

# **Examining Business Perceptions of a Pollutant Release and Transfer Register in China**

A Case Study in Tianjin Economic-Technological Development Area

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## **Abstract**

Pollutant Release and Transfer Registers (PRTRs) have been adopted in developed countries since 1970s to help stimulate public participation, facilitate environmental regulation and promote industrial transformation, but have not been widely established in developing countries. In China, environmental pollution is increasing rapidly and has reached severe levels as a result of economic development in the absence of effective environmental regulation and adequate public pressure. During the current exploratory period for establishing a PRTR, China needs support and knowledge when it concerns PRTR schemes and the mechanisms of improving business behaviour. Aiming to examine the Chinese context and facilitate the implementation of PRTR, the author took a three months' field research with survey, interviews and symposiums in Tianjin Economic-Technological Development Area (TEDA) for the research. With how the business perceive a PRTR in China and how implementation need to be adjusted as the main research questions, the thesis author took a corporate angle and identified the main strengths, weaknesses, opportunities and threats (SWOT) for companies to implement a PRTR scheme in China. Based on this, the thesis author also suggests a governmental action model, formed of setting the platform, making preparation and providing incentives for businesses, to facilitate the implementation of PRTRs in China, which has the potential to inform policy makers and to be transferred into other parts of China.

**Keywords:** Pollutant Release and Transfer Register, Tianjin Economic-Technological Development Area, Strengths Weaknesses Opportunities and Threats Analysis, Corporate Perspective

## **Executive Summary**

As a consequence of unfettered pollution from expanding industry and rapidly developing economics, the environmental conditions have been deteriorating in China in the past decades. Nevertheless, sustainable development has been gradually emerging as a theme in the social development strategies of China. Considering the experience of Organisation for Economic Co-operation and Development (OECD) countries, implementing a Pollutant Release and Transfer Register (PRTR) can be an effective way to facilitate the actions targeted to resolve pollution problems and improve the state of the environment. Being in an exploratory stage of establishing its own PRTR, China is a country in the need of foreign support and knowledge transfer concerning PRTR schemes and the mechanisms for improving business behaviour.

This thesis departs from a practical need to engage Chinese companies in PRTR schemes and the knowledge gap on facilitating the implementation of a PRTR in China under the absence of any binding legislation in the area. The author therefore did a case study in Tianjin Economic-Technological Development Area (TEDA), which is a prospective area for transforming foreign knowledge and operating trial cases of environmental management, and performed a three month field research in the TEDA Eco Centre, based on the “Environmental Governance Programme – Developing a Pilot Regional Pollutant Release and Transfer Register in Tianjin Binhai New Area, China” (EGP – PRTR) Project.

This thesis researcher applied a variety of methods for data collection and analysis. Firstly, the author performed a literature analysis in the field of PRTR mechanisms in OECD countries, corporate PRTR experience of OECD countries and the implementation context for PRTRs in China. This literature analysis aimed to identify the fundamental characteristics of a PRTR scheme, review the experience of international companies reporting against PRTRs and understand the context for implementing a PRTR in China. Secondly, empirical data collection in TEDA was done during the research stay in TEDA Eco Centre, including a mixed source of data collected by attending four official exchange symposiums, conducting thirteen in-depth interviews with company representatives and related PRTR experts, and re-analysing the survey, named “Survey on the incentives and barriers for facilities to accept environmental information disclosure”. Thirdly, the collected data were analysed by the method of Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis to generate explicit findings.

The main outcome of this research is an outline of key factors structured by SWOT categories. For a general Chinese company to implement a PRTR, corporate environmental awareness, business development needs and requirements of internal environmental management systems form the main strengths; uncalled operation, no commercial return and weak social pressure from the main weaknesses; meeting national binding rules, responding to policy call of environmental authorities and satisfying the requirements of parent companies and the supply chain form the main opportunities; and leaking confidential information, being misinterpreted by the public and ruining the enterprise’s reputation form the main threats. Based on these findings, the EGP - PRTR project partners can stream their work towards the

minimization of constraining factors and enhancement of facilitating factors to promote the implementation of a PRTR in TEDA.

Besides, this thesis author also discusses how to improve the PRTR established in TEDA according to the OECD experiences analyses the practice experience of TEDA and concludes a governmental action model to facilitate the implementation of PRTRs. This action model consists of the steps of establishing a diverse platform; developing pollutant list and reporting formats; providing training; offering strong incentives, including media promotion, monetary awarding, sending appreciation letters and publically evaluating corporate environmental performance. These are supplementary inputs for Chinese decision-makers to design a PRTR scheme, and can be potentially learned and imitated by other parts of China.

Finally, based on the literature analysis for experience learning from the PRTRs in OECD countries and a research on the Chinese context for implementing a PRTR, the research also discusses how to improve the TEDA PRTR and establish a suitable PRTR for the specific Chinese context. The thesis is therefore not only meaningful for the EGP-PRTR project operated in Tianjin, but can also benefit the overall development of PRTRs throughout China.

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## **Abbreviations**

CEO	Chief Executive Officer
CSR	Corporate Social Responsibility
CEMS	Continuous Emission Monitoring System
CEPA	Canadian Environmental Protection Act
CERIA	Canada Emission Reduction Incentives Agency
CNEMC	Chinese National Environmental Monitoring Centre
CNPC	China National Petroleum Corporation
CPC	Communist Party of China
DEWHA	Department of the Environment, Water, Heritage and the Arts
EAA	Environmental Assessment Agency
ECE	Economic Commission for Europe
EEA	European Environmental Protection Agencies
EFR	Emission Factor Rating
EGP	Environmental Governance Project
EPA	Environmental Protection Association
EPCRA	Emergency Planning and Community Right-to-Know Act
EMP	Environmental Management and Policy
EMS	Environmental Management System
EU	European Union
E-PRTR	European Pollutant Release and Transfer Register
HSE	Health Safety and Environment
HQ	Headquarters
IIIEE	International Institute for Industrial Environmental Economics
IPE	Institute of Public & Environmental Affairs
GDP	Gross Domestic Product
GHG	Green House Gas
GIS	Geographic Information System
KML/KMZ	Keyhole Mark-up Language
MEP	Ministry of Environmental Protection
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NGO	Non-governmental Organization
NPI	National Pollutant Inventory
NPO	Non-profitable Organization

NPRI	National Pollutant Release Inventory
NRDC	Natural Resources Defence Council
NTN	National Toxics Network
N/A	Not Available
OECD	Organisation for Economic Co-operation and Development
PEM	Predictive Emission Monitoring
PI	Pollution Inventory
PRTR	Pollutant Release and Transfer Register
POP	Persistent Organic Pollutant
RETC	Registro de Emisiones y Transferencia de Contaminantes
RIVM	National Institute for Public Health and the Environment
RMB	Renminbi
R&D	Research and Development
SASAC	State-owned Assets Supervision and Administration Commission
SEPA	Swedish Environmental Protection Agency
SMP	Swedish Environmental Report
SOE	State-owned Enterprises
SWOT	Strengths, Weaknesses, Opportunities and Threats
TAC	TEDA Administrative Commission
TAP	Technical Advisory Panel
TBNA	Tianjin Binhai New Area
TEDA	Tianjin Economic-Technological Development Area
TEPA	TEDA Environmental Protection Association
TEPB	TEDA Environmental Protection Bureau
TRI	Toxic Release Inventory
TRIPS	Toxics Release Inventory Processing System
UK	United Kingdom
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNITAR	United Nations Institute for Training and Research
US	United States of America
US EPA	US Environmental Protection Agency
WGCRK	The Working Group on Community Right-to-Know

## Glossary of Terms

Aid the readers to ensure consistency in definitions and use of terminology.

**Aarhus Convention** - On 25th June 1998 in the Danish city of Aarhus, the UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters was adopted at the Fourth 'Environment for Europe' Ministerial Conference. The so-called Aarhus Convention has three pillars, dealing respectively with rights of access to information, rights to participate in certain types of environmental decision-making, and rights of access to justice. It provides a framework for carrying forward the considerable body of work, which has been undertaken on PRTRs, and establishing it on a legally binding footing. (OECD, 1998)

**EU-China Environmental Governance Programme (EGP)** - an EU funded program in the field of environmental governance to improve the environmental protection in China and to benefit the local people through the stimulation of public participation and increased public and private sector accountability in China (ECEGP 2012). As one main part of this program, since 2013, a two-year research and implementation project between TBNA and the International Institute for Industrial Environmental Economics (IIIEE) "Developing a Pilot Regional Pollutant Release and Transfer Register in Tianjin Binhai New Area China" has been on. This project aims to develop a pilot PRTR scheme in TBNA, then, based on the trial experience, further promote the national replication and establishment of a new environmental governance system in which information disclosure is open and transparent, enterprises have initiative to bear responsibilities, and the general public is actively involved. (TEDA Eco Centre 2013)

**Environmental Information Disclosure** - a broader conception than PRTR, which is generally defined as "public and/or private attempts to increase the availability of information on pollution to workers, consumers, shareholders and the public at large". (Tietenberg, 1998)

**Pollutant Release and Transfer Register (PRTR)** - a database or register of chemicals covering releases to air, water and land as well as wastes transported to treatment and disposal sites. (Peck P. & Voytenko Y. 2013; UNITAR PRTR, 2013)

**Reform and Opening - Up Policy** - refers to the Chinese economic reform called "Socialism with Chinese characteristics" in the People's Republic of China (PRC) started in December 1978 by reformists, led by Deng Xiaoping, within the Communist Party of China (CPC).

**Tianjin Binhai New Area (TBNA)** - also called Binhai New Area, is a district area within the jurisdiction of Tianjin Municipality, China, including the former subordinate districts of Hangu, Dagang and Tanggu, and twelve functional zones, Tianjin Economic-Technological Development Area, Tianjin Port Free Trade Zone, Tianjin Port, Tianjin Binhai High-tech Industrial Development Zone, Dongjiang Free Trade Port Zone, Sino-Singapore Tianjin Eco-City, Binhai Coastal Leisure and Tourism Zone, Central Business and Commercial Area, Seaport-based Economic Zone, Bestown Economic Zone, Tianjin Marine Economic Area and Qingfang Economic Area. (Binhai, 2013)

**TEDA Eco Centre** is a non-for-profit organization, supported by the TEDA Administrative Commission and regulated by TEDA Environmental Protection Bureau. It was founded in 2011 and aims to set platforms for information service, business cooperation and international knowledge transfer, with an overall goal to promote the low-carbon economic development in TEDA. TEDA Eco Centre is the coordinating organization of the EGP - PRTR project. (TEDA Eco Centre, 2013b)

**TEDA Environmental Protection Agency (TEPA)** - an association of business companies in TEDA for achieving collaborative environmental protection. Companies in TEDA can voluntarily join the TEPA and elect the director. The committee of TEPA is integrated in the TEDA Environmental Protection Bureau (TEPB), and the TEPB keep the daily operation of TEPA.

**Tianjin Economic-Technological Development Area (TEDA)** - the main free economic zone and central part of TBNA. It was created in 1984 and has been ranked the top for fifteen years in the comprehensive appraisal on investment environment among all state-level economic development areas by the Ministry of Commerce in China. (TEDA, 2013)



# 1 Introduction

This chapter introduces the research background and clarifies the research question. It also pinpoints research limitations and describes the targeted and potential audience of the thesis.

## 1.1 Background

In China, there is a contradiction between economic development and environmental protection. Since implementing the Reform and Opening-Up Policy, China has achieved rapid development, as it has industrialized rapidly, alleviated poverty, improved education and gained people longer life expectancy. (Jiabao Wen, 2013) However, as a consequence of unfettered pollution from expanding industry and a lack of environmental regulation, the state of the environment has been declining. (Keqiang Li, 2012) Especially, in the year of 2013, the severe urban air pollution spread over eastern Chinese megacities (China Daily, 2013) has promoted the awareness and understanding of both the government and the general public about environmental risks in China. (P. J. MOL, Guizhen H. & Lei Z., 2011)

Matching the global trend, sustainability has gradually become a theme in the social development of China. As we can tell from the transformation of development themes of China, set by the Communist Party of China (CPC), which serves as an indication showing the trend of social development, it has changed from human conquering nature (1949-1978), to economic growth given top priority (1979-2003), to a scientific approach to development (2004), to harmonious society (2006) (more detailed, called to control total pollution discharge (2006), improve energy efficiency (2006), develop circular economy (2006)), reduce carbon emission (2009) and pursue low carbon development (2011). Furthermore, the public has grown to distrust the current evaluation systems and development indicators, which are monetary market values oriented. (Wanxin Li, 2012) Since the 1990s, a new mode of growth or a new form of economy has become an urgent trend called in China, which is an environmental friendly way of improving the wealth of human-being, and at the same time, preserving natural resources, reducing pollutions and ensuring social equity. (State Council, 1994)

Considering the experience of developed countries, implementing a Pollutant Release and Transfer Register (PRTR) is a potential way to resolve pollution problems and improve the environment of China. Following the traditional governmental administration and market-based mechanisms (Delmas et al., 2010), environmental information disclosure has been the third wave of environmental policy, emerging and serving as an important component of environmental regulation in major developed countries. (Campbell & Craig, 2005) Being the main form of environmental information disclosure at facility level, the PRTR is defined as a national or regional environmental inventory or database of pollutants released to air, water and land, transferred off-site for treatment or disposal, or other diffused hazardous chemical substances. It helps stimulate the public participation, improve the governmental environmental regulation and promote the industrial transformation. (UNECE PRTR, 2013) In view of its nascent and deficient development condition of environmental information disclosure, China is a country in the need of support and knowledge from developed countries concerning PRTR schemes. (TEDA Eco Centre, 2013b)

## 1.2 Problem Definition and Research Questions

The overall and long-term target of the research is to promote the establishment of a new environmental governance system, where information disclosure is open and transparent, enterprises have initiative to bear responsibilities, and the general public is actively involved. (TEDA Eco Centre, 2013b) With an aim to achieve the goal, the current deficiency in

governmental regulation, corporate performance and public participation form the barriers for Chinese governments. Facilitating the implementation of a PRTR, which helps improve governmental regulation, transforming the corporate performance and attracts public participation, is therefore the main research motivation.

