation, textile, leather and mining	13
MEP	List of Classified Sectors of Listed Companies for Environmental Verification	June, 2008	Thermal power, steel, cement, electrolytic aluminum, coal, metallurgy, construction materials, mining, chemical, petrochemical, pharmaceutical, light industry, textile, leather	14
MEP	Guidance for Environmental Information Disclosure of Listed Companies	September, 2010	Thermal power, steel, cement, electrolytic aluminum, coal, Charcoal, chemical, petrochemical, construction	16

			materials, paper making, brewing, pharmaceutical, fermentation, leather and mining	

From table 1, it is obvious that the number of sectors involved in the list has been increasing. The list involves steel and cement and electrolytic aluminum on the basis of the Notice. And the Guidance broadens light industry as paper making, brewing and fermentation. This phenomenon illustrated the government has been taking more efforts to ameliorate environmental information disclosure.

Among the classification mentioned above, the List of Classified Sectors of Listed Companies for Environmental Verification is the most commonly used standard in empirical researches of scholars. The List specified the definition of all the high-polluting sectors in a comprehensive way and includes thermal power, steel, cement, electrolytic aluminum, coal, metallurgy, construction materials, mining, chemical, petrochemical, pharmaceutical, light industry, textile and leather industry. Table 2 shows details as follows:

Table 2 Specification of High-polluting industry

Number	**Sector**	**Specification**
1	Thermal power	Thermal power (including thermal power, gangue comprehensive utilization of power generation, garbage power generation)
2	Steel	Iron making (with melting and reduction), pellets and sintered, steelmaking, ferroalloy smelting, steel calendaring and coking
3	Cement	Cement manufacturing (including clinker manufacturing)
4	Electrolytic Aluminum	Including the full scale, the whole process of production
5	Coal	Coal mining and washing, coal underground gasification, coal chemical (coal oil, coal gas, coal methanol or dimethyl ether, etc.)
6	Metallurgy	Non-ferrous metal smelting (commonly used non-ferrous metals, precious metals, rare earth metals, other rare metal smelting), manufacture of non-ferrous metal alloys, scrap metal smelting, non - ferrous metal rolling processing, metal surface treatment and heat treatment processing (electroplating; use of organic coating, hot galvanized (with passivation) process)

7	Construction materials	Glass and glass products manufacturing, glass fiber and glass fiber reinforced plastic products manufacturing, manufacture of ceramic products, asbestos products manufacturing; refractory ceramic products and other refractory materials manufacturing, graphite and carbon products manufacturing
8	Mining	Oil exploitation, natural gas extraction, non-metallic mineral mining (chemical mining; limestone, gypsum mining; building decoration stone mining; refractory rock mining; clay and other soil sand and gravel mining; salt; asbestos, mica mining; graphite, talc selection; Jade mining), ferrous metal mining, non-ferrous metal mining (commonly used non-ferrous metals, precious metals, rare earth metals, other rare metal mining)
9	Chemical	Manufacture of basic chemical raw materials (manufacture of inorganic acids, manufacture of inorganic bases, manufacture of inorganic salts, manufacture of organic chemical raw materials, manufacture of other basic chemical materials), fertilizer production (nitrogen fertilizer manufacturing, phosphate fertilizer manufacturing, potash production, compound fertilizer manufacturing, organic fertilizer and microbial fertilizer manufacturing, other fertilizer manufacturing), coatings, dyes, pigments, inks and other similar products, production of synthetic materials (primary type of plastic and synthetic resin, synthetic rubber, synthetic fiber single (polymer) body manufacturing, other synthetic materials manufacturing), manufacture of special chemicals (manufacture of chemical reagents and additives, manufacture of special chemical products, manufacture of chemical products for chemical products, manufacture of explosives and pyrotechnics, manufacture of information chemicals, manufacture of pharmaceuticals for environmental pollution, manufacture of chemical materials, manufacture of other special chemical products manufacture), chemical pesticide manufacturing, biochemical pesticides and microbial pesticide manufacturing (including intermediates), manufacture of daily chemical products (manufacture of soap and synthetic detergents, manufacture of cosmetics, manufacture of oral cleaning products, manufacture of fragrance and fragrance, manufacture of other daily chemical products), rubber processing, tire manufacturing, recycled rubber manufacturing
10	Petrochemical	Crude oil processing, natural gas processing, production of petroleum products (including ethylene and its downstream products), crude oil is extracted from oil shale, biological oil
11	Pharmaceutical	Chemical manufacture (including intermediates), manufacture of chemical preparations,

		biological, biochemical products manufacturing, Chinese medicine manufacturing
12	Light Industry	Brewing: Alcohol and beverage manufacturing (alcohol manufacturing, liquor manufacturing, beer manufacturing, rice wine manufacturing, wine manufacturing, other wine manufacturing, manufacture of carbonated beverages, manufacture of pots and bottled beverages, manufacture of fruit and vegetable juices and fruit and vegetable beverages, manufacture of milk beverages and vegetable protein beverages, manufacture of solid beverages, manufacture of tea drinks and other soft drinks; Paper-making: Pulp manufacturing (including pulp and paper construction), Paper (including waste paper and paper) Fermentation: Seasoning (MSG, citric acid, amino acid, etc.), fermentation process of grain, feed processing Sugar refining Vegetable oil processing
13	Textile	Chemical fiber manufacturing, cotton, chemical fiber textile and printing and dyeing finishing, wool and dyeing and finishing, silk textile and finishing, manufacture of chemical pulp, cotton pulp manufacturing
14	Leather	Leather tanning processing, fur tanning and processing products

3.3.2 Environmental information disclosure

What is environmental information disclosure?

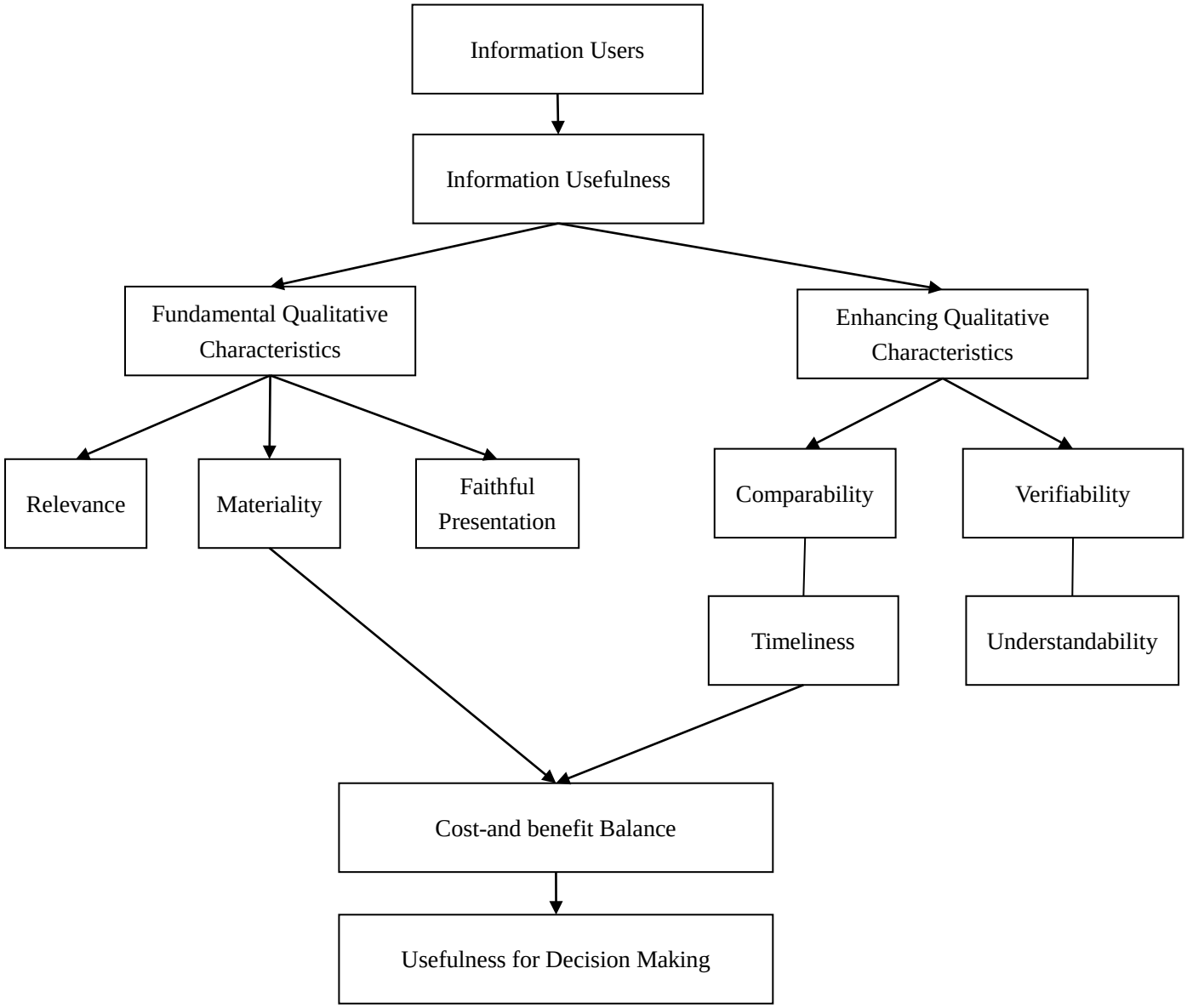
From the way of information disclosure, disclosure can be classified into voluntary disclosure and compulsory disclosure. By now, according to regulation, material adverse events are required to release in two day after the occurrence of events, along with progress of events and potential effects to the company and stakeholders. At the same time, SSE (Shanghai Stock Exchange) encourages listed entities in high-polluting industry to disclose the vision of environmental protection and other related information. MEP requires listed companies to release interim announcements in one day after the occurrence of environmental emergency.

From the content, environmental information can be divided into monetary information and non-monetary information. Monetary information refers to information that can be measured in money, such as environmental investment, green fees, subsidy for environmental protection and other information that can be quantified. Monetary environmental information is closely related to operating performance to reflect the financial impact of environmental behavior and disclosed in the footnotes of financial statements. On top of this, this thesis refers monetary environmental information as financial environmental information. Non-monetary information refers to qualified information that reflects corporate social responsibility. Such information includes environmental protection notion, goals of environmental protection and obedience of pollutant discharge standards and etc. Non-monetary information is not directly related to operating performance and is intended to reflect corporate governance of environment and legitimacy of environmental laws and regulations. Based on this, this thesis defines non-monetary environmental information as non-financial environmental information.