Representing an initial attempt to assess the implementing environment of a PRTR in China, this research faces the problems that there is limited literature introducing the Chinese context for establishing a PRTR, solving the barriers of implementing the PRTR and introducing the related foreign experience. Furthermore, as business corporations play essential roles during the process of PRTRs, a knowledge gap and the nascent state of researching those problems from a corporate perspective forms the main research problem for this thesis.

With the support of the “Environmental Governance Programme (EGP) – Developing a Pilot Regional Pollutant Release and Transfer Register (PRTR) in Tianjin Binhai New Area (TBNA), China” (EGP – PRTR) project, this thesis research aims to provide knowledge to academia, decision makers and other relevant actors on the factors facilitating and constraining the implementation of a PRTR in China. Furthermore, based on analysing the pilot experience in Tianjin Economic-Technological Development Area (TEDA), which has been adjusted according to corporate prospects, this research also suggests an action model to facilitate the implementation of PRTR for national replication. Therefore, the main research questions of this thesis are:

- **How do Chinese Companies Perceive the PRTR?**
- **How the Implementation of PRTR need to be Adjusted?**

### 1.3 Scope and Limitations

This research is based on a case study in TEDA, with limited research scope covering the main business corporations in TEDA and potential barriers for spreading the research findings to other contexts of China. A discussion on the special characteristics of TEDA and spreading the TEDA PRTR experience to other parts of China is conducted by the research.

There are other circumstances of restrictions and constraints faced by this thesis, setting the boundaries of the research. Firstly, based on a governmental oriented project implementing environment, the on-site research practice depends on the allowance of related authorities. Moreover, as the survey and symposiums organized by environmental authorities and the interviews carried out by the assistance of TEDA Eco Centre, the responses of companies were influenced by the indirect effect of governments to a certain extent. Furthermore, parts of the research plan match the historical practice of environmental information disclosure in TEDA, which is the same in principle yet slightly different from the thesis research proposal. For example, the survey has been done here coherently by TBNA and was designed to analyse the facilitating and constraining factors for enterprises to implement environmental information disclosure in TBNA. It is therefore not necessary to do a similar survey again, the author then asks for all the related survey findings and reanalyse them for the needs of this thesis research. However, the differences between general environmental information disclosure and specified PRTR schemes, and the confusion between internal and external factors during the process of analysing the facilitating and constraining factors form significant limitations of the thesis research. These limitations have been made up by conducting thirteen interviews, with company representatives in TEDA and environmental information disclosure experts outside TEDA, which are subject to less governmental influence and especially designed for the thesis research questions (See Appendix I).

## 1.4 Audience

The target audience of this thesis includes the International Institute for Industrial Environmental Economics (IIIEE) project research team, TEDA Eco Centre, the Institute for Public and Environmental Affairs (IPE) as well as governmental representatives, environmental organizations, business actors, industrial facilities, academia, public citizens and other actors concerned with environmental information disclosure and environmental protection primarily in TEDA but also in other parts of China. Furthermore, the potential audience of the thesis also includes actors in other developing countries, who need to refer to the Chinese experience to facilitate the implementation of local PRTRs.

## 1.5 Disposition

Chapter one introduces the background, presents the problem addressed in this research, pinpoints research limitations and also describes the audience.

Chapter two clarifies various research methods of the thesis, including literature analysis, personal observation, survey and interviews for data collection, and the SWOT framework for data analysis.

Chapter three gives a general introduction of PRTR, elaborating on the different mechanisms of implementing PRTRs in typical OECD countries, and introduces the foreign corporate experience facing a PRTR.

Chapter four analyses the special context for implementing a PRTR in China, including the legitimacy of environmental information disclosure, the current operating status from both the governmental and industrial perspectives, and the barriers and problems.

Chapter five introduces the findings of the thesis, which is made of three parts, the situation of Chinese companies taking in PRTRs, the prospects for Chinese companies to accept a PRTR, and an adjusted implementation model for the PRTR in TEDA, Tianjin, China.

Chapter six discusses how to improve the current PRTR scheme of TEDA, based on the experience and knowledge learned from OECD countries, and analyses the necessity and barriers for spreading the TEDA PRTR mechanism into other parts of China.

Chapter seven concludes concisely the thesis research.

## 2 Methodology

Taking advantage of the convenience and feasibility of collecting research information during the on-site internship in TEDA Eco Centre, which is the coordinating organization for EGP - PRTR project, this thesis combines various research methods such as literature analysis, personal observation, survey and interviews for data collection, and further adopts the SWOT analysis as its main data analysis method.

### 2.1 Methods for Data Collection

The thesis specifies the following approaches and related sources for data collection:

#### 2.1.1 Literature Analysis

This thesis research is based on the literature sources including academic literatures, OECD official documents, PRTR portals in different countries and other related documents and is benefited from the databases of Lund University libraries, especially the IIIIEE library, the on-line library of Nankai University and the data sources of TEDA Environmental Protection Association (TEPA), TEDA Environmental Protection Bureau (TEPB) and TEDA Eco Centre. The resource searching approach is associated with the research questions, targeting for the purpose of referring to the PRTR experience in OECD countries and to understanding the Chinese context for implementing a PRTR.

As a basis of the research, a review of literature in the field has been done to identify the fundamental characteristics, including background, developing progress, and current operating condition and mechanisms, of a PRTR scheme in typical OECD countries. Literature analysis is also conducted to refer to the experience of international companies reporting against PRTRs and to understand how governments, industry, academia, social organizations and the public perceive a PRTR. Furthermore, the thesis have gained and used secondary data, especially the presentation materials and study trip findings of the on-site training sessions for EGP – PRTR EU visiting group from TEDA China.

#### 2.1.2 Participant Observation

The author has joined several PRTR implementation activities during the on-site research period in TEDA and gained lots of practical observation and important findings. First of all, the author has attended and documented two, and gained meeting minutes of the other two out of the four symposiums, named “TEDA enterprise exchange symposium for environmental information disclosure”, which have been carried out by TEDA Administrative Commission on 11th March, 11th April, 18th June and 18th July 2013. These symposiums were joined by the leaders of the TEDA Administrative Commission, directors of the TEDA EPB, officers of the TEDA EPA, the director of the TEDA Eco Centre, the manager of the EGP-PRTR project, IIIIEE representatives including the author, the Chief Executive Officer (CEO) and/or Health Safety and Environment (HSE) managers from 44 enterprises in TEDA (See Appendix II). Such symposiums were designed for 1) explaining the necessity and urgency of environmental information disclosure along with the details of related domestic laws and regulations, 2) introducing the current situation of environmental information disclosure in TEDA and the worldwide development status, more importantly, 3) exchanging views with enterprises on their interests, incentives, worries, conditions and plans for implementing a PRTR, and 4) exploring how to facilitate the implementation of a PRTR.

Furthermore, the author has collected information or gained participant observation by lots of other PRTR related events. For instance, on 15th April 2013, under the support of EGP - PRTR project, the First Training on Environmental Information Disclosure in Company

Level of TEDA was held by TEPA and TEDA Eco Centre. The training introduced the details of the Guidelines on the Disclosure of Environmental Information for TEDA Enterprises (Trial), including the scoped pollutant list and the reporting methods. The training also explained promoting efforts and related encouragement policies offered by the TEDA Administrative Commission (TAC). More than seventy corporate directors or HSE managers from over fifty enterprises of TEDA participated in this training and shared views on the PRTR. Moreover, during the research period in TEDA Eco Centre, the author attended two PRTR experience-learning seminars between TEDA and the Suzhou Industrial Garden on 16th July 2013, and the Dongying Economic Development Area on 20th August 2013. During these seminars, the officers of environmental authorities discussed on mechanisms of pollutant regulation, especially shared experience on implementing a PRTR in different context of China, which have significantly benefited the thesis research.

### **2.1.3 Survey**

As another fundamental research method, the author has gained information and related documents of the survey named “Survey on the incentives and barriers for facilities to accept environmental information disclosure”. The survey was mainly designed by Professor Shi Han from the City University of Hong Kong, and has been conducted by TEDA Eco Centre since 2012. The survey was carried out in four parts of the TBNA, including TEDA, Tianjin Port Free Trade Zone, Harbour Industrial Zone and Binhai Hi-tech Industrial Development Zone. 41 survey responses from the sources covering such main company groups as Chinese state-owned facilities, Chinese private enterprises, foreign owned international companies, joint ventures between China and foreign countries, have been gained by the research.

Based on the information obtained, the author reanalysed the survey, consisted of 1) interviewing people involved in the implementation of the survey, including the designer, operators and statistical clerk, to understand the processing details of the survey, 2) compiling the data and responses in a different way of SWOT analysis, and 3) taking some of the key themes of the survey to examine them in depth by literature, symposiums and/or by conducting interviews with company representatives to check more deeply on how they perceive.

This survey is useful for thesis research not only for its significant relevance with the research questions of understanding how the Chinese companies perceive PRTRs and analysing how the implementation of PRTR can be facilitated. Moreover, based on the survey findings, the TEDA environmental authorities had adjusted governance mechanisms for promoting the PRTR since 2012 and achieved practical experience, which helps generate another thesis finding on how to adjust the facilitating mechanism according to corporate prospects.

### **2.1.4 Interviews**

The author conducted several in-depth interviews with company representatives, main stakeholders and PRTR experts, with an aim to examine the knowledge of Chinese companies on PRTRs, to check the research findings, to understand the TEDA PRTR facilitating mechanism, to acquire the information about the outcomes of PRTR and to conclude practice experience. (See Appendix V)

The interviewee selection criteria for companies in TEDA is diverse, and the thesis author therefore chose the supervisors of HSE issues from the companies, covering various industries and representing different characteristics such as nationality, state owned or private, listed or unlisted, hazardous chemical related or not and various experience level of environmental information reporting; The interviewee selection criteria for related

stakeholders of TEDA PRTR is representativeness, and the thesis author therefore chose the representatives from the TEDA Eco Centre and the IPE, which are two of the main partners for the EGP-PRTR project, as interviewees; The interviewee selection criteria for experts of environmental information disclosure in China is convenience, and the thesis author therefore chose familiar professors and former supervisors, who are also experts in related areas, as interviewees.