3.3.3 The quality of reporting

Accounting information has long been paid attention by entrepreneurs and scholars for the reason that it functions as the reflection of operating performance. However, it takes pervasive cost to generate information. Weighing cost and benefit of information disclosure, enterprises may release diversified financial reports with different quality. Therefore, the International Accounting Standard Board (IASB) released *Conceptual Framework for Financial Reporting*, under which relevance, materiality and faithful representation are fundamental qualitative characteristics and comparability, verifiability, timeliness and understandability are enhancing qualitative characteristics for measuring the quality of reporting. The structure of accounting information quality raised by IASB is shown as follows:

Graph 4



What is the measurement of reporting quality? Ge and Liu(2003) suggest to measure reporting quality by the essential need of investors due to non-exchangeability of information. Accounting information cannot flow as common goods in market, and the cost of accounting information is not directly related to revenue. Therefore, the best measurement for reporting quality is usefulness for decision making. This analysis is consistent with principles raised by IASB. Usefulness for decision- making, seems to be more than abstract. Fortunately, scholars have been exploring the way to quantify reporting quality. The number of empirical research on the quality of accounting information has been increasing. The premise of empirical research on

accounting information is to quantify reporting quality with proxy variables. Proxy variables can be divided into the following 2 types:

(1) On the basis of earning sustainability

On the basis of earning sustainability, theories suggest reporting quality can be reflected by degree of earnings' management. From different perspectives, models can be classified into the following 3 categories:

A. Jones model and modified Jones model

In general, accruals are acquired through normal access and exceptional access. The Jones model argues that the accruals are subject to changes of underlying variables of the firm, such as operating profit, changes in intangible assets and etc. The change in accrued items that cannot be explained by the change in the underlying variable is possibly to be manipulated—the possibility of earnings management. Usually, the proxy for earnings quality can be categorized into discretionary accruals and nondiscretionary accruals. By doing tricks on a bunch of accounts, instead of one account, managers could commit manipulations on earnings, which may deteriorate the quality of reporting. And the accruals that can be affected by managers for the purpose of conceal earnings' information refers to discretionary accruals. In reality, it is difficult to identify discretionary accruals. Using nondiscretionary accruals is the common case. Regression model is typically involved in estimating the nondiscretionary accruals. According to Jones model, nondiscretionary profit accruals can be calculated as follows:

$$NDA_t = \alpha_1\left(\frac{1}{A_t} - 1\right) + \alpha_2\left(\frac{\Delta REV_t}{A_{t-1}}\right) + \alpha_3\left(\frac{PPE_t}{A_{t-1}}\right)$$

$$Accrual_t = \alpha_1\left(\frac{1}{A_t} - 1\right) + \alpha_2\left(\frac{\Delta REV_t}{A_{t-1}}\right) + \alpha_3\left(\frac{PPE_t}{A_{t-1}}\right) + \varepsilon = NDA_t + +\varepsilon$$

The prerequisite of Jones model is that revenue is not able to manipulate, which may not be consistent with reality. Therefore, Dechowetal (1995) revised Jones model into modified Jones model. It may or may not be the best model but it is simple and one of the most commonly used model. The modified Jones model is represented as follows:

$$NDA_t = \alpha_1\left(\frac{1}{A_t} - 1\right) + \alpha_2\left(\frac{\Delta REV_t - \Delta REC_t}{A_t}\right) + \alpha_3\left(\frac{PPE_t}{A_t}\right)$$

$$Accrual_t = \alpha_1\left(\frac{1}{A_t} - 1\right) + \alpha_2\left(\frac{\Delta REV_t - \Delta REC_t}{A_t}\right) + \alpha_3\left(\frac{PPE_t}{A_{t-1}}\right) + \varepsilon = NDA_t + \varepsilon$$

Where:

$Accrual_t$ refers to total accruals, including discretionary accruals and non-discretionary accruals

NDA_t represents nondiscretionary accruals scaled by total average assets in year t.

ΔREV_t refers to change in sales from year t-1 to year t.

ΔREC_t refers to change in accounts receivable from year t-1 to year t.

PPE_t refers to Gross PP&E at the end of year t.

A_t refers to total assets at the end of year t.

ε represents accruals that cannot be transferred into cash flow, that is to say, discretionary accruals. The greater the ε, the greater degree of the earning management.

B. DD model

DD model, referring to Dechow and Dichev model (2002) suggest a new measure of one aspect of the quality of working capital accruals and earnings. One role of accruals is to shift adjust the recognition of cash flows over time so that the adjusted numbers (earnings) better measure firm performance. They argue that the quality of accruals and earnings is decreasing in the magnitude of estimation error. The practical measures of working capital accrual quality are derived as follows:

$$\Delta WC_t = \beta_0 + \beta_1 CFO_{t-1} + \beta_2 CFO_t + \beta_3 CFO_{t+1}$$

$$Accrual_t = \beta_0 + \beta_1 CFO_{t-1} + \beta_2 CFO_t + \beta_3 CFO_{t+1} + \varepsilon = \Delta WC_t + \varepsilon$$

Where:

$Accrual_t$ refers to total accruals, including discretionary accruals and non-discretionary accruals

ΔWC_t represents the change of working capitals from year t-1 to year t scaled by total average assets in the year t.

CFO_{t-1} represents operating cash flow in the year t-1 scaled by total average assets in the year t-1.

CFO_t represents operating cash flow in the year t-1 scaled by total average assets in the year t.

CFO_{t+1} represents operating cash flow in the year t-1 scaled by total average assets in the year t+1.

ε represents accruals that cannot be transferred into cash flow, that is to say, discretionary accruals. The greater the ε, the greater degree of the earning management.

C. Earnings smoothness

Goel and Thankor (2006) argues that earnings smoothing is a special case of earnings management involving intertemporal smoothing of reported earnings relative to economic earnings; it attempts to make earnings look less variable over time. The earnings of listed companies are closely related to their cash flows, which can be expressed by earnings smoothness. In the empirical practice of Chinese scholars, most of them employ earnings smoothness to indicate accounting information quality. The formula for earning smoothness is illustrated as follows:

$$\mathrm{ES}_{i,t} = \frac{\sigma(prof_{i,t})}{\sigma(CFO_{i,t})} + \varepsilon$$

Where $\mathrm{ES}_{i,t}$ refers to the degree of earnings smoothness.

$\sigma(prof_{i,t})/$ refers to the standard deviation of profit from year t-3 to year t.

$\sigma(CFO_{i,t})$ refer to the standard deviation of operating cash flow from year t-3 to year t.

ε represents residuals that cannot be transferred into cash flow.

(2) On the basis of information disclosure rating

A. AIMR disclosure score

AIMR, short for Association for Investment Management and Research, is an organization of 40,000 investment professionals. Starting from 1980s, AIMR has insisted in releasing AIMR disclosure score as a proxy for disclosure quality based on a comprehensive evaluation of the firm's disclosure activities. AIMR

disclosure score involves different type of disclosures (i.e., annual report, quarterly reports, and investor relations activities and etc.). Yet the annual report accounts for the majority of weight, approximately 40% to 50%. However, AIMR is now out of date and is rarely to be used in empirical practice (Hassan and Marston, 2001).

B. Accounting-based Investor Protection Index (AIPI)

While in China, AIPI is an index invented by Beijing Technology and Business University. The index is intended to provide basic data for the study of investor protection and investor protection mechanism of accounting, to assist in value evaluation for investors, governments, regulators, and other stakeholders, and finally, to promote communication for market participators with the ultimate goal of establishing a market-oriented reputation mechanism and disciplinary mechanisms for the improvement and practice in investor protection. AIPI is now applied by more and more scholars and institutions. The index is composed by 4 secondary indexes: accounting information quality index, internal control quality control index, external audit quality index and financial system operating quality index. Index structure is shown as follows:

Table 3 Index structure of AIPI

Primary index	Secondary index	Weight	Tertiary index	Weight
AIPI	Accounting information quality	27.76%	Reliability	40.95%
			Relevance	28.18%
			Information disclosure	30.87%
	Internal control quality	28.58%	Corporate culture	17.14%
			Corporate governance	23.93%
			Operation control	20.87%
			Information disclosure	19.98%
			External surveillance	18.08%
	External audit quality	19.14%	Independence	40.32%
			Audit quality	38.13%
			Guaranteeability	21.55%
	Financial system operating system	24.52%	Investment quality	25.08%
			Financing quality	16.29%

			Working capital quality	28.56%
			Dividends	17.57%

3.4 Theoretical basis

3.4.1 Information asymmetry

Traditional economics theory assumes that both sides of the market have full information. But the reality contradicts--the amount of information of buy side and sale side is not equal. Information asymmetry theory coincided with the failure of the total information hypothesis. Scholars in information asymmetry theory argue that sellers often have more information than buyers and the sellers often excel more power in the trade and resource allocation. In the securities markets, listed companies and investors represent sellers and buyers respectively. Listed entities take information advantages over investors, leading to adverse selection and moral hazard of the company. Therefore, investors no longer focus solely on the profits, but also aspire to know the fulfillness for corporate social responsibility. In the context of sustainable development, environmental information disclosure, as an important component of information disclosure, is beneficial to reduce the information asymmetry between listing companies and investors. Meanwhile, more information disclosure allows investors better their decision making process and enhance the quality of reporting.

3.4.2 Stakeholder theory

Stakeholder theory can apply to corporate management practices and also applies to analyzing environmental behavior. In the 1960 s, scholars started research on stakeholder theory. Friedman (1984) believes that stakeholders are people who can influence an organization's goal or can be influenced through the process of achieving goals. Freidman incorporates entities such as local communities, government departments and environmentalism into the research areas of stakeholders. As the modern corporate mechanism and corporate accounting framework are perfected, Clarkson's (1994) proposes that stakeholders refer to those who invest in real capital, human capital, financial capital or some meaningful value and take some form of risk. Later on, scholars in stakeholder theory point out stakeholders are all those who devote specific assets to companies and a group that is already taking risky capital. The early stakeholder theory focuses on shareholders and creditors. And then, as corporate social responsibility becomes increasingly valued, western scholars offer more comprehensive stakeholders: stakeholders may be employees inside customers. It could also be an external supplier of suppliers or pressure groups. In most cases, stakeholders

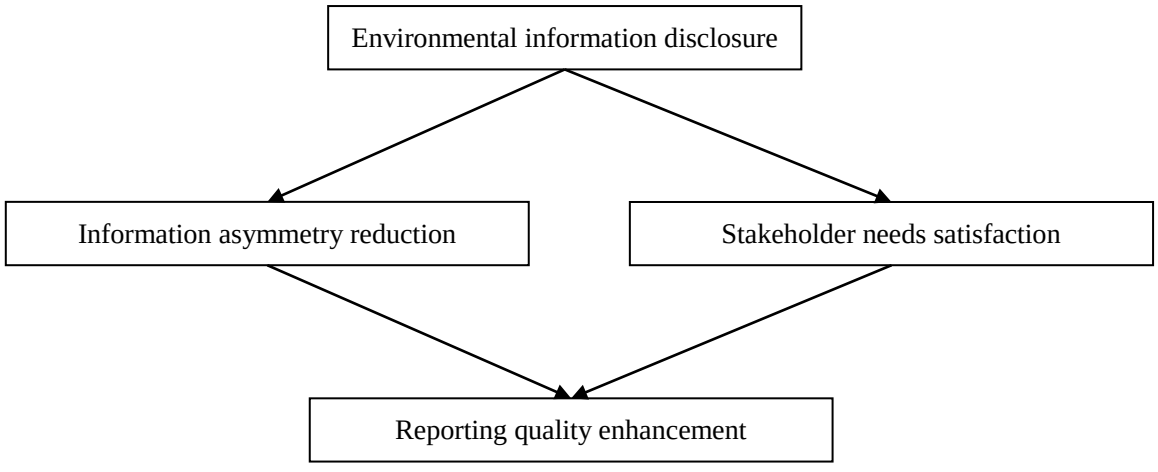
are categorized as follows: owners and shareholders, banks and other creditors, suppliers, buyers and customers, employees and customers, competitors and governments.

The concept of stakeholders is deepening. Corporate assets are not just from shareholders, but also from employees, suppliers and creditors. Stakeholders deal the risks springing from external uncertainty with their own human capital or non-human capital. They form an entity of common interest. Such traits determine that business' goals cannot be limited only to shareholders interests, but should also consider the interests of other stakeholders and take the same social responsibility. Maximizing shareholders' interest is being replaced by maximizing stakeholders' interest in order to achieve the organic integration of corporate value maximization and social value maximization. Meeting the environmental information users' need is not only the requirement of states, regulators or government, but also the aspiration of environmentalists and the public. Under the framework of stakeholder theory, adequate environmental information can attract stakeholders and increase confidence of potential investors towards companies. The company may earn more than lose by performing and disclosing social responsibility.

3.5 Path analysis

How does environmental disclosure enhance reporting quality?

Graph 5



The path leading to reporting quality is dual. Firstly, environmental information disclosure reduces information asymmetry, simply because of lower moral hazard or adverse selection. On the other, from

perspective of stakeholder theory, disclosing environmental information meets the decision-making related needs of different group of investor. On both paths, should boast the reporting quality of the observations.

4. Empirical study

4.1 Research hypothesis

Overall, according to information asymmetry and stakeholder theory, the more information available to stakeholder, the more usefulness to investors' decision making and higher qualified of the reporting quality. Thus, the hypothesis is as follows:

H1: all else being equal, more sufficient environmental information disclosure leads to enhancing reporting quality

Due to environmental information is classified into financial environmental information and non-financial environmental information. The two different types of information bear unidentified function in improving information quality. From the point of information users, financial information is measured monetary quantity, which is consistent to financial reports and informative preference of investors. On the contrary, non-financial information is mainly measured by descriptive information which takes more energy and time for investors to digest. From the perspective of information releasers, financial environmental information takes more efforts and costs. For example, it takes bunches of money to improve sewage-reduction technology while it only takes little time to promote environmental protection notion. In practice, the cost related to environmental information may be capitalized or expensed in such accounts as fixed assets or management fees. Therefore, monetary environmental information may be implicit. Considering cost-and-benefit effect and financial accounting practice, companies weigh preference to non-financial environmental information disclosure. The reversed goals between companies and information users contradict. This thesis conducts analysis from the point of companies, with assumption that non-financial environmental information disclosure explains reporting quality in a better way.

Furthermore, 2 more hypotheses are formed as follows:

H1a: financial environmental information disclosure is positively related to reporting quality

H1b:non-financial environmental information disclosure is positively related to reporting quality and has a more significance.

4.2 Sample selection

Since high-polluting industry in China is required to release environmental information, this thesis chooses the Shanghai Stock Exchange listed companies in 6 sectors (mining, leather, paper-making, textile, pharmaceutical and chemical industry) mentioned in the List of Classified Sectors of Listed Companies for Environmental Verification covering the year 2016 as our research sample. Data in 2015 also accumulated in order for the measurement of reporting quality. ST, *ST (Special Treatmentand) and PT (Particular Transfer) companies and observations that lack main variables data are deleted and observations whose values are upper 1% and lower 1% ranges are excluded to make the values more reasonable. Finally, a sample of 165 observations was achieved.

4.3 Variable definition and measurement

4.3.1 Dependent variable

This thesis measures dependent variable by modified Jones Model. As described in Chapter 3. Reporting quality can be quantified by the degree of earning management while earning management can be measured by discretionary accruals. According to Modified Jones model, non-discretionary accruals can be calculated by the formula: $NDA_t = \alpha_1\left(\frac{1}{A_t} - 1\right) + \alpha_2\left(\frac{\Delta REV_t - \Delta REC_t}{A_t}\right) + \alpha_3\left(\frac{PPE_t}{A_t}\right)$. And the total accrual can be measure by net operating assets (total accounts receivable minus total accounts payable) divided by total assets. That is to say, $Accural_t = (Net\ Operating\ Asset)_t/A_t$. By executing the linear regression model:

$$Accrual_t = \alpha_1\left(\frac{1}{A_t} - 1\right) + \alpha_2\left(\frac{\Delta REV_t}{A_{t-1}}\right) + \alpha_3\left(\frac{PPE_t}{A_{t-1}}\right) + \varepsilon = NDA_t + \varepsilon.$$

We can quantify discretionary accruals by residuals ε. The larger the ε, the more intention for earning manipulation, the worse the reporting quality. For simplicity and completeness, this thesis chooses opposite number of original output—employing opposite number as a proxy for reporting quality. Thus, the larger the opposite number of ε, the better the reporting quality.

4.3.2 Independent variable

Environmental information disclosure is the explanatory variable of this thesis. Previous research mainly employs content analysis method to construct environmental information disclosure index. Based on the study of environmental information disclosure system (Bi et al., 2012) and contemporary practice in environmental information disclosure in China, this thesis explains financial environmental information in

two dimensions—environmental cost and environmental revenue. The details are shown in the following table.

Table 4 Financial Environmental Information Index and Explanation

Financial Environmental Information	**Index**	**Index Explanation**
Environmental cost	Environmental Investment	Equity investment related to environmental protection
	Green Fees	Green fees listed in the financial statements or notes
	Sewage Charges	Sewage charges, listed in the financial statements or notes
	Environmental Compensation and Fine	Fine, indemnity, litigation costs and etc due to environmental issues
	Energy Saving Fees	Inputs related to energy saving , emission reduction or technical transformation
	Education and Training Fees Related to Environmental Protection	Cost paid for environmental protection education and training
Environmental Revenue	Government Grants Related to Environmental Protection	Various types of government funding and subsidies, including environmental incentives
	Tax Deduction Related to Environmental Protection	Tax relief according to environmental protection policies
	Revenue Related to Waste Reutilization	Income due to waste recycling
	Financing Related to Environmental Protection	Funds raised or borrowed specifically for environmental projects
	Education	Educative activity for employees on environmental protection

For non-financial information, this thesis follows the rules in the Guidance for Environmental Information Disclosure of Listed Companies. The index selected is as follows:

Table 5 Non-Financial Environmental Information Index and Explanation

Non-financial information	Index	Index Explanation
	Environmental Protection Notion	Business philosophy and values closely related to environmental protection
	Organization Structure Related to Environment Management	Organizational structure, functional departments and personnel and the operation related to environmental management
	Goals of Environmental Disclosure	Medium and long term objectives, target completion and plan related to environmental protection policy
	Certification Related to Environmental Protection	Environmental management system certification and environmental protection certification
	Honor Related to Environmental Protection	Honor granted by government or other authorities

This thesis employs content analysis to score environmental information disclosure by evaluating contents. The thesis chooses to measure the environmental information disclosure by the level of accuracy of information with scoring method. If none of information is disclosure, the index will be scored zero points. If there is rough description (e.g. one term or one sentence), the index will be scored one point. If detail description is employed, the index will be scored two points. Thus, the maximum EDI score is 32.

This thesis defines scores calculated by both financial and non-financial index as EDI (environmental information disclosure index). FEDI and NFEDI refer to financial environmental information disclosure index and non-financial environmental information disclosure index. All the index will be calculated in a weighted-average way and the explicit explanation of EDI, FEDI and NFEDI are shown as follows:

$$EDI_i = \frac{\sum_{i=1}^{n} EDI_i}{32}$$

Where EDI_i refers to the weighted-average environmental information disclosure index *i*th sample; $\sum_{i=1}^{n} EDI_i$refers to the sum of all indexes; 32 is the maximum FEDI score.

$$FEDI_i = \frac{\sum_{i=1}^{n} FEDI_i}{20}$$

Where $FEDI_i$ refers to the weighted-average financial environmental information disclosure index *i*th sample; $\sum_{i=1}^{n} FEDI_i$ refers to the sum of all indexes; 20 is the maximum score.

$$NFEDI_i = \frac{\sum_{i=1}^{n} NFEDI_i}{12}$$

Where $NFEDI_i$ refers to the weighted-average non-financial environmental information disclosure index ith sample; $\sum_{i=1}^{n} NFEDI_i$ refers to the sum of all indexes; 12 is the maximum NFEDI score.

4.3.3 Control variables

The quality of reporting of listed entities is influenced by diverse factors. Based on the previous research, this thesis chooses return on equity, leverage, ownership concentration and board structure as control variables. The control variables are explained below:

(1) Return on equity refers to the profitability of the company, measured by rate of return on common shareholders' equity. Theoretically, higher profitability may come from the pressure to manipulate the earnings. Assumption is that the more the return on equity, the less qualified the reporting quality. Return on equity is negatively related to the quality of reporting.