Table 2-1. Details of the Interviews with Corporate Representatives

Company Name	Nationality / Industry	Related Characteristics	Interviewee Information	Interview Details
Guohua Energy (Tianjin) Co. Ltd.	China / Energy	Hazardous chemical related; State-owned.	CEO	Interviewed on 2nd Aug. 2013 (25 minutes) Personal & Documented
Cenway Pharmaceuticals Co. Ltd.	China / Pharmaceuticals	Hazardous chemical related; Listed.	HSE Department Officer	Interviewed on 21st Aug. 2013 (32 minutes) Phone & Documented
Tianjin TEDA Bio-Pharmaceutics Engineering Co., Ltd.	China / Pharmaceuticals	Encouraged.	HSE Vice-Manager	Interviewed on 22nd Aug. 2013 (30 minutes) Phone & Documented
Novozymes (China) Co. Ltd.	Denmark / Biotech	TEDA PRTR engaged; Hazardous chemical related; Listed.	HSE Manager	Interviewed on 2nd Aug. 2013 (40 minutes) Personal & Documented
Samsung (Tianjin) Vision Mobile Electronics Co., Ltd	Korea / Electrics	TEDA PRTR engaged; Encouraged.	HSE Manager	Interviewed on 21st Aug. 2013 (28 minutes) Phone & Documented
Samsung (Tianjin) Communication Technology Co., Ltd	Korea / Electrics	TEDA PRTR engaged; Hazardous chemical related.	Environment and Safety Department Manager	Interviewed on 20th Aug. 2013 (25 minutes) Phone & Documented
Cargill (Tianjin) Foods Co., Ltd	United States of America (US) / Foods	Illegal environmental performance and punished before; Hazardous chemical related.	HSE Manager	Interviewed on 21st Aug. 2013 (30 minutes) Phone & Documented
General Electric (GE) Semi-Conductor (China) Co., Ltd	US / Electrics	Hazardous chemical related; Listed.	HSE Manager	Interviewed on 21st Aug. 2013 (23 minutes) Phone & Documented
PPG Coating (Tianjin) Co., Ltd	US / Coating	TEDA PRTR engaged; Hazardous chemical related.	HSE Manager	Half-interviewed (See excerpts below) on 21st Aug. 2013 (5 minutes) Phone & Documented

Source: The Author

Table 2-2. Details of the Other Interviews

Corporation Name	Related Characteristics	Interviewee Information	Interview Details
The Institute of Public and Environmental Affairs (IPE)	Leading research institute of environmental information and typical non-governmental organization (NGO) in environmental protection of China	Project Manager	Interviewed on 5th Jun. 2013 (60 minutes) Personal
The TEDA Eco Centre	The coordinating centre of EGP-PRTR project	EGP-PRTR Project Manager	Interviewed on 12th Jul. 2013 (70 minutes) Personal & Documented
Nordic Institute of Asian Studies (NIAS)	A special research institute of Asian Studies lies in Copenhagen Denmark, offering student SUPRA scholarship for two weeks' thesis stay	Professor of Shanghai University and Visiting Scholar in NIAS	Interviewed on 4th and 8th Sep. 2013 (40 minutes) Personal
Hong Kong City University	The consultant of Eco-TEDA and the EGP-PRTR project	Professor; Director of the Public Policy Department.	Interviewed on 17th Aug. (90 minutes) Personal & Documented
Tsinghua University	The expert of environmental information disclosure in China	Professor; The Public Administration School.	Interviewed on 17th Aug. (20 minutes) Phone & Documented
Nankai University	Expert and governmental consultant of Tianjin Binhai New Area (TBNA)	Professor; The Zhou En'lai School of Government	Interviewed on 18th Aug. (50 minutes) Personal

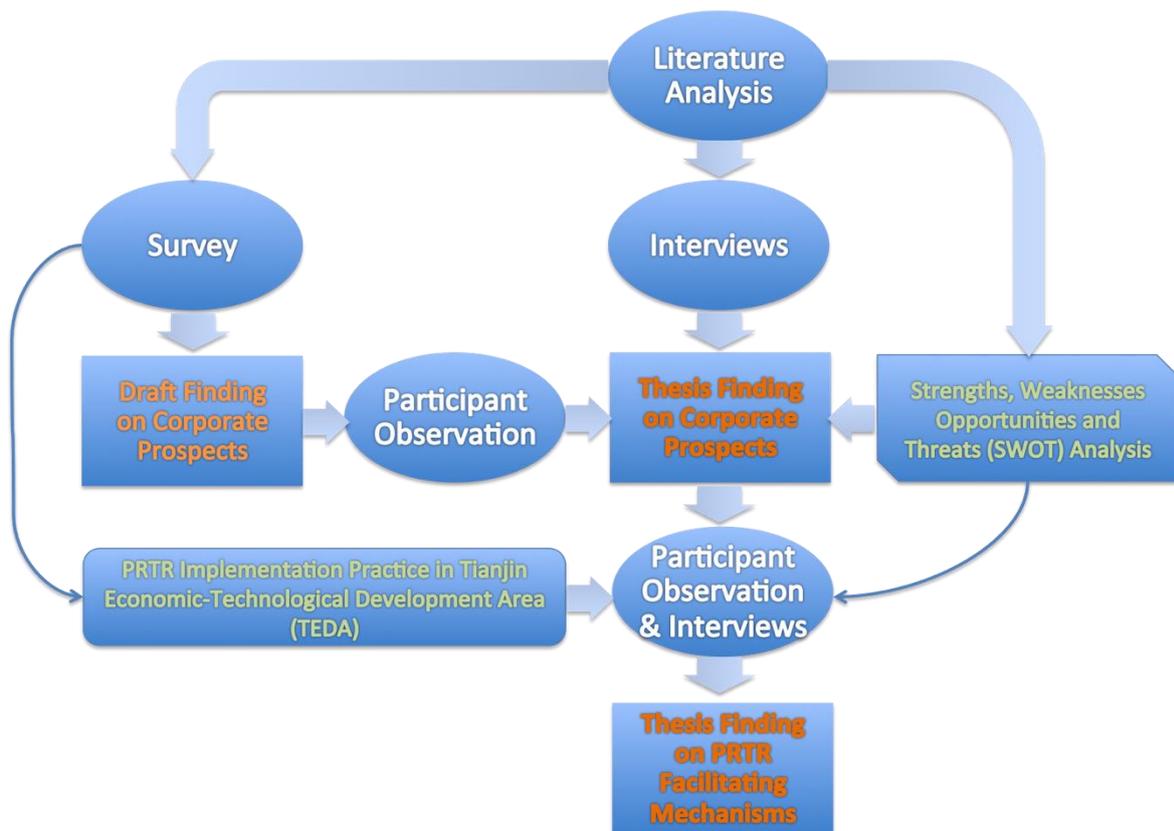
Source: The Author

## 2.2 Methods for Data Analysis

In order to analyse adequately the prospects of corporate corporations for PRTR, the thesis author uses the SWOT analysis as the main method for data analysis. The SWOT analysis was developed between the 1950s and the 1960s, credited to Albert Humphrey (Humphrey Albert, 2005), as a notable advance in strategic thinking. It is designed to analyse an organisation's internal and external environment with the aim of identifying internal strengths, taking advantage of external opportunities, addressing the organisation's weaknesses and avoiding external threats (Panagiotou, 2003; Ghazinoorya, 2011). It is applied not limited to profit seeking, yet widely used in the process of decision-making and achieving the goals or objectives set by the organization (Davide Viaggi, 2013).

SWOT analysis groups key business influential factors into two main categories: internal factors, including the strengths and weaknesses inside the organization, and external factors, consisting of the opportunities and threats presented by the environment outside the organization. Concisely, "strengths" means "the characteristics of a business that give itself advantage relative to others"; "weaknesses" means "the characteristics that place the team at a disadvantage compared to others"; "opportunities" means "elements that a business exploits or transfers to its advantage"; and "threats" means "elements in the external environment that could cause trouble or form barrier for the business". (Naga Jyothi et. al, 2008)

Figure 2-1. Approach and Methods of Research



Source: The Author

### **3 The PRTR Experience of OECD Countries**

This chapter presents an international background and builds a context for further data collection and analysis. Firstly, it gives a detailed introduction on the PRTR mechanism and generates common and differentiated experience of PRTR in different OECD countries. Besides, this chapter elaborates the mechanisms of implementing PRTR in several typical OECD countries, which is significantly relevant for the experience learning of TEDA, China. Finally, the chapter also analyses and introduces the corporate experience for implementing a PRTR in OECD countries, in order to form an overall reference of the OECD experience and provide specified enlightenments for the thesis research.

#### **3.1 The PRTR and Its Benefits**

A PRTR is a database or register of chemicals covering releases to air, water and land as well as wastes transported to treatment and disposal sites. (Peck P. & Voytenko Y. 2013; UNITAR PRTR, 2013) An operational PRTR has a potential to deliver a number of benefits for different actors, such as assisting the environmental management of governments, improving the operating performance of business sectors and facilitating the public participation on environmental issues.

A PRTR, when adapted to national or local needs, can assist governments in tracking the information of pollutant emission, regulating hazardous chemical substances, examining the administration process, evaluating the progress of environmental policies, checking the policy effect over time, and setting priorities of regulation for different types of released and transferred pollutants. (UNECE PRTR, 2013) Based on these, governments are facilitated to make proper policy and improve environmental regulation, while lessening their burden of the traditional demand-control regulation, which requires strict monitoring and enforcement efforts.

As to industry, a PRTR can support targeted facilities carry out their pollution prevention actions. Acting as a self-monitoring system for companies, it helps stimulate saving resources and reducing emission. These result in efficiency rise, cost saving and the reduction of negative environmental impact simultaneously. Furthermore, a PRTR is also a benchmarking scheme in introducing and promoting industrial technological improvement for cleaner production within the same industry. (UNECE PRTR, 2013)

A PRTR is also an important tool for various social organizations. Non-governmental Organization (NGO), Non-profit Organization (NPO) and other social organizations use and disseminate emission information to achieve their goals, such as tracing the environmental performance of business enterprises and improving the administrative behaviours of governmental authorities. Academic research institutes use PRTR data for researching, modelling or other related studies. Financial organizations evaluate proposed investment by assessing the information of reliability or sustainability information generated from PRTR data.

More fundamentally, a PRTR benefits the public and ideally help build a better-informed society. It reflects that the right to know is fulfilled, possible risks to humans and the environment is alerted, sources and amounts of potentially harmful releases or transfers are identified and occurred pollution is publically informed. (OECD, 1996a)

## 3.2 PRTR Mechanisms in OECD Countries

The PRTR mechanisms can be analysed from the perspectives of why pursue a PRTR, who is registered, what pollutants are registered, how often data is registered, how to generate the data, how to monitor and audit, how to report and publicize, supplements and current trends, which are the main components of a PRTR scheme. Based on examining the experience of typical OECD countries, this thesis chooses one or two countries with representative mechanism to introduce each perspective.

### 3.2.1 Why Pursue A PRTR

According to the World Resource Institute Report, three main forces have triggered pursuing a PRTR are: 1) the urgency of environmental problems; 2) the increase of activism in civil society; and 3) the developments in information technology and means of communication. (Petkova, Maurer & Henninger, 2002)

Different countries have various backgrounds of PRTR pursuit. For example, in Australia, for decades before implementing the National Pollutant Inventory (NPI) system, environment, union and community groups as well as the minor political parties had campaigned for 'community right-to-know' legislation and access to information about chemical emissions, storage and pollution. A turning point came with the major chemical fires at the Coode Island, which was a large chemical storage site surrounded by homes, in August 1991. Mass evacuations were carried out, leaving people keeping afraid that this will happen in their suburb. The Coode Island Review panel approached a local community and environment organization (Hazardous Materials Action Group) to prepare a report on community right-to-know, "Unlocking the Factory Door" (Adams P. & Ruchel M., 1992). At the same time in rural Australia, the growing number of transported chemical spills, the incidences of pesticide drift and contamination of rivers and creeks led regional local communities to demand the information of targeted pollution on agricultural chemicals. Furthermore, the international pollutant management practice influenced Australia, as most groups were aware of the US Toxics Release Inventory (TRI) and its associated community right-to-know provisions. As to the development of information technology, in 1990, members of National Toxics Network (NTN) worked on a research project to develop 'community right-to-know' chemical information systems, based on Geographic Information System (GIS) technology, which benefit the establishment of the NPI.

### 3.2.2 Who Is Registered for PRTR

The domain of facilities that must report to a PRTR is typically determined by reporting thresholds, such as the number of employees, production capacity, or the amount of chemical used, processed or produced by the facility. Facilities that exceed specified reporting thresholds for a chemical are required to report to PRTR. (OECD, 1996a)

More detailed information of reporting thresholds can be found in Table 3-1.

*Table 3-1. Reporting Thresholds of Typical OECD Countries<sup>1</sup>.*

*(Abbreviations: kg for kilogram; yr for year; MWh for megawatt-hour; MW for megawatt; lbs for pounds)*

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<sup>1</sup> In 2012, the OECD Task Force of PRTR launched an activity to compare sectors and their reporting thresholds among different PRTRs, in order to produce a harmonized list of sectors, improve the comparability of PRTR data and form the basis for the future development of core elements for a global PRTR.