(2) Leverage refers to the financial risk the company takes, measured by debt-to-asset ratio. For investors, leverage means risks. The more leverage, the less confidence investors hold, the more intended companies to manipulate the earnings. Thus, the more leverage, the less qualified the reporting quality. Leverage is negatively related to the quality of reporting.

(3) Ownership concentration refers to the amount of stock owned by individual investors and large-block shareholders[5] measured by the top 1 shareholders' percentage shareholding. In general, the more concentration of shares' distribution, the less intention the companies to please

[5] http://lexicon.ft.com/Term?term=ownership-concentration

the outside investors and manipulate the earnings. Therefore, the more the ownership concentration, the more qualified the reporting quality. Ownership concentration is positively related to the quality of quality.

(4) Board structure refers to the board composition, which can be measured by the ratio of outside chairs over total board chairs. In general, the more outsiders, the more supervision, thus, the less possibility of earning manipulation. Therefore, the more independent members in the board of directors, the more qualified the reporting quality. Diversified board structure is positively related to the quality of reporting.

All in all, the summary of all variables are shown as follows:

Table 6 Summary of Variables

Variables	**Index**	**Variable Definition**
Independent variables	*RP*	Reporting quality, measured by the opposite number of error calculated in Modified Jones model
Dependent variables	*EDI*	Environmental disclosure index
	FEDI	Financial environmental disclosure index
	NFEDI	Non-financial environmental disclosure index
Control variables	*ROE*	Return on Equity=Net income/Equity
	LEV	Financial leverage, measured by the debt-to-assets ratio
	FIRST	Ownership concentration, measured by the top 1 shareholders' percentage shareholding
	RID	Board structure, measured by the ratio of independent members in Board of Directors

4.4 Hypothesis and regression models

To test hypothesis, this thesis uses the following three regression models:

Model EDI: $$RP = \alpha_0 + \alpha_1 EDI + \alpha_2 ROE + \alpha_3 LEV + \alpha_4 FIRST + \alpha_5 RID + \varepsilon$$

Model FEDI: $$RP = \alpha_0 + \alpha_1 FEDI + \alpha_2 ROE + \alpha_3 LEV + \alpha_4 FIRST + \alpha_5 RID + \varepsilon$$

Model NFEDI: $RP = \alpha_0 + \alpha_1 NFEDI + \alpha_2 ROE + \alpha_3 LEV + \alpha_4 FIRST + \alpha_5 RID + \varepsilon$

Where:

EDI refers to environmental disclosure index

ROE refers to return on equity

LEV refers to debt-to-assets ratio

$FIRST$ refers to the percentage of shareholding by the top 1 shareholder

RID refers to the ratio of independent directors over the total number of directors in the Board

ε refers to the residuals that cannot be explained by the model

4.4.1 Data

The data are collected via Wind database and rearranged in Microdsoft Excel and Eviews 7.0. 6 industries out of 14 in the List are selected. The selected industries include mining, leather, paper-making, textile, pharmaceutical and chemical industry. SSE-listed companies in these industries are widely analyzed and tested in empirical researches. In general, these companies release environmental information in a more complete and comprehensive way. This thesis chooses industries in consistence with prior researches.

4.4.2 Descriptive Analysis

Having mentioned in previous chapter, this thesis classifies samples in high-polluting industry into 6 minor industries, including mining, leather, paper-making, textile, pharmaceutical and chemical industry. According to Guidelines for the Industry Classification of Listed Companies by China Securities Regulatory Commission (CSRC), this thesis concludes 14 minor industries into 2 classifications for clearer presentation of industrial distribution.

Table 7 Industrial Distribution of Sample Companies

CSRC Industry Category	Minor Industry Category	Number of Companies	Percentage
Mining	Mining	38	23.03%

Manufacturing	Leather	6	3.64%
	Paper-making	11	6.67%
	Textile	17	10.30%
	Pharmaceutical	58	35.15%
	Chemical	35	21.21%
Total		165	100.00%

As shown in table 7, 165 samples are categorized into 2 CSRC industries: mining and manufacturing, among which mining and manufacturing industry account for 23.03% and 76.97% respectively. Admittedly, manufacturing takes the larger weight, among which pharmaceutical and chemical industry rank the top 2 in weight, becoming the representative sample of the study.

4.4.3 Channels of environmental information disclosure

Environmental disclosure information in this thesis mainly sources from the annual reports and notes of sample companies, and social responsibility reports (CSR) or environmental reports (ER) which are disclosed voluntarily parallel with annual reports. Table 8 reflects the channels of environmental information disclosure among sample companies.

Table 8 Channels of Environmental Information Disclosure

Channels of Environmental Information Disclosure	**Number of Companies**	**Percentage**
Only Annual Reports	111	67.27%
Both Annual Reports and CSR or ER	54	32.73%
Total	165	100%

From table 8, we can see that in 2016, 111 companies disclosing environmental information only through annual report and 54 companies both through CSR or ER and annual report. Over half of the observations disclose environmental information through annual reports and notes. In fact, there are few companies which issue nothing in environmental information and are excluded from the sample at the beginning.

Although annual reporting has been the main channel of environmental information disclosure, CSR and ER have been an increasingly popular way for disclosure among companies while only few listed entities issues no environmental information. Investors and companies in high-polluting industry have paid more attention to environmental information, and the way to disclose has been more diverse and more formal, which demonstrates increasing corporations are not only *profit seekers*, but also becoming social responsibility takers.

4.4.4 EDI analysis

(1) Frequency analysis of EDI score

Table 9 Frequency Distribution of Environmental Information Disclosure Score in 2016

EDI	**Number of Companies**	**Percentage**
0-3	17	10.30%
4-7	38	23.03%
8-11	57	34.55%
12-15	37	22.42%
16-19	12	7.27%
20-23	4	2.42%
24-27	0	0.00%
28-32	0	0.00%
Total	165	100.00%

Considering the best performance of EDI score is 21 and the current situation of environmental information disclosure, this thesis sets 12 as the bottom-line of qualified EDI score . From table n, it is obvious that 112 companies listed in SSE scores less than bottom-line in 2016, that is to say, 67.88% of observations. Meanwhile, 53 companies score more than 12, that is to say, 32.12% of sample companies reach the bottom-line.

(2) Statistical analysis

Table 10 EDI score statistics

EDI	Number of companies	Minimum	Maximum	Average	Standard Deviation
Mining	38	1	21	11.63	4.76
Manufacturing	127	0	20	8.92	4.50
Total	165	0	21	9.55	4.69

EDI score reflects the quality and completeness of environmental information disclosure. From table 10, overall, the minimum score and maximum score are 0 and 21 respectively, illustrating there exists entities that disclose no environmental information and entities that disclose 65.63% of environmental information. Apparently, there is wide disparity among different companies.

From industrial perspective, mining industry scores higher than manufacturing industry, meaning that industry discloses environmental information in a more complete way. In China, companies in mining industry are imposed to stricter supervision by government, watchdogs and the public. Together with pressure from outside, peer pressure contributes to higher EDI score in mining industry. It does not mean companies in manufacturing industry have done worse, but to highlight the industry that is equipped with more obvious features.

4.4.5 FEDI analysis

(1) Frequency analysis of FEDI score

Table 11 Frequency Distribution of Financial Environmental Information Disclosure Score in 2016

FEDI	Number of Companies	Percentage
0	11	6.67%
1	12	7.27%
2	12	7.27%
3	17	10.30%
4	22	13.33%
5	24	14.55%

6	19	11.52%
7	13	7.88%
8	19	11.52%
9	8	4.85%
10	4	2.42%
11	2	1.21%
12	1	0.61%
13	0	0.00%
14	1	0.61%
Total	165	100.00%

Considering the best performance of FEDI score is 14 and the current situation of environmental information disclosure, this thesis sets 8 as the bottom-line of qualified EDI score. From table 11, it is obvious that 130 companies listed in SSE scores less than bottom-line in 2016, that is to say, 78.79% of observations. Meanwhile, 35 companies score more than 8, that is to say, 21.21% of sample companies reach the bottom-line.

Comparing table 10 and table 11, fewer companies reach bottom-line in EDI score than FEDI score, reflecting that the quality of quality of overall environmental information disclosure becomes worse than financial environmental information disclosure. By rough derivation, listed companies in high-polluting industry of SSE get better off EDI by disclosing more non-financial environmental information.

(2) Analysis in index detail of FEDI score

Table 12 Statistics in FEDI Score

Index	**Number of Companies**	**Percentage**
Environmental Investment	124	75.15%
Green Fees	38	23.03%
Sewage Charges	77	46.67%
Environmental Compensation and Fine	7	4.24%
Energy Saving Fees	54	32.73%
Education and Training Fees Related to	5	3.03%

Environmental Protection		
Government Grants Related to Environmental Protection	121	73.33%
Tax Deduction Related to Environmental Protection	7	4.24%
Revenue Related to Waste Reutilization	44	26.67%
Financing Related to Environmental Protection	5	3.03%

From table 12, one can simply tell that over half of the companies in high-polluting companies listed in SSE releases information about environmental investment (75.15%) and government grants related to environmental protection (73.33%) in 2016. And nearly half (46.67%) of the companies disclose environmental information of sewage charges. Most companies pay high attention to the categorized information listed above. Meanwhile, only 5 companies disclose education and training fees related to environmental protection and companies releases tax deduction related to environmental protection information which possibly because companies involve related fees into management fees and thus there is no indication. 5 companies release financing related to environmental protection, possibly because environmental financing is more difficult than environmental investing.

4.4.6 NFEDI analysis

(1) Frequency analysis of NFEDI score

Table 13 Frequency Distribution of Non-Financial Environmental Information Disclosure Score in 2016

NFEDI	**Number of Companies**	**Percentage**
0	9	5.45%
1	11	6.67%
2	16	9.70%
3	14	8.48%
4	31	18.79%
5	30	18.18%

6	18	10.91%
7	14	8.48%
8	9	5.45%
9	6	3.64%
10	6	3.64%
11	1	0.61%
12	9	5.45%
Total	165	100.00%

Considering the best performance of NFEDI score is 12 and the current situation of environmental information disclosure, this thesis sets 6 as the bottom-line of qualified NFEDI score. From table 13, it is obvious that 102 companies listed in SSE scores less than bottom-line in 2016, that is to say, 67.27% of observations. Meanwhile, 63 companies score more than 6, that is to say, 32.72% of sample companies reach the bottom-line.