PRTR / Kiev Protocol	General Thresholds		Sector-Specific Thresholds
	Employees	Activity	
Australia NPI	No employee threshold	Chemical usage <sup>A</sup> (5 to 25,000 kg/yr) <sup>B</sup> Annual fuel combustion <sup>A</sup> (400,000 to 2,000,000 kg/yr) <sup>B</sup> Hourly fuel combustion <sup>A</sup> (1,000 kg/hour) <sup>B</sup> Energy usage <sup>A</sup> (60 MWh) Power rating <sup>A</sup> (20 MW) Emission / transfers <sup>A</sup> (3,000 to 15,000 kg) <sup>B</sup>	Employee threshold applies to certain sectors
Canada National Pollutant Release Inventory (NPRI)	20,000 employee hours	Manufacture, process, or otherwise use <sup>A</sup> (5 to 10,000 kg/yr) <sup>B</sup> Release, disposal, or transfer for recycling <sup>A</sup> (50 kg/yr) Activity <sup>C</sup> Air releases <sup>A</sup> (300 to 20,000 kg/yr) <sup>B</sup>	Facilities in certain sectors must report regardless of employee threshold. Facilities in certain sectors are exempt from reporting if annual production falls below a threshold.
European Pollutant Release and Transfer Register	No employee threshold	Air releases <sup>A</sup> (0.0001 – 100,000,000 kg/yr) <sup>B</sup> Water releases <sup>A</sup> (0.0001 – 2,000,000 kg/yr) <sup>B</sup> Land releases <sup>A</sup> (0.0001 – 2,000,000 kg/yr) <sup>B</sup> Offsite transfers of waste <sup>D</sup>	Facilities in certain sectors are exempt from reporting if production capacity falls below threshold. Facilities in certain sectors are exempt from reporting if annual production falls below a threshold.
Kiev Protocol (Two Threshold Options) <sup>E</sup>	No employee threshold	Air release <sup>A</sup> (0.001 – 100,000,000 kg/yr) <sup>B</sup> Water release <sup>A</sup> (0.001 – 2,000,000 kg/yr) <sup>B</sup> Land release <sup>A</sup> (0.001 – 2,000,000 kg/yr) <sup>B</sup>	Facilities in certain sectors are exempt from reporting if production capacity falls below threshold.
	10 full-time employees	Manufacture, process, or use (0.0001 – 10,000 kg/yr) <sup>B</sup>	Facilities in certain sectors are exempt from reporting if annual production falls below a threshold.
Japan PRTR	21 regular employees	Annual amount handled (1 ton or 0.5 ton) <sup>B</sup>	Facilities in certain sectors must report regardless of annual amount handled threshold. Additional capacity and activity thresholds apply to facilities in certain sectors.
US TRI	10 full-time equivalent employees	Manufacture (0.0001 kg to 25,000 lbs / Around 11337 kg) <sup>B</sup> Process (0.0001 kg to 25,000 lbs / Around 11337 kg) <sup>B</sup> Otherwise use (0.0001 kg to 25,000 lbs / Around 4535 kg) <sup>B</sup>	Not Available (N/A)

Source: OECD, 2013

A Whether a threshold applies depends on the chemical.

B The threshold amount varies across chemicals.

C Threshold only applies to certain chemicals and is based on whether or not the facility engages in a list of specified activities.

D Covered facilities must report waste transfers of hazardous waste if the amount of hazardous waste transferred off site exceeds 2 tons. In addition, covered facilities must report waste transfers of other waste if the amount of other waste transferred off site exceeds 2,000 tons.

E The Kiev Protocol recommends that PRTRs be designed such that the chemical reporting thresholds be based either on 1) Quantities of the chemical released and transferred by media; or 2) Number of employees and quantities of the chemical manufactured, processed, or used.

### 3.2.3 What Pollutants Are Registered for PRTR

Although there are about 1,200 chemicals registered by PRTRs worldwide, only fourteen of them are common to all PRTRs in different countries. (OECD, 2009) Chemicals and industry sectors are the two key elements identifying the chemicals reported.

The registered pollutants of PRTRs normally include emissions to air, surface waters or land, which are generated from different emission types of release, transfer and diffuse sources. For example, according to the EU PRTR protocol, each member state shall ensure that its PRTR system includes releases of pollutants, off-site transfers and releases of pollutants from diffuse sources (UNECE PRTR, 2013). For instance, in the Netherlands, the Emission Register system contains annual release data of more than 350 pollutants to air, soil and water, which covers the whole process of collecting, processing and reporting of those emission data. Besides, the diffuse emissions from individual point sources, such as companies are also calculated from national statistics by task forces and stored into central database. (RIVM, 2013)

### 3.2.4 How Often Are Data Registered for PRTR

As to how to design the periodic reporting for the PRTR system, typically, the EU protocol stipulates that each member party need to ensure that the required information is publicly available, compiled and presented on the PRTR register by every calendar year. As to implementation, each member party needs to treat the calendar year after the protocol entering into force as the first reporting year. Furthermore, the EU PRTR protocol makes different requirements for two groups of member parties. The party members, who are not regional economic integrated, need to ensure their information is incorporated into the register system within fifteen months after the end of each reporting year. Especially for the first reporting year, the information can be incorporated within two years from the end of the reporting year. The party members, who are regional economic integrated, shall ensure the information is incorporated and registered within six months afterwards. (UNECE PRTR, 2013)

### 3.2.5 How to Generate the Data of PRTR

According to the PRTR experience of the OECD countries, facility operators generally determine (mainly by estimation) their own emissions and transfers, while diffuse emissions from households and other sources like motor vehicles are estimated by governmental agencies. As in the PRTR documents of Switzerland state, measuring emission is often difficult and time-consuming, especially if the information needs to be valid for the entire year. Therefore, generating the data either by estimation (based on assumptions and model calculations) or by appropriate calculation models (based on substance balances or emissions factors) can be better than direct monitoring or other kinds of measurements, which are not necessarily more precise while adding tremendous cost and regulation burden. (Switzerland PRTR, 2013)

In Australia, the criteria of generating the emission data are based on how much fuel, electricity and the amount of NPI substances the facility used. Firstly, facilities are suggested to draw a process flow diagram of their operations, including the estimation of chemical substance used, in order to help identify the emission points of NPI substances and the potential emission streams. Afterwards, the facilities can start to estimate their emissions, with the help of calculation tools provided, such as computer spread sheets, databases and/or other software tools. They can either use a single calculation tool or combine a tool with other ones. Facilities can also choose to use offline mechanism or the NPI online calculating and

reporting system. (NPI, 2013) In detail, the general calculation methods include: mass balance, engineering calculations, direct measurement (monitoring) and emission factors.

a) Mass balance: identifying the substance quantity getting into and out of the entire facility or the equipment process and calculate the emissions by the difference between input and output of each specified chemical substance, taking into consideration the accumulation or depletion of that substance inside the equipment; (NPI, 2013)

b) Fuel analysis or engineering calculations: mathematically calculate the emission data by using the physical/chemical properties of each specified chemical substance, or can also rely on theoretical models for specific processes to calculate; (NPI, 2013)

c) Sampling or direct measurement: carry out periodic sampling or continuous monitoring to measure the concentrations of the substance in certain process or waste stream, for instance, the commonly used Continuous Emission Monitoring System (CEMS) that provides a continuous and adequate record of emissions, for example, in the form of concentration, over time; (NPI, 2013)

d) Emission factors: relates the quantity of specified substances emitted from the facility to some common activity related to those emissions, in the form of the weight of the substance emitted multiplying the unit weight, volume, distance, or duration of the activity emitting the substance. Based on this, the Emission Factor Rating (EFR) code is generated, in which A stands for excellent, B for above average, C for average, D for below average, E for poor and U means unrated, representing a decreasing certainty degree of the test results; (NPI, 2013)

e) Approved alternative methods: the state or territory environment agency provides the facility with written approval to choose other different technique that is not specified in the NPI system, while has to base this on its robustness and the ability to be reviewed and verified on the alternative technique. For instance, Predictive Emission Monitoring (PEM) is one of the alternative methods, which is based on the correlation between pollutant emission rates and process parameters. (NPI, 2013) The facility has to obtain such written allowance before the facility calculates and submits the emissions report.

### **3.2.6 How to Monitor and Audit for PRTR**

Generally, once the information is correctly categorized in the PRTR system, the government authorities are in the position to track the information consistently over time.

According to the EU PRTR protocol, each party is required to assess and assure the quality of the information that the facilities report, from the perspectives of completeness, consistency and credibility. For instance, there is a unique measuring series and an extensive system for PRTR monitoring in Sweden. (Sweden PRTR, 2013) Besides individual member's mechanism, there also exists a general management, monitoring and auditing scheme for the whole protocol, combining with the proper functions of the United Nations Economic Commission for Europe (UNECE), the United Nations Environment Programme (UNEP), United Nations Institute for Training and Research (UNITAR), and the UNECE Aarhus Convention Secretariat. Furthermore, the newly founded International PRTR Coordinating Group helps to spread the PRTR experience worldwide and serves to promote the capacity-building for PRTR systems, especially in developing countries. (UNECE PRTR, 2013)

The American TRI system has set special requirements for data recordkeeping, targeting at accurate and efficient TRI reporting scheme. In detail, facilities are required to keep a copy of their report for at least three years after the submission date. Together with the report,

facilities must keep and maintain other documents, such as calculation details, worksheets and extra forms related to the final reports. All these documents are likely to be requested by EPA and used for further analysis and future reports. (TRI, 2013) Besides record keeping, the TRI also specifies the approach of revising TRI data. As to new monitoring data, new emission factors, new chemical concentration data, recalculation or others, facilities may want a revision and submit a request form. For other errors that exist in the database of the Toxics Release Inventory Processing System (TRIPS) yet not revised, the US Environmental Protection Agency (US EPA) may take enforcement action to improve the accuracy of the data, or impose civil administrative penalties on facilities for the following reasons: omitting major source of emissions, not using the most readily available information, no reporting records or other reasons, such as mathematical or transcriptional or typographical errors. (TRI, 2013)

### **3.2.7 How to Report and Publicize the Data of PRTR**

As to whether reporting in a voluntary or mandatory way, typically, OECD countries ask facilities beyond thresholds to mandatorily report their release data, and, at the same time, encourage other facilities to voluntarily disclose their information. As a special case, Mexico tried to set up a PRTR system only based on voluntary reporting. However, the Mexican system was challenged by the poor outcomes during voluntary reporting and the importance of mandatory reporting was backed by NGO, with the support of government. Furthermore, the absence of the legal standards regarding the list of substances also leaves it open for companies to disregard addressing all chemicals identified until legal standard takes effect. Eventually, the industry recognised the difficulty of accomplishing consistent and reliable results by a voluntary program and started to offer to integrate PRTR reporting with other existing requirements and simplify the industrial reporting scheme in general. Currently, companies under federal jurisdiction are required to comply with PRTRs. (OECD, 1996b)

For publicizing the PRTR data, the OECD countries are generally operating based on web-based mechanisms. As the EU PRTR protocol stipulates that the register needs to be designed for the maximum public access through electronic means, especially the Internet or other public telecommunications networks, the PRTR data shall be made continuously and immediately available. The member parties shall also ensure that the public access to PRTR information is free of charge. (UNECE PRTR, 2013) For instance, in Sweden, based on the permit regulation and environmental reports (Swedish Portal for Environmental Reporting), the publicizing of PRTR data is operated by a GIS mapping scheme, through which the Swedish EPA shows the emission data from point and diffuse sources in the unit of country or municipality according to a web-based map grid where each square measures one multiply with one kilometre. (Sweden PRTR, 2013)

### **3.2.8 Current Trends and Supplements of PRTR**

In order to encourage facilities to use cleaner production techniques to reduce substance emissions and decrease waste, reporting facilities have the option to report their cleaner production activities and current pollution control developments undertaken during the specified reporting year. As in the US, facilities can indicate their environmental performance by showing the reduction of hazardous substance, pollutant or contaminant, the decrease of the hazards to the environment and public health, the increase of recycling, energy recovery, or by introducing equipment or technology modifications, product redesign, pollution prevention, housekeeping improvements, training, inventory control or substitution of raw materials. (TRI, 2013) Furthermore, in order to attract and facilitate the public to take interest in PRTR, several countries have publicized specified PRTR information by means of GIS, which is based on Keyhole Mark-up Language (KML/KMZ) files operating with Google Earth or other GIS mapping tools. For instance, Sweden has implemented this mechanism

since 2010, which has been established by the United Kingdom (UK), the US and Canada in 2008.

The credibility of the reported data and the reporting risks of leaking business secrets are generally the two main worries for countries implementing a PRTR. As a result, the Australian Department of the Environment, Water, Heritage and the Arts (DEWHA) is working on a project with state and territory governments to improve the NPI, with a main aim to gradually guarantee the data quality by means of coding the equations, setting the validation mechanism, capacity-building and updating emission estimation technique manuals. (NPI, 2013) As to the reporting exemption, the US stipulates that the laboratory activities, the coal extraction activities, the metal mining beyond threshold can be exempted, and also allows the exemption from trade secret claims based on two versions (“unsanitized” version and “sanitized” version) of substantiation forms submitted by facilities. (TRI, 2013) This also exists in the Japanese context. As in the case of trade secrets, the Japanese facilities need to directly report the data to the state government, and then the competent ministers will oversee and coordinate the business. (Japan PRTR, 2013)

### **3.3 PRTRs in Representative OECD Countries**

Against the background of increasing public concerns about the management of chemical substances and environmental protection, based on Principle 10 of the 1992 Rio Declaration on the United Nations Conference on Environment and Development and 1998 Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, developed countries have widely established PRTR systems since 1980s. (UNECE PRTR, 2013) By 2000, 44 countries had passed access-to-information legislation (World Bank, 2002), and by 2006, almost 70 countries had established their PRTR systems (Banisar David, 2006). An reference on the mechanism of different OECD countries has been conducted by the thesis research to set the basis for understanding the PRTR prospects of foreign companies, generate knowledge for improving and also testifying the TEDA PRTR facilitating mechanisms.