Comparing table 12 and table 13, more companies reach bottom-line in NFEDI score than FEDI score, reflecting that the quality of non-financial environmental information disclosure becomes better than quality of financial environmental information disclosure. Roughly, listed companies in high-polluting industry of SSE disclose non-financial environmental information in a more complete and detail way, possibly because practices related to non-financial environmental information cost less than activities related to financial environmental information but assist companies to promote their brand image. Companies, therefore, from cost-and-benefit perspective, are more willing to release non-financial environmental information.

(2) Analysis in index detail of NFEDI score

Table 14 Statistics in NFEDI score

Index	**Number of Companies**	**Percentage**
Environmental Protection Notion	151	91.52%
Organization Structure Related to Environment Management	59	35.76%
Goals of Environmental Disclosure	143	86.67%
Certification Related to Environmental	60	36.36%

Protection		
Honor Related to Environmental Protection	34	20.61%
Education	43	26.06%

From table 14, 91.52% and 88.67% of companies in high-polluting companies listed in SSE releases environmental protection notion and goals of environmental disclosure in 2016, which is to say, nearly all companies are willing to present their environmental belief. Companies perform a better role in disclosing non-financial environmental information than financial environmental information. This may be caused by the different disclosing cost of 2 type of information above. Meanwhile, 34 companies disclose honor related to environmental protection and 43 companies releases education information which possibly because companies involve related fees into management fees.

4.4.7 Descriptive analysis of variables

Table 15 Descriptive Statistics of Control Variables

Proxy	**Number of companies**	**Mean**	**Median**	**Maximum**	**Minimum**	**Std.Dev.**
RP	165	-0.00769	-0.00190	0.18860	-0.53910	0.07877
EDI	165	0.29830	0.28125	0.65625	0.00000	0.14647
FEDI	165	0.24606	0.25000	0.70000	0.00000	0.14271
NFEDI	165	0.38535	0.41667	1.00000	0.00000	0.21173
ROE	165	0.06921	0.06582	0.74135	-0.82180	0.14217
LEV	165	0.42388	0.39133	0.99570	0.09691	0.20292
FIRST	165	0.37496	0.36000	0.89090	0.06800	0.15991
RID	165	0.37045	0.33333	0.66667	0.30769	0.05415

Table 15 represents descriptive statistics of all the variables. The minimum and maximum of RP are -0.53910 and 0.18860 respectively, indicating that there exits disparity in reporting quality among companies. Some intend to window-dress bad data while some companies cover good data for the reason of earning smoothness and etc. The average, minimum and maximum of EDI are 0.29830, 0, and 0.65625 respectively. The average, minimum and maximum of FEDI are 0.24606, 0, and 0.65625 respectively. The average, minimum and maximum of NFEDI are 0.38535, 0, and 1 respectively. EDI, FEDI and NFEDI represent consistent statistics and NFEDI has a better statistical result. The average, minimum and maximum of ROE are 0.06921, -0.82180 and 0.74135 respectively. Sample companies diverge in profitability. The

average, minimum and maximum of LEV are 0.42388, 0.09691 and 0.99570 respectively. The average, minimum and maximum of FIRST are 0.37496, 0.06800 and 0.89090 respectively. The average, minimum and maximum of RID are 0.37045, 0.30769 and 0.66667 respectively.

4.4.8 Correlation Analysis

Table 16 Correlation Result

		RP	**EDI**	**FEDI**	**NFEDI**	**ROE**	**LEV**	**FIRST**	**RID**
RP	Correlation	1.00000							
	t-Statistic	-----							
EDI	Correlation	0.21642***	1.00000						
	t-Statistic	2.83011	-----						
FEDI	Correlation	0.15940**	0.88429***	1.00000					
	t-Statistic	2.06148	24.17886	-----					
NFEDI	Correlation	0.22017***	0.85140***	0.50796***	1.00000				
	t-Statistic	2.88171	20.72328	7.52893	-----				
ROE	Correlation	-0.27737***	-0.21003***	-0.22684***	-0.13263*	1.00000			
	t-Statistic	-3.68585	-2.74267	-2.97367	-1.70843	-----			
LEV	Correlation	0.07821	0.33812***	0.32270***	0.26125***	-0.25282***	1.00000		
	t-Statistic	1.00161	4.58706	4.35286	3.45547	-3.33611	-----		
FIRST	Correlation	0.17784**	0.10386	0.04586	0.14008*	0.05639	-0.05885	1.00000	
	t-Statistic	2.30722	1.33317	0.58610	1.80618	0.72110	-0.75270	-----	
RID	Correlation	-0.07447	0.00319	-0.02428	0.03316	-0.02414	0.00033	0.10806	1.0000
	t-Statistic	-0.95341	0.04073	-0.31011	0.42362	-0.30829	0.00415	1.38779	-----

***,**,* represents significance on 1%, 5%, and 10% levels respectively.

In order to the relation among environmental information disclosure, financial environmental information disclosure and non-financial information disclosure, control variables and reporting quality. This thesis conducts correlation analysis. And the results are presented above. Table 16 has implied that:

(1) Environmental information disclosure bears a positive relation with reporting quality and passes the significance test on the 1% level, which is consistent with empirical hypothesis.

(2) Financial environmental information disclosure bears a positive relation with reporting quality and passes the significant test on the 5% level. Although the correlation is not as significant as environmental information disclosure, the result is consistent with empirical hypothesis.

(3) The quality of reporting is positively related to non-financial environmental information disclosure with significance on 1% level. This is consistent with empirical hypothesis.

(4) ROE is negatively related with reporting quality. The correlation is significant on 1% level which is consistent with empirical hypothesis.

(5) Leverage does not bear a significant correlation with reporting quality.

(6) The top 1 shareholders' percentage shareholding (FIRST) is positive related to reporting quality on 5% significant level, which is consistent with empirical hypothesis.

(7) The ratio of independent members in Board of Directors (RID) is not significantly related to the quality of reporting.

4.4.9 Regression Analysis

This thesis tests the relation between environmental information disclosure and reporting quality with collected data of high-polluting companies listed in SSE in 2016. Ordinary least squares (OLS) method is employed for regression. The regression result of 3 models is shown as follows:

Table 17 Regression Result

Variables	**Model EDI**	**Model FEDI**	**Model NFEDI**
EDI	0.081423** (1.905946)		
FEDI		0.048749 (1.113133)	
NFEDI			0.062715** (2.190685)
ROE	-0.147322*** (-3.466870)	-0.151201*** (-3.521295)	-0.151741*** (-3.610235)
LEV	-0.011338 (-0.366110)	-0.002914 (-0.094139)	-0.009496 (-0.313539)
FIRST	0.091791*** (2.494436)	0.098311*** (2.669572)	0.088508** (2.405416)
RID	-0.147638	-0.146152	-0.154302

	(-1.375186)	(-1.350440)	(-1.442422)
C	0.003296 (0.074733)	0.009291 (0.209020)	0.006641 (0.152418)
F-statistic	5.390332	4.842978	5.657076
Prob(F-statistic)	0.000132	0.000377	0.000079
R-squared	0.144939	0.132167	0.151028
Adjusted R-squared	0.118050	0.104876	0.124331

***,**,* represents significance on 1%, 5%, and 10% levels respectively.

According to the regression models performed on the cross-sectional data in 2016, following conclusions can be drawn: according to model EDI, environmental information disclosure positively related to the reporting quality which is consistent with H1. The regression result indicates that disclosing environmental information improve the quality of reporting. Environmental information may be an advertising tool for corporates' image branding or a tool for window-dressing bad news. However, image branding does improve the reporting quality or does not provide the public with qualified information for decision making. Model two, however, implies that there is no significant relation between financial environmental disclosure and reporting quality. In other words, either strong or weak desire to disclosing financial environmental information does not basically influence the quality of decision-making related information. No strong proof can be found to justify H1a.This may be explained by the fact that financial environmental information is disclosed on a compulsory basis. Thus, in the reporting context, there is no room for companies to window-dress their earning or other decision-making information. From regression model NFEDI, we can draw conclusion as similar as model EDI. Non-financial environmental information disclosure bears a positive relation with reporting quality which is consistent with H1b. That is to say, more description on non-financial environmental information can be less delusional and leads to confusing decision-making related information. And model NFEDI has a better regression result: higher R-square, higher t-Statistic and higher F-Statistic. Table 17, at the same time, provides insight of the relation between reporting quality and control variables which include ROE, Leverage, ownership and the board structure. Among all the control variables, ROE, representing profitability, is negatively related to reporting quality which accord with expectation. Reporting quality is negatively related to ROE and leverage, demonstrating that the more profit the company has gained and the higher debt-to-asset ratio, the higher the quality of reporting. Ownership concentration, on the contrary, is positively related to the reporting quality. The result is consistent with the hypothesis. Board structure, measured by the ratio of number of independent members in the board of directors has a negative relation with reporting quality. From the perspective of statistics,

ROE and ownership concentration perform significantly on 5% or 1% level while leverage and board structure are not significant on the test. This may because of the small sample and limit time-span of the sample. Second, this thesis chooses to use the Jones model to calculate the discretionary earning as a proxy for reporting quality, which is based on rigid hypothesis and leads to bias.

4.5 Conclusions and Implications

4.5.1 Conclusions

This thesis chooses companies in high-polluting industry listed in SSE as sample, and data in 2016 is selected for empirical research. Main focus is on the relation between environmental information disclosure, financial environmental information disclosure, non-financial environmental information disclosure, other 4 control variables and reporting quality measured by Jones model. Descriptive analysis, correlation analysis and regression analysis are conducted and the following conclusions can be drawn:

From the perspective of environmental information disclosure

In 2016, over half of the SSE-listed companies in high-polluting industry post environmental information through annual reports, while nearly one third of observed companies release environmental information via CSR or ER. On the other side, most companies score in the range of 4 to 11 points, which is lower than the bottom-line, illustrating an inferior quality and incompleteness of pubic environmental information. On average, compared with manufacturing, mining industry outperforms in disclosing environmental information.

From the classification of disclosed environmental information

In 2016, it is plausible to say non-financial environmental information disclosure outperforms with the comparison to financial environmental disclosure. Apparently, financial environmental information covers more subjects than non-financial environmental information and thus possesses a higher *total value.* Companies, however, disclose more non-financial environmental information. From financial perspective, most attention has been given to environmental investment, government grants related to environmental protection and sewage charges. Only few companies post education and training fees related to environmental protection and tax deduction related to environmental protection. In comparison, non-financial information is covered in a more comprehensive way. Nearly all observed companies post

environmental protection notion and goals of environmental disclosure. And nearly 45% companies disclose organization structure related to environmental management. Non-financial information disclosed in the least frequency is honor related to environmental protection and education.

From the regression result

Regression results of this thesis indicate that environmental information disclosure influences the quality of reporting in a positive way. As financial environmental information disclosure does affect quality of reporting in a positive but not significant way, there is no importance to make further explanation. Non-financial environmental information disclosure makes a difference on improving reporting quality. One can also imply that non-financial environmental information balance off the insignificant effect of financial environmental information and has a superior or stronger power to the relation between environmental information disclosure and reporting quality. The positive relation between explanatory variable and dependent variable indicates investors can tell good report and bad ones by glimpsing the environmental information.

4.5.2 Implications

From the perspective of investors

Since complete and appropriate disclosure of environmental information implies better reporting quality and less possibility of earnings management. By identifying environmental information, investors could fasten their decision-making process and kaizen their investing activities. On the other, since non-financial environmental information shows a more significant relationship, investors should also strengthen learning further to enhance understanding, analysis and processing of environmental information, especially in terms of non-financial environmental information. The empirical research may be anti-intuition because basically attentions are mainly focused on financial information whereas this thesis testify that financial environmental disclosure is not significant relevant to reporting quality.

From the perspective of listed companies in high-polluting industry

It is necessity to improve the quality of environmental information disclosure. Pubic information is incomplete. Whereas almost all of the heavy polluting companies have been exposed to environmental information, the environmental disclosure of most of the most polluting companies has failed to reach the

bottom-line. Secondly, communication and responsibility-taking mechanisms should be established between the functions of the listed companies to ensure that major environmental problems can be communicated and the treatment and environmental impacts of environmental events can be externally disclosed on a timely basis. Last but not least, companies shall realize that disclosing environmental information does not only mean cost, time or actions required by watchdogs, but also a way to build confidence and faith with investors, which is beneficial for stock prices and image branding in the long-term.

5. Limitation

Overall, this thesis firstly composes research background and research significance, and reviews the literature both abroad and domestically. Afterwards, theory analysis is conducted and 3 testable hypothesis are raised. Empirical research is conducted in chapter 4 where hypothesis are tested. Overall, we can conclude that:

All else being equal, more sufficient environmental information disclosure leads to enhancing reporting quality. All else being equal, financial disclosure is not significantly related to reporting quality which may indicates the incompleteness of the model design. All else being equal, non-financial environmental information disclosure is positively related to reporting quality and has a more significance. However, there are limitations in this thesis:

Firstly, in dealing with basic data, this thesis employs content analysis method. Scoring information disclosure index by judgment may be arbitrary and subjective. In the process of scoring, judgmental mistakes may arise, thus, deteriorating the completeness and correctness of environmental information disclosure.

Secondly, sample data of this thesis source from 6 out of 14 high-polluting sectors in 2016. Instead of panel data covering several years, only one-year sectional data are selected. The regression models are not based on time-series. This could possibly explain why the financial environmental information disclosure index is not significant in regression model.

Thirdly, this thesis only chooses 4 control variables: ROE, leverage, the share percentage that the top1 shareholder holds, and the ratio of independent member in board of directors. 4 control variables may not explain the model in a complete way. This thesis is conducted on the background of integrated reporting (IR) momentum. Reporting quality, measured by discretionary accruals, is not completely equal to reporting quality defined in the IR framework. Hence, results in this model may be misleading. Further research with more rigid derivation and data selection is needed to remedy flaws of this thesis.

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SUMMARY

How Environmental Information Disclosure Affects Quality of Reporting in China.

1. Introduction

International insights of environment have been rising in recent years. Besides Copenhagen Accord announced in 2009, but also Carbon Disclosure Project (CDP) in 2014 led to nearly 2000 business reporting climate change data. Reports have shown that the global CO_2 emissions from fossil-fuel use and cement production doubled from 1970 to 2015. According to *Trends In Global CO_2 Emissions 2016 Report,* the year 2015 has by far been the warmest year on record and Coal-fired power plants cause one-third of global CO_2 emissions. Among the top 5 emitting countries and European Union, China has ranked the top in CO_2 emissions from fossil-fuel use and cement production.

Nevertheless, questions concerning the environmental information have sprung up. Have the guidance and regulations come into effect? Does the information disclosed truly meet the satisfaction of investors and stakeholders? Is it reasonable to integrate environmental information into future IR reporting practice in China? Although listed companies in heavy industry are enforced to disclose environment information, does the disclosure enhance the quality of reporting, thus ensuring better information understanding of investors? These issues provide guide for this thesis and need to be tested by empirical research.

On the purpose of testing whether environmental information disclosure could improve the quality of reporting for listed companies in high-polluting industries, the result of the research would, on the one hand, clarify whether environmental information disclosure would meet the information needs of investors and stakeholders or not, thus assisting investors to discriminating risk in stock investment. On the other hand, this research constructs a theoretical framework on how environmental information disclosure influences the quality of reporting. Therefore, the result may inspire the practice of IR implementation in China Mainland. This research also provides data for regulatory institutions who may take actions on supervision based on the quality of environmental information. It is beneficial to listed companies to integrate themselves into IR framework.

2. Literature Review

2.2 Environmental information: a definition

Environmental information has a broad, plausible and inexplicit definition. Li (2005) supposes traditional legal forums for CSE disclosure are in areas such as labor, occupational safety, product safety, environmental protection, and consumer protection law. Ashcroft (1999) argues that according to Statement of Financial Accounting Standards (SFAS), a comprehensive analysis of the information provided in firms' annual reports related to environmental costs, policies, strategies, pollution effects of regulation and current and future actions to respond to environmental concerns is needed to understand firms' environmental disclosure decisions The University of Edingurgh (2015) gives environmental information a wider scope: environmental information is recorded information, in any form, in any of the environment-related areas[6].

In China, most researches of environmental information are based on the legal or regulation context. When referring to environmental information, people tend to resort to *the Measures for the Disclosure, the Guidance for Environmental Information Disclosure of Listed Companies* and other regulations for explicit definition.

2.2 International literature

Environmental information disclosure is underpinned by legislation and regulation system. Since 1980, the US has almost inserted environmental information disclosure requirement in any environmental legislation, such as the National Environmental Policy Act, the Resources Conservation and Recovery Act, Comprehensive Environmental Response, Compensation and Liability Act, Clean Water Act and so on. [7] Meanwhile, beginning from 1971, the SEC (Securities and Exchange Commission) has released several acts and regulation related to environmental protection. Efforts also have been taken by European countries. Netherlands required enterprises to disclose environmental information periodically with "Carrot and Stick" policy. In 1995, Demark integrated mandatory environmental reporting into "Environmental Protection Act" and the first law on green accounts was passed. Other countries such as Sweden and Norway also took actions.

The majority of the early research assumes that investment of ESG by nature probably reduces financial return, motivating companies to window-dress their earnings performance and deteriorate quality of reporting. However, after 1998, scholars argue that companies which bear CSR (corporate social responsibility) and disclose ESG endeavor draw most of the public attention and benefit from it. Therefore,

[6] http://www.ed.ac.uk/records-management/freedom-of-information/about/environmental-information/environmental-info
[7] https://gelr.org/2016/05/18/environmental-disclosure-in-china/

there has been no incentive to cheat on the reporting as people are more and more concerned about environmental protection. Increasing public awareness of environmental issues prompted firms to voluntarily increase environmental performance information in their annual reports (Carol Ann Leary, 2003). Transparency around ESG performance and policies is used as a proxy for management quality and the potential for the management to grow profitably the business in the future (Eccles et al, 2011).

However, doubts have been arising. In Canada, general descriptions and definition in a statement of basic accounting theory which provides ex ante information do not advise specifically what the role of accounting should with regard to environmental issues (Nola Buhr, 1994). Does quantity truly transform to quality? Some researches show obscure results. In a research to test the relation between CSR and earnings management, no consistent conclusion was founded in a sample of trans-scale enterprises (Tre'bucq S and Russ R., 2005). And different measure of quality of reporting exhibits a different result (Chih H et al, 2008).

2.3 Domestic literature

Chinese environmental agencies and departments have been devoted to the foundation and perfection of environmental information disclosure system. The State Environmental Protection Administration (SEPA), mandated companies applying for IPO or listed companies applying for seasoned offering shall execute verification for environmental protection in 2003. After 4 years, all the Chinese listed companies in high-polluting industries shall conduct environmental protection verification under a stricter standard by SEPA, instead of provincial environmental agencies. Since 2008, when "Measures for the Disclosure of Environmental Information (for Trial Implementation)" was published, Chinese companies have been encouraged to release relevant environmental information voluntarily. Later on, more environment-related acts and regulations are enacted.

Few researches have been conducted on the topic of relation between environmental information disclosure and quality of reporting. Taking CSR as a cut-in point, Chen and Ma (2005) found that information users paid little attention to CSR information. Market showed little interest in CSR. Song and Gong (2006) proved by questionnaire research that there was barely value of decision and the value of public relations on social responsibility information. The reason why CSR was not recognized by scholars and capital market is that listed companies tend to hold a negative attitude toward CSR information disclosure (Liu and Kong ,2006) and the arbitrariness and inconsistence of CSR disclosure (Shen, 2006).

However, there was a switch afterwards. Gao et al (2011) studied that CSR disclosure is positively

related to information transparency, but has nothing to do with relevance and reliability. It was tested that the better firms perform on CSR, the more they gain on the stock market and the higher evaluation of market on their earnings, namely the higher informativeness of accounting earnings (Zhu, 2011). But there was no clear definition of Empirical research has shown that companies with social responsibility information disclosure or better CSR performance have lower earnings management and less financial restatement; corporate social responsibility information disclosure assists investors to discriminate the quality of financial reports (Wang et al, 2014).

3. Research structure and theoretical analysis

3.1 Research structure

This thesis contains 5 chapters and is organized as follows. Chapter 1 is introduction which aims to roughly describe the current situation of global environmental issues and raise the questions to be examined in the thesis. Research significance is also mentioned. Chapter 2 reviews the past literature and aims at examining the concept of environmental information disclosure both in the foreign and home context. Moreover, Chapter 3 will introduce research method, structure and framework. Chapter 3 contains the description of the research objectives and design of the analytical process. This chapter is intended to introduce the theoretical prerequisite of empirical research. In the following chapter -- Chapter 4, the data is also collected and analyzed in order to uncover the motivation drivers for embracing environmental information disclosure and the measurement of reporting quality of Chinese listed companies. Furthermore, the empirical analysis will tackle the key issue of this thesis: the interaction between environmental information disclosure and the reporting quality and how the former influences the latter. Based on the chapters above, Chapter 5 will introduce the limitation and implication for further research which may inspire latter scholars.