#### **3.3.1 European Union (EU)**

The EGP – PRTR project is an EU funded program and will build on years of experience of the OECD countries, particularly focusing on EU experience. Therefore, the experience in PRTRs of the EU serves as the main learning resource for the thesis research.

The PRTR of EU is based on the Kiev Protocol on PRTR, which is the first legally binding international instrument on PRTRs. Its objective is "to enhance public access to information through the establishment of coherent, nationwide PRTRs". (OECD, 2000) The EU PRTR is designed to be a global protocol, which means countries that are not members of the Economic Commission for Europe (ECE) or the Aarhus Convention are also included. The protocol became international law binding since 8th October 2009. By 26th September 2012, 29 countries have ratified the protocol, and the EU PRTR is currently applied to 32 countries, including 27 EU member states, Iceland, Liechtenstein, Norway; Switzerland and Serbia (voluntary). (UNECE PRTR, 2013)

With a large application scope, the protocol sets the minimum requirements of implementing PRTR for its members, based on which, member parties can stipulate additional pollutants and specifically design their PRTR systems. It is operated in a form of annual reporting covering 91 pollutants. (EEA, 2013) The EU PRTR makes a difference, as it contributes to transparency and public participation in the process of environmental decision-making not only at European level but also in certain specified countries: it empowers citizens to engage

in environmental matters and bargain with the industrial sectors; and it provides important data input for governments and other actors, such as institutions, academia, and NGOs. (EEA, 2013)

### **3.3.2 The Netherlands**

The Netherlands has been a forerunner of implementing PRTR from the beginning. Since 1974, a number of organizations have been working closely together in pollutant register project to collect and formally establish the yearly releases register system in the Netherlands. Result of this project serves to underpin the EU environmental policy. (RIVM, 2013)

In the Netherlands, on behalf of the Ministry of Infrastructure and Environment, the National Institute for Public Health and the Environment (RIVM) coordinates the annual Emission Register. According to a standard protocol, the national emission for each specified source is collected and processed. Especially, there are different emission experts from various participating organizations, named the Task Forces, calculating the final national emissions from 1,200 emission sources. After intensive checking, the emission figure is potentially to be authorized by the project leader of the Emission Register, and the Environmental Assessment Agency (EAA) keeps the record after publishing the information. (RIVM, 2013)

### **3.3.3 Sweden**

Sweden has implemented the PRTR, achieved significant improvements, and generated meaningful experience. Furthermore, as where the IIIIEE, who hosts this project research, lies in, Sweden need to be paid special attention for the thesis research.

According to the environmental reporting rules stipulated by the SEPA (NFS 2006/9), and implemented by the Environmental Code, Ordinance on Environmentally Hazardous Activities (MPF 18/6), Ordinance on Environmental Sanction Charges and Regulation on Environmental reports, the Swedish PRTR contains annual emission data in the quantities of main chemical substances from large facilities. The implementation of Swedish PRTR was launched in 2007 and is based on providing targeted companies with permit for their activities and emission. In order to have such permit, facilities have to submit environmental reports to the supervisory authorities annually. It is mandatory for an operator to have a self-monitoring system and the operators shall submit the environmental report electronically via the website of the Swedish Environmental Report (SMP), which is continuously supervised by regional and local competent authority parties. (SEPA, 2013) Based on the reports, it forms the register database containing the emissions of approximately 7,000 facilities in Sweden, which will be shown publically. (Sweden PRTR, 2013; SEPA, 2013)

With the rule that corporate environmental information is considered public and available to everyone, in the Swedish PRTR system, data about the plants, emissions and wastes from the SMP replicates once a day, and is generally used by students for their education, the public with special interest, the environmental journalists for media purpose, and the environmental researchers for academic and research purpose. Furthermore, the Swedish PRTR data is reported to the EU every year, with a typical reporting process of 1) reporting by operators, 2) checking data quality and clarifying responsibilities, 3) data review and 4) reporting by the government. (SEPA 2013)

### **3.3.4 Australia**

As a main player of OECD, Australia is very important when generating the OECD PRTR experience since it has diverse condition as an immigration country with well-protected environment, it has representative geology as an isolated continent lying in the southern

hemisphere, and it has similar process since implementing national PRTR based on two successful pilot cases.

NPI forms the Australian national PRTR system, which is unique in tracking emissions across Australia and coordinated by the Department of Sustainability, Environment, Water, Population and Communities. The legislative framework of the NPI is the National Environment Protection Measure (NEPM), which was initiated by the National Environment Protection Council (NEPC) on February 1998. (NPI, 2013) Especially, before the implementation of NPI, Australia had made preparative testing on two trial cases, compiling and presenting NPI data in southeast Queensland and Kalgoorlie, Western Australia. Besides, there also formed a project team to draft the NEPM and impact statement, and established a non-government organization advisory group to ensure industry, environment and community concerns were considered into NEPM and organized an independent Technical Advisory Panel (TAP) to determine a methodology for evaluating substances to be included in the NPI and design the reporting list. Furthermore, certain related public meetings and symposiums were held around Australia. As to the implementation of NPI, local governments, with their state and territory environment protection agencies, set up their own legislative frameworks, which have to be in compliance with the NPI NEPM. To ensure the effectiveness of the system, all jurisdictions must report their progress in implementing the NEPM to the NEPC annually. (NPI, 2013)

### **3.3.5 Other OECD Countries**

As another representative of EU member, Switzerland is a special one for three reasons: distinctive environmental protection results, facing relative more cross-border pollution problems, and has been the research and conference centre of the OECD PRTR. The SwissPRTR is a publicly accessible register system that provides information on pollutant releases into air, water or land, and on pollutant transfer into wastewater. The legal basis of SwissPRTR is the ordinance on pollutant release and the transfer (PRTRO, SR 814.017), which is entirely based on the UNECE PRTR Protocol, the UN Economic Commission for Europe Protocol on PRTR, ratified by Switzerland in 2007. (Switzerland PRTR, 2013)

Used to be the leading industrialized country, the UK had faced urgent pollutant problems in history. With proper operating PRTR system, UK has achieved distinctive protection results and accumulated important experience. In the UK, the Pollution Inventory (PI) provides basic release and transfer information about pollutant substances generated by various industrial activities. As in other countries, the PI system requires each relevant facility to report annually the quantities of specified substances released to air, land and controlled waters and also the transferred pollutant off-site into wastewater, including such details as the type and fate of the wastes. Furthermore, most industrial sectors also need to report data or have to provide explanation on resource efficiency. (PI, 2013)

Playing as the largest economic unit and also being widely considered a forerunner in operating PRTR system, the US deserves China's learning from. In the US, the TRI has been set up as a substantial pollutant release and transfer registering mechanism since 1990. It has the legislation basis from Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA) of the year 1986, Public Law 99-499 and came into force in 1991. (TRI, 2013)

Although it is another North American country close to the US, Canada implements a different PRTR system. Furthermore, Canada has lots of similarities with China, such as its roughly same land area and diverse pollution condition inside the country. In Canada, the National Pollutant Release Inventory (NPRI) plays the role of PRTR as a legislated, publicly

accessible inventory of pollutant release, disposal and transfer data. The NPRI is managed by Environment Canada and has its legislation basis from Sections 46–53 of the Canadian Environmental Protection Act 1999, which contains information-gathering provisions and requires the Minister of the Environment to establish a national inventory of releases and transfers of pollutants, and to report the substantial information. Owners or operators of facilities meeting the reporting requirements are required to report to the NPRI. The reported information includes comprehensive emission summaries, trends for key air pollutants and emission estimates for other sources, such as motor vehicles and residential heating, based on facility-reported data. (NPRI, 2013) Afterwards, the Environment Canada needs to summarize and post the completed information, following the requirements processed by the Canada Emission Reduction Incentives Agency (CERIA).

As the representative of Asian countries, Japan, in response to the OECD recommendation, has established a PRTR system subject to the Environment Agency of Japan (the present Ministry of the Environment) in 1999. The Japanese PRTR requires specified businesses to estimate the amounts of chemical substances they released and transferred, and report the data to local governments. After compiling, the national government publicizes those data submitted. (Japan PRTR, 2013)

Mexico is also necessarily to be considered since Mexico is a representative case of developing country with significant relevance for China. Furthermore, in the case of Mexico, they used to try to base the system on voluntary reporting mechanism and generate meaningful experience during the process. The system, along with the database, is called the “Registro de Emisiones y Transferencia de Contaminantes” (RETC) and has been implemented since 2006. RETC makes toxic pollution release and transfer data publicly available on all federally regulated industrial plants, more than 1,000 currently. (WGCRK, 2006)

Table 3-2. PRTR Operating Conditions of Typical OECD Countries

Country	First year of data collection	Mandatory or voluntary system	Number of listed chemical	Diffuse sources included	Report cycle	Public Dissemination of data	Pilot study	Consult with affected and interested parties on design	Site specific reporting
Australia	1998	Mandatory	90	Yes	Annual	Yes	Yes	Yes	Yes
Canada	1993	Mandatory	245	Yes	Annual	Yes	Yes	Yes	Yes
Japan	2001	Mandatory	N/A	Yes	Annual	Yes	Yes	Yes	Yes
Mexico	1997	Both	191	No	Annual	Yes & No <sup>A</sup>	Yes	Yes	Yes
Netherlands	1976 <sup>B</sup>	Mandatory	180	Yes	Annual	Yes & No <sup>A</sup>	Yes	Yes	Yes
Sweden	N/A	Mandatory	N/A	Yes	N/A	N/A	Yes	Yes	Yes
Switzerland	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Yes	N/A
United Kingdom	1991 <sup>C</sup>	Mandatory	183	Yes	Annual	Yes	No	Yes	Yes
United States	1987	Mandatory	643	No	Annual	Yes	No	Yes	Yes

Source: OECD, 2000

Based on the compiled results of government responses to the 1999 OECD PRTR questionnaire.

N/A: Not available or not answered

A “Yes” for public dissemination of full (raw) data; “No” for public dissemination of aggregated data sets.

B 1998 for new system

C 1999 for new system

### **3.4 Corporate PRTR Experience of the OECD Countries**

Although there are lots of approaches, such as ensuring employment and stakeholders rights, providing a safe working environment, improving the community relations and supplier relations, for enterprises to show their corporate social responsibility. Information disclosure, especially environmental information disclosure, has been a main action trend as it helps facilitate the fulfilment of the other targets of taking social responsibility, at the same time, it can assist in improving the corporate environmental management, identify opportunities for pollution prevention, saving resources, recycling waste, increasing communication with workers, community and other stakeholders. However, according to the OECD countries experience, even though the PRTRs can help exploit the strengths and assist in utilizing the opportunities of enterprises, the business actors are still widely trapped into the weaknesses for implementing a PRTR and concerned about the potential threats carried out by a PRTR.

#### **3.4.1 Corporate Facilitating Factors for A PRTR in OECD Countries**

Information is critical for companies to understand and act on risks and to stimulate safer and cleaner alternatives. PRTRs play an important role in forming corporate environmental policies through providing the enterprise decision-makers with an independent and authoritative source of information about pollutant releases and transfers. (Rory Sullivan & Andy Gouldson, 2007) Furthermore, in a specific industry, PRTRs can act as a benchmarking scheme to improve the corporate environmental performance. For example, as indicated by specified industry research, chemical firms often know very little about their supply chain and are not aware of the chemicals used further up or down the supply chain. It is therefore virtually impossible to manage chemicals properly without the knowledge on chemical used. (ESPR, 2005) Testified by the research on the oil refining industries in Europe and the US, the data published by governments through PRTRs are of much more value than other forms of corporate environmental reports from the perspective of comparing the environmental performance of different companies or sites in certain industry. (Rory Sullivan & Andy Gouldson, 2007) Furthermore, information disclosure policies act as a stronger impetus for a change, to help enterprises to identify opportunities for achieving greater efficiency in production while reducing environmental impacts. According to a survey on the TRI in the US, 46.7% of the sampled companies reported that the TRI helped them to identify the needs and opportunities for source reduction. (Theo de Bruijn & Vicki Norberg-Bohm, 2001)

Externally, corporate information can also be used as the signal, which is one key component of the main conceptual streams in the instrumental stakeholder theory<sup>2</sup>. (Jones & Wicks, 1999) Information, disclosed by the enterprises, serves as an important reference when stakeholders make evaluations and decisions. That is also the reason that the PRTRs' environmental information has showed influence on financial performance of firms. (Klassen & Whybark, 1999) A study conducted by the PricewaterhouseCoopers on what performance factors influence and attracts investor shows that 54 % of investors and analysts believe environmental performance, which is basically showed in the environmental information disclosed, is particularly valuable. (Humphrey Albert, 2005) A research on the association between environmental performance and financial performance of public-listed companies, engaged in the NPI, in Australian Stock Exchange market made by the Management School of the University of Waikato, also shows there is close connection between environmental performance and financial performance.