3.2 Relevant concept and theoretical analysis

3.2.1 High-polluting industry

Which companies shall be included in the high-polluting sector? The answer influences sample selection and the scope of the research. It is vital to specify the definition of high-polluting industry. Since 2001, MEP (Ministry of Environmental Protection of People’s Republic of China) has insisted in conducting verification and supervision of listed entities in high-polluting industry, promoted environmental law, regulations and

legitimacy, in order to direct the cash flow of financing, reduce the investment risk related to environmental issue. Shown as follows, MEP and other regulatory department have already announced several documents to define high-polluting sector, such as *Notice on Environmental Protection Verification of Listed Companies and Refinancing Listed Companies* and *List of Classified Sectors of Listed Companies for Environmental Verification.*

3.2.2 Environmental information disclosure

From the way of information disclosure, disclosure can be classified into voluntary disclosure and compulsory disclosure. By now, according to regulation, material adverse events are required to release in two day after the occurrence of events, along with progress of events and potential effects to the company and stakeholders. At the same time, SSE (Shanghai Stock Exchange) encourages listed entities in high-polluting industry to disclose the vision of environmental protection and other related information. MEP (Ministry of Environmental Protection of People's Republic of China) requires listed companies to release interim announcements in one day after the occurrence of environmental emergency.

From the content, environmental information can be divided into monetary information and non-monetary information. Monetary information refers to information that can be measured in money, such as environmental investment, green fees, subsidy for environmental protection and other information that can be quantified. Monetary environmental information is closely related to operating performance to reflect the financial impact of environmental behavior and disclosed in the footnotes of financial statements. On top of this, this thesis refers monetary environmental information as financial environmental information. Non-monetary information refers to qualified information that reflects corporate social responsibility. Such information includes environmental protection notion, goals of environmental protection and obedience of pollutant discharge standards and etc. Non-monetary information is not directly related to operating performance and is intended to reflect corporate governance of environment and legitimacy of environmental laws and regulations. Based on this, this thesis defines non-monetary environmental information as non-financial environmental information.

3.3.3 The quality of reporting

Accounting information has long been paid attention by entrepreneurs and scholars for the reason that it functions as the reflection of operating performance. The International Accounting Standard Board (IASB)

released *Conceptual Framework for Financial Reporting*, under which relevance, materiality and faithful representation are fundamental qualitative characteristics and comparability, verifiability, timeliness and understandability are enhancing qualitative characteristics for measuring the quality of reporting.

What is the measurement of reporting quality? Ge and Liu(2003) suggest to measure reporting quality by usefulness for decision- making, seems to be more than abstract. Scholars have been exploring the way to quantify reporting quality. Most of empirical researches on accounting information quantify reporting quality with proxy variables. Proxy variables can be divided into the following 2 types:

(3) On the basis of earning sustainability

On the basis of earning sustainability, theories suggest reporting quality can be reflected by degree of earnings' management. From different perspectives, models can be classified into the following 3 categories:

D. Jones model and modified Jones model

In general, accruals are acquired through normal access and exceptional access. The Jones model argues that the accruals are subject to changes of underlying variables of the firm, such as operating profit, changes in intangible assets and etc. The change in accrued items that cannot be explained by the change in the underlying variable is possibly to be manipulated—the possibility of earnings management. Usually, the proxy for earnings quality can be categorized into discretionary accruals and nondiscretionary accruals. In reality, it is difficult to identify discretionary accruals. Using nondiscretionary accruals is the common case. Regression model is typically involved in estimating the nondiscretionary accruals. According to Jones model, nondiscretionary profit accruals can be calculated as follows:

$$NDA_t = \alpha_1\left(\frac{1}{A_t} - 1\right) + \alpha_2\left(\frac{\Delta REV_t}{A_{t-1}}\right) + \alpha_3\left(\frac{PPE_t}{A_{t-1}}\right)$$

$$Accrual_t = \alpha_1\left(\frac{1}{A_t} - 1\right) + \alpha_2\left(\frac{\Delta REV_t}{A_{t-1}}\right) + \alpha_3\left(\frac{PPE_t}{A_{t-1}}\right) + \varepsilon = NDA_t + +\varepsilon$$

The prerequisite of Jones model is that revenue is not able to manipulate, which may not be consistent with reality. Therefore, Dechowetal (1995) invented modified Jones model shown as follows:

$$NDA_t = \alpha_1\left(\frac{1}{A_t} - 1\right) + \alpha_2\left(\frac{\Delta REV_t - \Delta REC_t}{A_t}\right) + \alpha_3\left(\frac{PPE_t}{A_t}\right)$$

$$Accrual_t = \alpha_1\left(\frac{1}{A_t} - 1\right) + \alpha_2\left(\frac{\Delta REV_t - \Delta REC_t}{A_t}\right) + \alpha_3\left(\frac{PPE_t}{A_{t-1}}\right) + \varepsilon = NDA_t + \varepsilon$$

E. DD model

DD model, referring to Dechow and Dichev model (2002) suggest a new measure of one aspect of the quality of working capital accruals and earnings. One role of accruals is to shift adjust the recognition of cash flows over time so that the adjusted numbers (earnings) better measure firm performance. They argue that the quality of accruals and earnings is decreasing in the magnitude of estimation error. The practical measures of working capital accrual quality are derived as follows:

$$\Delta WC_t = \beta_0 + \beta_1 CFO_{t-1} + \beta_2 CFO_t + \beta_3 CFO_{t+1}$$

$$Accrual_t = \beta_0 + \beta_1 CFO_{t-1} + \beta_2 CFO_t + \beta_3 CFO_{t+1} + \varepsilon = \Delta WC_t + \varepsilon$$

F. Earnings smoothness

Goel and Thankor (2006) argues that earnings smoothing is a special case of earnings management involving intertemporal smoothing of reported earnings relative to economic earnings; it attempts to make earnings look less variable over time. The earnings of listed companies are closely related to their cash flows, which can be expressed by earnings smoothness. In the empirical practice of Chinese scholars, most of them employ earnings smoothness to indicate accounting information quality. The formula for earning smoothness is illustrated as follows:

$$\mathrm{ES}_{i,t} = \frac{\sigma(prof_{i,t})}{\sigma(CFO_{i,t})} + \varepsilon$$

(4) On the basis of information disclosure rating

C. AIMR disclosure score

AIMR, short for Association for Investment Management and Research, is an organization of 40,000 investment professionals. Starting from 1980s, AIMR has insisted in releasing AIMR disclosure score as a proxy for disclosure quality based on a comprehensive evaluation of the firm's disclosure activities. AIMR

disclosure score involves different type of disclosures (i.e., annual report, quarterly reports, and investor relations activities and etc.). Yet the annual report accounts for the majority of weight, approximately 40% to 50%. However, AIMR is now out of date and is rarely to be used in empirical practice (Hassan and Marston, 2001).

D. Accounting-based Investor Protection Index (AIPI)

While in China, AIPI is an index invented by Beijing Technology and Business University. The index is intended to provide basic data for the study of investor protection and investor protection mechanism of accounting, to assist in value evaluation for investors, governments, regulators, and other stakeholders, and finally, to promote communication for market participators with the ultimate goal of establishing a market-oriented reputation mechanism and disciplinary mechanisms for the improvement and practice in investor protection. AIPI is now applied by more and more scholars and institutions. The index is composed by 4 secondary indexes: accounting information quality index, internal control quality control index, external audit quality index and financial system operating quality index.

3.3 Theoretical basis

3.3.1 Information asymmetry

Scholars in information asymmetry theory argue that sellers often have more information than buyers and the sellers often excel more power in the trade and resource allocation. In the securities markets, listed companies and investors represent sellers and buyers respectively. Listed entities take information advantages over investors, leading to adverse selection and moral hazard of the company. Therefore, investors no longer focus solely on the profits, but also aspire to know the fulfillness for corporate social responsibility. Environmental information disclosure is beneficial to reduce the information asymmetry between listing companies and investors. Meanwhile, more information disclosure allows investors better their decision making process and enhance the quality of reporting.

3.3.2 Stakeholder theory

Stakeholder theory can apply to corporate management practices and also applies to analyzing environmental behavior. In the 1960s, scholars started researches on stakeholder theory. They argue that corporate assets are not just from shareholders, but also from employees, suppliers and creditors.

Stakeholders deal the risks springing from external uncertainty with their own human capital or non-human capital. They form an entity of common interest. Such traits determine that business' goals cannot be limited only to shareholders interests, but should also consider the interests of other stakeholders and take the same social responsibility. Maximizing shareholders' interest is being replaced by maximizing stakeholders' interest in order to achieve the organic integration of corporate value maximization and social value maximization. Meeting the environmental information users' need is not only the requirement of states, regulators or government, but also the aspiration of environmentalists and the public. Under the framework of stakeholder theory, adequate environmental information can attract stakeholders and increase confidence of potential investors towards companies. The company may earn more than lose by performing and disclosing social responsibility.

4. Empirical study

4.1 Research hypothesis

Overall, according to information asymmetry and stakeholder theory, the more information available to stakeholder, the more usefulness to investors' decision making and higher qualified of the reporting quality. Thus, the hypothesis is as follows:

H1: all else being equal, more sufficient environmental information disclosure leads to enhancing reporting quality

Due to environmental information is classified into financial environmental information and non-financial environmental information. The two different types of information bear unidentified function in improving information quality. From the perspective of information releasers, financial environmental information takes more efforts and costs. Monetary environmental information may be implicit. Considering cost-and-benefit effect and financial accounting practice, companies weigh preference to non-financial environmental information disclosure. This thesis assumes that non-financial environmental information disclosure explains reporting quality in a better way. Furthermore, 2 more hypotheses are formed as follows:

H1a: financial environmental information disclosure is positively related to reporting quality

H1b:non-financial environmental information disclosure is positively related to reporting quality and has a more significance.

4.2 Sample selection

This thesis chooses the Shanghai Stock Exchange listed companies in 6 sectors (mining, leather, paper-making, textile, pharmaceutical and chemical industry) mentioned in the List of Classified Sectors of Listed Companies for Environmental Verification covering the year 2016 as our research sample. ST, *ST, PT companies and observations that lack main variables data are deleted and observations whose values are upper 1% and lower 1% ranges are excluded to make the values more reasonable. Finally, a sample of 165 observations was achieved.

4.3 Variable definition and measurement

4.3.1 Dependent variable

This thesis measures dependent variable by modified Jones Model. Non-discretionary accruals can be calculated by the formula: $NDA_t = \alpha_1 \left(\frac{1}{A_t} - 1\right) + \alpha_2 \left(\frac{\Delta REV_t - \Delta REC_t}{A_t}\right) + \alpha_3 \left(\frac{PPE_t}{A_t}\right)$. And the total accrual can be measure by net operating assets (total accounts receivable minus total accounts payable) divided by total assets. By executing the linear regression model, we can quantify discretionary accruals by residuals ε. For simplicity and completeness, this thesis quantifies reporting quality with opposite number of ε. The larger the opposite number of ε, the better the reporting quality.

4.3.2 Independent variable

Environmental information disclosure is the explanatory variable of this thesis. Previous research mainly employs content analysis method to construct environmental information disclosure index. Based on the study of environmental information disclosure system (Ren, 2012) and contemporary practice in environmental information disclosure in China, this thesis explains financial environmental information in two dimensions—environmental cost and environmental revenue. The environmental cost involves environmental investment, green fees, sewage charges, environmental charges, environmental compensation fine, energy saving fees and education and training fees related to environmental protection. Environmental revenue includes government grants related to environmental protection, tax deduction related to environmental protection, revenue related to waste reutilization, financing related to environmental protection and education. For non-financial information, this thesis follows the rules in the Guidance for Environmental Information Disclosure of Listed Companies. The index includes environmental protection

notion, organization structure related to environment management, goals of environmental disclosure, certification related to environmental protection and honor related to environmental protection.

The thesis chooses to measure the environmental information disclosure by the level of accuracy of information with scoring method. If none of information is disclosed, the index will be scored zero points. If there is rough description (e.g. one term or one sentence), the index will be scored one point. If detail description is employed, the index will be scored two points. Thus, the maximum EDI score is 32.

This thesis defines scores calculated by both financial and non-financial index as EDI (environmental information disclosure index). FEDI and NFEDI refer to financial environmental information disclosure index and non-financial environmental information disclosure index. All the index will be calculated in a weighted-average way and the explicit explanation of EDI, FEDI and NFEDI are:$EDI_i = \frac{\sum_{i=1}^{n} EDI_i}{32}$, $FEDI_i = \frac{\sum_{i=1}^{n} FEDI_i}{20}$ and $NFEDI_i = \frac{\sum_{i=1}^{n} NFEDI_i}{12}$

4.3.3 Control variables

The quality of reporting of listed entities is influenced by diverse factors. Based on the previous research, this thesis chooses return on equity, leverage, ownership concentration and board structure as control variables. The summary of all variables are shown as follows:

Table 1Summary of Variables

Variables	**Index**	**Variable Definition**
Independent variables	*RP*	Reporting quality, measured by the opposite number of error calculated in Modified Jones model
Dependent variables	*EDI*	Environmental disclosure index
	FEDI	Financial environmental disclosure index
	NFEDI	Non-financial environmental disclosure index
Control variables	*ROE*	Return on Equity=Net income/Equity
	LEV	Financial leverage, measured by the debt-to-assets ratio

	FIRST	Ownership concentration, measured by the top 1 shareholders' percentage shareholding
	RID	Board structure, measured by the ratio of independent members in Board of Directors

4.4 Hypothesis and regression models

To test hypothesis, this thesis uses the following three regression models:

Model EDI: $$RP = \alpha_0 + \alpha_1 EDI + \alpha_2 ROE + \alpha_3 LEV + \alpha_4 FIRST + \alpha_5 RID + \varepsilon$$

Model FEDI: $$RP = \alpha_0 + \alpha_1 FEDI + \alpha_2 ROE + \alpha_3 LEV + \alpha_4 FIRST + \alpha_5 RID + \varepsilon$$

Model NFEDI: $$RP = \alpha_0 + \alpha_1 NFEDI + \alpha_2 ROE + \alpha_3 LEV + \alpha_4 FIRST + \alpha_5 RID + \varepsilon$$

4.4.1 Data

The data are collected via Wind database and rearranged in Microdsoft Excel and Eviews 7.0. 6 industries out of 14 in the List are selected. The selected industries include mining, leather, paper-making, textile, pharmaceutical and chemical industry. SSE-listed companies in these industries are widely analyzed and tested in empirical researches. In general, these companies release environmental information in a more complete and comprehensive way. This thesis chooses industries in consistence with prior researches.

4.4.2 Correlation Analysis

Table 2 Correlation Result

		RP	**EDI**	**FEDI**	**NFEDI**	**ROE**	**LEV**	**FIRST**	**RID**
RP	Correlation	1.00000							
EDI	Correlation	0.21642***	1.00000						
FEDI	Correlation	0.15940**	0.88429***	1.00000					

NFEDI	Correlation	0.22017***	0.85140***	0.50796***	1.00000				
ROE	Correlation	-0.27737***	-0.21003***	-0.22684***	-0.13263*	1.00000			
LEV	Correlation	0.07821	0.33812***	0.32270***	0.26125***	-0.25282***	1.00000		
FIRST	Correlation	0.17784**	0.10386	0.04586	0.14008*	0.05639	-0.05885	1.00000	
RID	Correlation	-0.07447	0.00319	-0.02428	0.03316	-0.02414	0.00033	0.10806	1.00000

***,**,* represents significance on 1%, 5%, and 10% levels respectively.

Table 2 has implied that: (1) Environmental information disclosure bears a positive relation with reporting quality and passes the significance test on the 1% level, which is consistent with empirical hypothesis; (2) Financial environmental information disclosure bears a positive relation with reporting quality and passes the significant test on the 5% level. Although the correlation is not as significant as environmental information disclosure, the result is consistent with empirical hypothesis; (3) The quality of reporting is positively related to non-financial environmental information disclosure with significance on 1% level. This is consistent with empirical hypothesis. (4) ROE is negatively related with reporting quality. The correlation is significant on 1% level which is consistent with empirical hypothesis; (5) Leverage does not bear a significant correlation with reporting quality; (6) The top 1 shareholders' percentage shareholding (FIRST) is positive related to reporting quality on 5% significant level, which is consistent with empirical hypothesis; (7) The ratio of independent members in Board of Directors (RID) is not significantly related to the quality of reporting.

4.4.3 Regression Analysis

This thesis tests the relation between environmental information disclosure and reporting quality with collected data of high-polluting companies listed in SSE in 2016. Ordinary least squares (OLS) method is employed for regression. The regression result of 3 models is shown as follows:

Table 3 Regression Result

Variables	Model EDI	Model FEDI	Model NFEDI
EDI	0.081423** (1.905946)		
FEDI		0.048749 (1.113133)	
NFEDI			0.062715** (2.190685)
ROE	-0.147322*** (-3.466870)	-0.151201*** (-3.521295)	-0.151741*** (-3.610235)
LEV	-0.011338 (-0.366110)	-0.002914 (-0.094139)	-0.009496 (-0.313539)
FIRST	0.091791*** (2.494436)	0.098311*** (2.669572)	0.088508** (2.405416)
RID	-0.147638 (-1.375186)	-0.146152 (-1.350440)	-0.154302 (-1.442422)
C	0.003296 (0.074733)	0.009291 (0.209020)	0.006641 (0.152418)
F-statistic	5.390332	4.842978	5.657076
Prob(F-statistic)	0.000132	0.000377	0.000079
R-squared	0.144939	0.132167	0.151028
Adjusted R-squared	0.118050	0.104876	0.124331

***,**,* represents significance on 1%, 5%, and 10% levels respectively.

According to the regression models performed on the cross-sectional data in 2016, following conclusions can be drawn: according to model EDI, environmental information disclosure positively related to the reporting quality which is consistent with H1. The regression result indicates that disclosing environmental information improve the quality of reporting. Environmental information may be an advertising tool for corporates' image branding or a tool for window-dressing bad news. However, image branding does improve the reporting quality or does not provide the public with qualified information for decision making. Model two, however, implies that there is no significant relation between financial environmental disclosure and reporting quality. In other words, either strong or weak desire to disclosing financial environmental information does not basically influence the quality of decision-making related information. No strong proof can be found to justify H1a.This may be explained by the fact that financial environmental information is disclosed on a compulsory basis. Thus, in the reporting context, there is no room for companies to window-dress their earning or other decision-making information. From regression model NFEDI, we can draw conclusion as similar as model EDI. Non-financial environmental information disclosure bears a positive relation with reporting quality which is consistent with H1b. That is to say, more

description on non-financial environmental information can be less delusional and leads to confusing decision-making related information. And model NFEDI has a better regression result: higher R-square, higher t-Statistic and higher F-Statistic. Table 17, at the same time, provides insight of the relation between reporting quality and control variables which include ROE, Leverage, ownership and the board structure. Among all the control variables, ROE, representing profitability, is negatively related to reporting quality which accord with expectation. Reporting quality is negatively related to ROE and leverage, demonstrating that the more profit the company has gained and the higher debt-to-asset ratio, the higher the quality of reporting. Ownership concentration, on the contrary, is positively related to the reporting quality. The result is consistent with the hypothesis. Board structure, measured by the ratio of number of independent members in the board of directors has a negative relation with reporting quality. From the perspective of statistics, ROE and ownership concentration perform significantly on 5% or 1% level while leverage and board structure are not significant on the test. This may because of the small sample and limit time-span of the sample. Second, this thesis chooses to use the Jones model to calculate the discretionary earning as a proxy for reporting quality, which is based on rigid hypothesis and leads to bias.

4.5 Conclusions and Implications

The empirical results show that the although over half of the SSE-listed companies in high-polluting industry post environmental information through annual reports in 2016, quality and completeness is inferior; non-financial information is covered in a more comprehensive way; environmental information disclosure is positively related to reporting quality; financial environmental information disclosure is positively related to reporting quality, but not in a significant way; non-financial environmental information disclosure is positively related to reporting quality. The empirical results are consistent with the hypothesis.

This thesis also gives some implications from diverse perspectives but bears limitations. Firstly, in dealing with basic data, this thesis employs subjective content analysis method. Secondly, sample of this thesis source from one-year data, instead of panel data covering several years. Thirdly, this thesis only chooses 4 control variables: ROE, leverage, the share percentage that the top1 shareholder holds, and the ratio of independent member in board of directors which may not be complete. Further research with more rigid derivation and data selection is needed to remedy flaws of this thesis.