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<sup>2</sup> The basic premise of instrumental stakeholder theory is that "if firms contract with their stakeholders on the basis of mutual trust and cooperation, they will have a competitive advantage over firms who do not" (Jones, 1995).

Moreover, the pressure from regulatory stakeholders, like legislative and governmental authorities, is another important facilitating factor for companies to implement a PRTR. Regulatory pressure can be defined as the extent to which governments can modify a company's operations based on their environmental performance. (Delmas & Toffel, 2004) Governments and legislatures can promote the improvement and bring behaviour changes of corporate environmental performance by employing multiple "carrots and sticks". (Rugman & Verbeke, 1998; Dasgupta et al., 2000) Firstly, legislation may lead to penalties and governments have the power and capacity to exert criminal enforcement. Secondly, government authorities can also use such market-based incentives as trading permits and deposit-refunds, to comply with traditional command and control methods. (Stavins, 2003) Currently, there is a trend of environmental management that the regulators play a "facilitator" role rather than a 'coercer' one to employ environmental information disclosure strategies for improving firms' environmental performance, for example, affecting firms' competitive position (Porter & V. D. Linde, 1995), modifying firms' pollution prevention strategies (Buysse & Verbeke, 2003), and influencing companies' internal management practices. (Delmas & Toffel, 2004)

In conclusion, based on the human rights of the willingness to know and the existence of environmental information asymmetry between business sectors and other stakeholders, the internal incentives such as improving corporate image, identifying improvement potential, benchmarking with competitors, achieving better financial performance, and external promotion from the public, and other related stakeholders, especially the regulative actors coherently forced greater data availability and corporate environmental information disclosure. (Gerde & Logsdon, 2001)

### **3.4.2 Corporate Constraining Factors for A PRTR in OECD Countries**

First of all, implementing a PRTR causes certain amount of cost to the business corporations, which constrains lots of companies to join the PRTR scheme voluntarily. According to the experience of the TRI in the US, corporate environmental information disclosure brings at least the following costs: the expenses for establishing inventory and reporting systems, staff training and operating labour fee, budget for environmental contracting and public relation keeping, and more importantly, the potential huge cost for improving, upgrading or even changing the former business operation and production line under the public pressure or administrative requirements. As indicated in a national survey research on the TRI, complying with TRI regulations can directly cost more than one thousand dollars per year. (ESPR, 2005)

Besides, companies' size and experience might form another barrier to implement a PRTR. Researches on Japanese companies demonstrated that smaller-sized companies and newly founded companies tend to disclose information with limited scope and content. It is therefore necessary to set clear criteria for PRTR implementing mechanism, disclosing requirements, the minimum reporting contents, and the reporting thresholds. By these criteria, the small-sized companies or newly founded companies will also generate standard PRTR data to facilitate comparative analysis and achieve more desirable environmental disclosure effects. (Katsuhiko et al., 2001)

Moreover, although different countries design varied policies and set specific mechanisms to manage, leaking confidential business information is still a main concern and serious worry of the companies facing the PRTR scheme. According to OECD experience, in Canada and the US, enterprises who report information to the NPRI or the TRI may submit a written request identifying the confidential information and noticing that revealing the information would be revealing trade secrets. (CEC, 2002) Indeed, the number of reports deemed as business secret is small and authorities denied most of such requests criteria laid down in laws and regulations.

Otherwise, governmental authorities issue a determination of confidentiality and block the disclosing process of the environmental confidential information. (CEC, 2002)

Overall, an amount of investment and operating cost to implement a PRTR scheme, weaknesses caused by the characteristics of specified small-sized and newly founded business corporations and threats for enterprises as leaking business secrets, form barriers and constrain the business actors to accept and implement a PRTR.

## 4 The Context of China for Implementing PRTR

This chapter analyses China's context for implementing a PRTR, in terms of the legitimacy of environmental information disclosure, the current operating status from both the governmental and industrial sides, and the barriers and problems for implementing a PRTR.

### 4.1 Legislation

The legislation on environmental protection in China has a relatively short history dating back to 1989, the start of the implementation of the Environmental Protection Law, which forms the basis for environmental information disclosure in China. (Gong Cheng W. & Li You H., 2008) It has increasingly developed after that, yet in a slow pace.

The MEP (the former State Environmental Protection Agency of China) issued the first regulation in 2003 on environmental inspection and public disclosure of environmental performance for companies accessing or refinancing on the stock market. (P. J. MOL, Guizhen H. & Lei Z., 2011)

The Cleaner Production Promotion Law of the Year 2004 has been fundamentally instrumental in assisting informational governance, as it enables the Ministry of Environmental Protection (MEP) and local environmental protection agencies to publicize environmental data of non-complying companies by public media. (Mol & Liu, 2005)

In 2005, the State Council promulgated the Decision on the Implementation of Scientific Development for Strengthening Environmental Protection, which set further explicit requirements on the disclosure of environmental information. It points out the need to implement an environmental quality noticing system and sets regular indicators for local environmental protection, which includes disclosing the information of urban air quality, urban noise, and drinking water quality, the status of watershed and coastal waters, and ecological condition evaluation. (MEP, 2013a)

In 2007, the State Council promulgated the "The regulations on government information disclosure", stipulating that environmental information is one of the main duties of governmental information disclosure. (State Council, 2007) The main motivations behind are to alleviate the information asymmetry between different actors, in order to gain political credit by achieving transparency and to improve the governmental administrative process. (Wang, Greer & Lin, 2008)

After that, MEP (the former state EPA) issued the Measures on Open Environmental Information (for Trial Implementation) (MEP, 2008), which is currently the only specific governmental rules legally regulating the environmental information disclosure and clarifying the reporting mechanisms. (Gong Cheng W. & Li You H., 2008) It stipulates that environmental information is clustered into four major categories: laws and regulations, quality, management and supervision, and accidents and emergency responses. (P. J. MOL, Guizhen H. & Lei Z., 2011) Furthermore, it stipulates that the environment information disclosure of facilities follows the principle of combining mandatory and voluntary mechanism, meaning general facilities can voluntarily publicize their environment information, while facilities exceeding certain specified emission threshold must disclose their data publically, based on the Clean Production Promotion Law (17-31). (MEP, 2013a) Especially, serious polluting enterprises that discharge above emission standards must disclose, without any exemption, the information of four categories: the company's name, address and the name of its legal representative; the concentration and volume of each pollutant and its discharge mode; the environmental facilities in operation; and the company's emergency response plan.

(P. J. MOL, Guizhen H. & Lei Z., 2011) It also specifies how and within what time frame environmental information need to be provided to the public, and requires the establishment of monitoring, evaluation and supervision systems.

On December 2011, the State Council stipulated the Twelfth Plan of National Environmental Protection, which promotes the establishment of environmental monitoring system and the transformation of economic development mode, resulting in evident reduction of total pollutant emission. Based on this, recently in 2013, MEP, State Statistical Bureau, National Development and Reform Commission, National Ministry of Supervision jointly implement the “Announcement of implementing the “Twelfth Five-year Plan on quantity control, reduction counting and monitoring mechanism of main pollutant”, which stipulates “polluting companies are required to disclose subjectively monitored emission data through publically feasible forms”, and “companies with objectively monitored emission data are required to disclose them instantaneously”. (MEP, 2013d)

Furthermore, legislations as the ones targeting heavily polluting industries related to lead, publicly listed companies that discharge heavy metals (MEP, 2011), justice rules as “Supreme Court Rules on Hearing Administrative Cases on Government Information Disclosure” (Supreme Court, 2011), official notices as “The notice of strengthening the work on environmental information disclosure” (MEP, 2012a) and “The name-list of plants that had adopted less than desirable technologies” stipulated by the Ministry of Industry and Information Technology in 2010, promotes to transform and improve the environmental information disclosure practice in China.

These indicate that China has preliminarily established a system of environmental information disclosure, and has promoted the transformation of environmental management mode from the traditional government-oriented with multi-stakeholder involvement into shared burdened open environmental regulation pattern with information disclose measures. However, an evident lack of legislation on environmental information disclosure of at general facility level, except for certain specified stipulation on quoted companies, forms an urgent problem for China. (Guo Chuan, Sun Ye & Lian Jie, 2007; Gong Cheng W. & Li You H., 2008)

## **4.2 Current Status**

The current status of PRTR in China can be examined from the perspectives of the condition of governmental environmental information disclosure and the condition of corporate environmental information disclosure, including the emission data disclosure.

### **4.2.1 Governmental Environmental Information Disclosure**

Following the legislation and policies of the State Council, the central government of China has formed mechanisms of environmental monitoring, including ambient environmental quality monitoring, compliance monitoring of pollution sources, monitoring under an emergency situation, and monitoring for environmental management functions. (Wanxin Li, 2012) The local governments have generally formulated environmental information disclosure measures (interim), mechanisms of implementation, specified rules, disclosure details and established coordination, news spokesman system or information clarifying and modifying mechanism. Some cities formulated a confidential review of environmental information disclosure system, and a few local governments even established the system for public appraisal on government environmental information disclosure, social request and accountability system, to continuously monitor the information disclosure behaviours. (DMEI Conference, 2009) A review of the provincial EPAs’ websites in 2010 proved that, the websites of 30 environmental protection agencies of local governments have a direct clickable

link to the item of information disclosure, whereas there were only 21 provinces in 2008, and twenty-one of the thirty websites have online application request forms for environmental information disclosure, which are the same as the website of the MEP. (P. J. MOL, Guizhen H. & Lei Z., 2011)

In particular, for the current disclosed environmental information provided by the government to the public, air quality related information forms the main part, which is largely influenced by the widely public concern on urban air pollution. Based on the new version of the State Standard of Environment and Air Quality, further stipulated by the Implementation Mechanism of Monitoring the new Version of State Standard of Environment and Air Quality during the first period (MEP, 2012b), 74 cities with related 400 and 96 state-controlled monitoring spots have been included in the national environmental information disclosure system. Since 1st January 2013, the data collected by this system has been disclosed publicly, with a focus on the concentration of PM 2.5. Besides, MEP publishes the weekly report on sectional water quality of main water bodies, covering 131 monitored units. (MEP, 2013c)

The publicizing media for China's current environmental disclosure is mainly web-based media, typically the official websites of the governmental environmental protection departments. Besides, there are also other disclosing means, such as news conference, environment bulletin, newspapers, magazines, radio and television stations, as well as through the establishment of a public reading rooms, information request spot and other forms as electronic information screens in public areas. A large quantity of emission data has been collected and published by the Chinese National Environmental Monitoring Centre (CNEMC), the Water Quality (The Water Quality, 2013a), and the Air Quality Index, which is disclosing primary air pollutants, overall level of air quality, and level of pollution, for 113 designated key cities. (Wanxin Li, 2012; The Water Quality, 2013b)

#### **4.2.2 Corporate Environmental Information Disclosure**

The practice of environmental information disclosure by business corporations in China started since a pilot research in the City Zhenjiang of Jiangsu Province in 1998, led by the World Bank and the MEP of China. (Shijun Zhang, 2007) This is a facility assessment scheme with criteria of pollutant emission, quantity control, administrative punishment, the operation of pollutant control equipment and citizens' complaint. Based on the information gained, the government implemented different regulative measures, and disclosed information of corporate environmental related behaviours on April annually through public media. (Zhenjiang Government, 2011) Since the beginning of 2000, the trial case of Zhenjiang has expanded from 91 companies into over one thousand facilities spreading over other cities. (China Environmental News, 2000) Based on this trial practice, the MEP stipulated, on November 2005, that local governments are generally required to implement corporate environmental information pilot practices and developed areas are required further assess facilities' disclosure behaviours. Moreover, from the beginning of 2006, cities in China need to widely implement a mechanism of evaluating corporate environmental behaviour by 2010. (Gong Cheng W. & Li You H., 2008)

In early 2007, the MEP published a list of more than six thousand industrial polluters on its website, who are required to install automatic monitor and control systems that are directly connected to local environmental protection agencies. (P. J. MOL, Guizhen H. & Lei Z., 2011) According to the accounted data of main pollutant facilities scoped by the MEP's automatic controlling and coordinating platform, up until April 2013, there are 169 heavy pollutant facilities, including main state-owned companies, have been continuously monitored on their emission of the main pollutants as Carbon Dioxide, Sulphur Dioxide, Nitrogen Oxide and Soot.

Currently, there are two types of firms requested to disclose their environmental information on a mandatory basis in China. According to the Bulletin on Disclosure of Corporate Environmental Performance published by the MEP on September 2nd 2003, firms that discharge pollutants above the threshold specified must disclose their related information of the previous year by 31st March every year. Besides, based on the executive policy orders of 2003:101 and 2007:105 issued by the MEP, firms belong to one of the specified industrial sectors, elaborated by Table 4.1, that apply for public listing or refinancing in the stock market must go through environmental audits and publicize the results by audit reporting. (S. X. Zeng et al., 2012)

Especially for the heavy metal industry, in the year 2012, MEP, National Development and Reform Commission, together with seven other governmental agencies launched a national special action on regulating main pollutant facilities and ensuring public health. Based on this, MEP set up a “special column for information disclosure of main industries” on its official website, through which, MEP disclose the information of 2,940 mining and smelting facilities, 799 leather tanning facilities, 4,131 electroplating facilities and update the information of 1,151 lead accumulator facilities and 3,617 centralized sewage treatment plant, in order to have them supervised by the public. (MEP, 2013c)

Except the specified industrial sectors, other firms are encouraged to disclose environmental information on a voluntary basis. Especially, in the Chinese context of environmental information disclosure, the phrase “governmental encouragement” initially has more influence on State-owned Enterprises (SOE)<sup>3</sup> than private firms. SOE often play as pioneers during implementing new regulations, including voluntary environmental information disclosure. (S. X. Zeng et al., 2012) Especially, on 31st July 2013, the MEP promulgated the Procedures on Self-Monitoring and Information Disclosure of Key State-owned Enterprises, asking for 15,797 key state-owned enterprises to voluntarily monitor pollutant emission and disclose the monitored emission data to the public. The procedures basically sets the threshold that companies with pollutant emission 65% or more out of the total industrial discharge and companies with heavy metal pollution need to self-monitor and publically disclose their pollutant emission data. It covers the emission to air, water bodies and noise pollution, yet without requirements for land related pollutant. The procedures stipulate that local governments in province and city level, with their associated environmental authorities, need to set uniform platform for corporate environmental information disclosure. At the same time, companies can also publicize emission data by other supplementary media forms, as publically accessible websites, newspapers, radio or television. (MEP, 2013e)

To sum up, there are three main environmental information disclosure forms, environmental reports, sustainable reports and corporate social responsibility reports. (Zhu Jinfeng & Yang Xiuqiang, 2008) The Haier Environmental Reports of 2005 was the start point of facility practice. Since 2006, lots of state-owned, influential huge companies, including State Grid, China National Petroleum Corporation (CNPC) and Sinopec, have widely started disclosing environmental reports in certain forms. By 2007, at least 40 Chinese companies had publically disclosed their environmental reports. (Gong Cheng W. & Li You H., 2008)

*Table 4-1. State Specified Industrial Sectors of China*

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<sup>3</sup> According to China Stock Market Accounting Research database, at April 2011, about 984 SOEs have been listed in the stock market, accounting for 45% of all the listed companies.

Main Industry Category	Associated Sub Industry Categories
<b>Agriculture</b>	Farming; Forestry; Animal husbandry; Fishery.
<b>Mining industry</b>	Coal mining and processing; Petroleum and natural gas mining; Ferrous metal mining and processing; Non-ferrous metal mining and processing; Non-metal mining and processing; Mining support activities; Others.
<b>Manufacture industry</b>	Agricultural and side-line products manufacture; Foods manufacture; alcohol, Beverage and refined tea manufacture; Tobacco manufacture; Textile manufacture; Clothing/Fashion; Leather, fur, feather and associated products, and shoe manufacture; Woods processing and woods, bamboo, rattan, palm, grass related products manufacture; Furniture manufacture; Paper and paper-based products manufacture; Printing and duplicating; Culture, painting, sports, entertainment products manufacture; Petroleum processing, coking and nucleus fuel Manufacture; Chemical raw materials and chemical products manufacture; pharmaceutical manufacture; chemical fibre manufacture; rubber and plastic products manufacture; non-metallic mineral products manufacture; ferrous metal smelting and rolling processing; non-ferrous metal smelting and rolling processing; metal products manufacture; general equipment manufacture; specific equipment manufacture; automobile manufacture; railway, ship, aviation and other transport equipment manufacture; electrical machinery and equipment manufacture; computer, communication and other electronic equipment manufacture; instrument manufacture; other manufacturing; comprehensive utilization of waste resources; metal products, machinery and equipment repairing.
<b>Electricity, heat, gas and water production and supply industry</b>	Electricity, heat production and supply; gas production and supply; water production and supply.
<b>Construction industry</b>	Housing construction; Building construction; Construction related installation; Architectural decoration and other construction.
<b>The tertiary industry</b>	Wholesale and retail trade; Transportation, storage and postal; Accommodation and catering; Information transmission, software and information technology services; Real estate; Leasing and business service; Science and technology service; Water conservancy, environment and public management; Residents service, repair and other services; Education; Health and social work; Culture and education and entertainment; Public management and social organization; International organizations.

*Source: National Bureau of Statistics of China, 2011; Table Made by the Author.*

### 4.3 Implementation Problems

A lot of factors pose the barriers for implementing a PRTR in China, including the non-complete governmental regulation, poor industry performance, lack of public pressure and effective public participation.

#### 4.3.1 Governmental Behaviour

Environmental information disclosure is a complicated political problem, and is always in conflict with the pattern of behaviours and mind-set of the Chinese governmental officers. (Hai Yu 2012) Targeting at rapid economic development, the general governmental behaviours have been economy-oriented, treating other affairs with an exclusion attitude. In the cases of lobbying and bargaining, environmental information with potential negative impacts on corporate images and/or business profits will always be blocked from the public and no enforcement actions will be taken. (Tao Bie, 2012) Especially, some local governments consider environmental protection departments competing with the economy development and thus restrict their power and behaviours. More importantly, the Chinese local governments and related governmental officers are assessed based on their Gross Domestic Product (GDP) increase figure. Under this pressure, there is connivance or relaxation on regulation of the local polluting industries, since those pollutant facilities basically benefit the

local government, especially the political promotion of local governmental officers. Therefore, the local governments actually become the "umbrella" of local polluting enterprises. On one hand, they help the enterprises adapt to or even evade the national environmental regulation; on the other hand, they use public power to coordinate local citizens' dissatisfaction and to suppress the underlying public protest. (DMEI Conference, 2009)

During the implementation of environmental administration, the efforts and function of governments are also limited. The common approach and main efforts on solving environment issues for Chinese governments simply come from huge financial investment. For instance, the Chinese government has confirmed to invest four trillion Renminbi (RMB)<sup>4</sup> in 2011-2020 only on the rural water conservancy project. Furthermore, the central and local governments will invest at least 1,200 billion RMB on various clean-up projects. Looking back on the past decade, the Chinese government has also invested huge amount of money in pollution control. For example, up to five years by 2010, China spent 700 billion RMB for the construction of water infrastructure. However, these inputs did not carry out targeted output, such as the water pollution situation in China is still serious. MEP confirms 43% of the watershed locations contains heavily polluted water that human cannot contact directly. (MEP, 2011)

Besides, there is also a lack of binding legislation and guiding procedures to conduct and regulate the governmental behaviours. For environmental information disclosure, there are only seventeen general provisions of the Measures on Open Environmental Information (for Trial Implementation), which is currently the only specific governmental rules legally regulating the environmental information disclosure, and is too limited to establish an integrated information disclosing system. For instance, a sewage company in Henan Province was requested by the local government to disclose their emission information. However, as a countermeasure, the facility chose late-night video to publicize their information, which was hardly accessed by public citizens. (DMEI Conference, 2009)

### **4.3.2 Industrial Performance**

Although more and more companies chose to disclose environmental information in recent years, the corporate environmental information disclosure is still limited, incomplete and the information disclosed is of low utility. Generally, for disclosing environmental information, companies prefer positive information to negative ones. For example, they focus on environmental subsidies, recycling rate and investments environmental protection, instead of mentioning environmental influence and pollutant details (Pan Ane, 2012). At the same time, companies always only disclose qualitative information, instead of quantitative data. Therefore, the current corporate information accessed by the public hardly covers up-to-date quantitative emission data or provides complete data for year-to-year comparisons. (Wu, Zhang & Lin, 2008)

Since the implementation of Measures on Open Environmental Information (for Trial Implementation) in 2008, there is basically no improvement in the industrial emission disclosure field. (DMEI Conference, 2009) On one hand, this was caused by the lack of corporate responsibility and the weak environmental awareness of facilities. (Pan Ane, 2012) On the other hand, it is due to the defects in the process of law enforcement. For instance, the Clean Production Promotion Law stipulates that, if specified facility cannot observe the mandatory disclosure regulations, the local environmental protection departments will fine them 100,000 RMB and publicize the information on their behalf. However, even though lots

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<sup>4</sup> Four trillion RMB equals around 650 billion US dollars, according to the exchange rate of Bank of China on 12th Sep. 2013.

of facilities failed to meet the requirements, there had been no company penalized up until 2009, challenging the binding effect and credibility of this law. (DMEI Conference, 2009) Furthermore, many Chinese factories illegally modify facilities and manipulate emission data (Bin Duan, 2013), misleading the authorities, the masses and the media audience. (China's MEP & NRDC, 2011)

### **4.3.3 Public Participation**

During the establishing and implementing of PRTR systems in OECD countries, public awareness, organizations, such as NGO, and other forms of public pressure had played an important role. However, these are what China is lacking. (Hai Yu, 2012) Poor public cognition of environmental issues, inadequate development of social organizations, and deficiency in protesting approaches form another barrier of the environmental information disclosure in China. (Anbang, 2012)

Influenced by the long history of feudalism and the political scheme of centralized government, the governmental information disclosure in China follows the frame of basing on confidentiality principle, with publication as exception. Conversely, developed countries generally have the fundamental principle of disclosing to ensure public consciousness and the public right to know, as stipulated in the Aarhus Convention, while treating confidentiality as exception when it comes to certain high level of state secrets. (Anbang, 2012)

Based on the Confucianism belief, harmonization has formed the basis of Chinese culture and has been influencing people's behaviour. "Hiding private information as secrets", "As few words as possible", "Avoiding bothering and caring about someone else's business" is typical Chinese behavioural ways. These also form the barrier to public anticipation and facilities' disclosure behaviours. Besides, different parts of China have various cultures and special situations for information disclosure, making it hard to coordinate and implement state general regulation. For example, environmental information disclosure is not evenly distributed throughout China since eastern and coastal provinces seem doing better in websites and online interactive communication than the other parts of China, and there are also differences in technical and financial capacities between rich and poor provinces. (P. J. MOL, Guizhen H. & Lei Z., 2011)

The contribution and efforts of social organizations, like NGOs, for promoting the environmental information disclosure in China is not well developed. Among limited practices, the IPE has set up a database on water pollution and air pollution, with nine thousand records, and continuously request companies to disclose their environmental discharge data. (Wang & Ruan, 2010) On 11th April 2013, three NGOs (Nature Friend, Tianjin Green Leader and the IPE) jointly request the related governmental agencies to disclose the monitored emission data through feasible forms, as has been stipulated, in order to promote social awareness and public participation. (Caixin Net, 2013)

## **5 Findings**

The findings of the thesis are comprised of three parts: the situation of understanding PRTR for Chinese companies, the prospects of Chinese companies for a PRTR and a typical implementation model for PRTR in TEDA, Tianjin China. The research findings is based on the case study in TEDA, where over seventy companies with various characteristics have joined and supported the research activities, in different forms of interviews, symposiums, survey and other PRTR related activities. Considering the information about the company norms and inherited history plays as a basis for understanding the findings of the thesis research, details of the related Chinese companies have been attached in the Appendix II.

### **5.1 The Corporate Understanding of A PRTR in China**

The thesis researcher has examined the situation of understanding PRTR for Chinese companies in order to set the basis for further analysis. This was mainly operated by literature analysis in the Chinese context for implementing a PRTR and conducting seven in-depth interviews with company representatives.

This work found that generally, there is a rather weak awareness of environmental information disclosure at the corporate level in China. (China's MEP & NRDC, 2011) Parts of the companies, especially foreign world-famous corporations, demonstrate their knowledge of PRTR. For example, Samsung (Tianjin) Co. Ltd. has a fundamental awareness of the PRTR issues (Samsung, 2013). However, most of the enterprises have a poor understanding of PRTR. According to the interview findings, the Chinese companies seldom heard about PRTR before and are not familiar with the implications that PRTR have for industry and for the public. Moreover, partly influenced by the poor awareness of PRTR, companies are not prepared to deliver the data that a PRTR requires, or not able to act upon stakeholder responses on emissions information disclosure.

In the case of TEDA, a lack of understanding of PRTRs was identified as the main barrier by TEDA during its implementation process of PRTRs. (TEDA, 2012) However, the problem of corporate awareness of PRTR has been alleviated by specially designed forehand training seminars on PRTRs, which have covered over 70 companies. Besides, symposiums also help introduce the fundamental information of PRTRs and related legislation to over 40 corporations. Moreover, activities, such as press conferences, openly inform the business and public of PRTRs and generate influence on different social actors. Testified by the thesis research, most of the corporate interviewees stated that the PRTR trainings, symposiums and other efforts made by TEDA had played an essential role in improving their understanding of PRTR issues.

### **5.2 The Prospects of Chinese Companies for a PRTR**

The findings on the prospects of Chinese companies for a PRTR are presented in Table 5.1, Table 5.2, Table 5.3 and Table 5.4, which elaborate on the three main influential factors for each category of the SWOT. Basically, the table presents the findings on corporate prospects, which was generated by the survey integrating 41 corporate responses. The author combined the identified influential factors with corporate statements gained from symposiums or other means of communication with companies, to justify and adjust the raw findings.

Table 5-1. The Main Strengths of Chinese Companies for Implementing a PRTR  
(All the references in this table refer to the symposium findings elaborated by Appendix II)

<b>Strength 1</b>	<b>Environmental self-awareness and possessing corporate social responsibility</b>
<b>Corporate Statements</b>	<p>PPG has its own moral norm, sustainability commission and top-down eco-management system. (PPG, 2013)</p> <p>Although Pepsi is an intensive water-consumption enterprise, Pepsi has made continuous efforts to save water, and has been titled as “Model of Water Use Efficiency” in TEDA, which matches the group environmental strategy. Pepsi would like to publish its environmental information showing these. (Pepsi, 2013)</p> <p>As a private enterprise, Rionlon works hard with confidence to be the best one in its production fields of China. They will therefore restrain themselves from all perspectives and improve their environmental performance, such as their business philosophy of attaching importance to social responsibility and continuously improving techniques. Rionlon believes environmental information disclosure can help enterprises present and demonstrate their positive environmental working attitude. (Rionlon, 2013)</p> <p>As required by the parent company with higher environmental awareness, local companies need to keep complying with the environmental working standard higher than the local one. (Energizer, 2013)</p>
<b>Strength 2</b>	<b>Belief that PRTR fits the enterprise’s operation and development needs</b>
<b>Corporate Statements</b>	<p>Cenway aims to and has started to improve its environmental performance from the source, in order to achieve the goal of “zero solid waste discharge”. Cenway believes environmental information disclosure can record and disseminate this improving process. (Cenway, 2013)</p> <p>Fuji currently urges technical innovations, and strongly advocates “zero emission”. (Fuji, 2013)</p> <p>Donghai is promoting technical transformation, such as achieving lead-free techniques. (Donghai, 2013)</p> <p>Tsingzheng has achieved significant effects on VOC administration projects. They are very willing to publish and disseminate in virtue of PRTR scheme. (Tsingzheng, 2013)</p> <p>Environmental disclosure is a good thing since it provides a gold chance to improve the corporate image. (Energizer, 2013)</p> <p>In a word, PRTR is driven by social trend, promoted by governments, and initiated by corporate needs. (John Deere, 2013)</p>
<b>Strength 3</b>	<b>Requirements of the enterprise’s environmental management systems</b>
<b>Corporate Statements</b>	<p>ZX is equipped with 24 hour Continuous Emission Monitor System (CEMS). Furthermore, it has two own wastewater treatment plants (for treating VOC, BOD and ammonia nitrogen), which form the incentive to disclose own environmental performance. (ZX, 2013)</p> <p>As many other companies in TEDA, Cenway has also been certificated by ISO 14001, and has its own wastewater treatment plant, achieved 24 hour CEMS. (Cenway, 2013)</p> <p>Toyota has its own adequate Environmental Management System (EMS), which has been certificated by ISO 14001, including that for water treatment, energy balance and auditing, recycle and reuse, and also the needs for information reporting. (Toyota, 2013)</p> <p>Nokia &amp; Siemens is also certificated by ISO 14001, actively implement lots of eco-friendly mechanisms, such as the mechanisms for water and electricity saving, forming advantages of information disclosure. (Nokia &amp; Siemens, 2013)</p> <p>Both Otis and Nestlé have integrated EMS, and environmental information disclosure is therefore required and promoted by the enterprise’s environmental management system to a large extent. (Otis, 2013; Nestlé, 2013)</p>

Source: The Author

Table 5-2. The Main Weaknesses of Chinese Companies for Implementing a PRTR  
(All the references in this table refer to the symposium findings elaborated by Appendix II)

<b>Weakness 1</b>	<b>Belief that company has no adverse operational impact on the environment<sup>5</sup></b>
<b>Corporate Statements</b>	As a pharmaceutical manufacture enterprise, in ZX, all the solid wastes have a high value of recycle and reuse, but no adverse impact on the environment. (ZX, 2013) As a technical service enterprise, Schlumberger doesn't have industrial pollution or evident discharge itself. (Schlumberger, 2013) Influenced by their characteristics of the industry, Boai and Toyota Faw Dies don't have significant effect on environment. There is no need or unnecessary for them to join the PRTR scheme. (Boai, 2013; Toyota Faw Dies, 2013)
<b>Weakness 2</b>	<b>Belief that there is no commercial return from establishing investment and implementing cost</b>
<b>Corporate Statements</b>	Influenced by the characteristics of chemical industry, PPG has a large quantity of hazardous waste and faces problems of VOC discharge and disposition. Therefore, it is hard to gain competitive advantage and commercial return by implementing PRTR. (PPG, 2013)
<b>Weakness 3</b>	<b>Perceptions of No/Weak social pressure exerted to disclose environmental information</b>
<b>Corporate Statements</b>	Facing environmental information disclosure, companies pay more attention on actual public participation and effective media supervision. (Nokia and Siemens, 2013) If the public cares, companies cannot conceal. (Jingong, 2013) Considering the society does not has strong or urgent needs for PRTR, to perform as many other companies, integrating emission information into Corporate Social Responsibility (CSR) reports is enough. (Toyota Faw, 2013)

Source: The Author

Table 5-3. The Main Opportunities of Chinese Companies for Implementing a PRTR  
(All the references in this table refer to the symposium findings elaborated by Appendix II)

<b>Opportunity 1</b>	<b>Meeting the requirements of the national environmental binding rules</b>
<b>Corporate Statements</b>	Compliance stands the first. (Stanley, 2013) Jinyao exports 60% of its products. Currently, it is applying to be listed and has been audited on environmental impact. (There is environmental information disclosure requirements for listed companies in China) (Jinyao, 2013) There are national regulative requirements and rules for specified enterprises, such as Tangxian, who has its production of lead-based heavy metal. It has to mandatorily report environmental information. (Tangxian, 2013)
<b>Opportunity 2</b>	<b>Responding to the policy call of environmental protection authorities</b>
<b>Corporate Statements</b>	Cargill had emission exceeding the national standard last year and has rectified the situation this year following the regulation of government, thus treating PRTRs as a rare form and good chance to react to this changing process and improve its reputation. (Cargill, 2013) Same as Cargill, Jingong and Otis had illegal act on environmental issues, and have achieved satisfactory administrative correction results. Therefore, they became interested in joining PRTR. (Jingong, 2013; Otis, 2013)
<b>Opportunity 3</b>	<b>Satisfying the needs of headquarters, parent company and/or the supply chain</b>
<b>Corporate Statements</b>	TEDA has formed an advanced waste treatment system, with several specified waste treatment companies accepted and properly treated transferred medical wastes, solid wastes

<sup>5</sup> This factor is heavily influenced by and is actually a special result of TEDA promoting mechanism, since the current purpose does not identify or track the related polluted companies, yet attract more and more companies to join the PRTR scheme, making evident quantity result for the trial case. (Han Shi, 2013) Therefore, by the promoting mechanism, TEDA is actually facilitate all kinds of companies to join the scheme, especially treating the enterprises with less adverse impact on the environment as one of the key promoting company groups for PRTRs. This factor has been testified by interviews.

	<p>and other waste pollutants. (TEDA Hospital, 2013; Continental Automotive, 2013)</p> <p>The parent company of Fuji has specific and definite environmental index system and detailed environmental management rules, related to information disclosure. (Fuji, 2013)</p> <p>The parent company of Nestlé promulgates strict rules on local facilities, which need to keep consistent with the requirement of environmental protection from the upper level. (Nestlé, 2013)</p> <p>Besides the requirements of parent company, there is also great pressure from consumers. PRTR and related information disclosure is a golden chance to gain competitive advantages in the market competition. (Idemitsu Lubricating Oil, 2013)</p> <p>Rionlon is an export-oriented enterprise, exporting 70% of its production. Therefore, it faces more strict requirements and higher standard. Especially for the pressure from the supply chain, Rionlon directly cooperates with world-famous large enterprises, such as Bayer and BASF, who generally have integrated green supply chain management systems, within which environmental information disclosure is always a basic requirement. (Rionlon, 2013)</p> <p>Since the year 2013, the parent company of Otsuka has raised a claim on Otsuka (Tianjin) to mandatorily implement a group pollutant register scheme. (Otsuka, 2013)</p> <p>Donghai and Weike have to periodically report to their parent companies on PRTR information. (Donghai, 2013; Weike, 2013)</p> <p>Boai suffers huge supply chain pressure, since their main customers are KC, Johnson, P&amp;G and Heng'an, who ask for adequate information disclosure. (Boai, 2013)</p> <p>The requirement and pressure from the parent company is the most essentially influential factor to Toyota Faw Dies. Toyota has its systematic supply chain management system. (Toyota Faw Dies, 2013)</p>
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Source: The Author

Table 5-4. The Main Threats of Chinese Companies for Implementing a PRTR

(All the references in this table refer to the symposium findings elaborated by Appendix II)

Threat 1	Competitive issues and concerns related to the leaking of information to competitors via PRTR reporting
Corporate Statements	<p>The most urgent concern of Rionlon facing PRTR the worry about leaking business information, especially intellectual property rights, to competitors. Besides, companies are afraid about their competitors can estimate their annual output by disclosed data. Moreover, Rionlon is afraid that minor enterprises will gain tremendous competitive advantages by the PRTR of big companies. (Rionlon, 2013)</p> <p>As a knowledge-intensive company, Motimo and Cenway have lots of intellectual property rights, and thus afraid of leaking information to competitors. (Motimo, 2013; Cenway, 2013)</p> <p>Kelein has its own confidential agreement on new medicines processing, the company therefore afraid to accept the PRTR. (Kelein, 2013)</p> <p>The motor industry is a very competitive industry, Toyota is afraid of leaking business information as well. (Toyota, 2013)</p>
Threat 2	Potential risk of data misrepresentation by media or the public
Corporate Statements	<p>The industrial layout in TEDA is quite complicated, as many companies deal with professional chemicals and rare resources, thus their emission is hard to be understood by the public while may be easily misinterpreted. (Schlumberger, 2013)</p>
Threat 3	Potential risks related to harm to the enterprise's reputation due to information availability
Corporate Statements	<p>Especially for food industry, which has close relationship with consumers, PRTRs are urgently needed by the masses, yet can easily bring reputational harms to the enterprises.</p> <p>In the case of Dentsply, who produces month-used products, it ought to meets more strict requirements, while with a threat that PRTR may ruin the company reputation and even brand image. (Dentsply, 2013)</p>

Source: The Author

### **5.3 The Implementation of a PRTR in TEDA**

TEDA is a prospective area for transferring foreign experience, especially with numerous advantages for setting a trial case of PRTR for nationwide imitation. TEDA, established in 1984, was among the first batch of state-level development zones approved by the State Council. It has been ranked the top first leading state-level economic development zones in China for fifteen years. (The State Department of Commerce, 2013) TEDA is composed of Airport-based Industrial Zone, Advanced Manufacturing Zone, Binhai Hi-tech Zone, Central Business District, Coastal Leisure & tourism Zone, Nangang Industrial Zone, Seaport Logistics Zone, Seaport-based Industrial Zone, and Sino-Singapore Tianjin Eco-city. With these functional areas, TEDA is functioning as the manufacturing, research and development (R&D) centre of China and the international shipping and logistics centre in Northern China. (TEDA, 2012) With over 3300 foreign invested companies, among which there are 82 Fortune Five Hundred Companies invested 185 projects here (TEDA, 2013), TEDA is a gateway and an economic developing engine for the current China. Further acting as the national pioneer area of comprehensive reform, TEDA has tremendous advantages in learning the foreign experience and transform them into the Chinese context.

#### **5.3.1 The Corporate Environmental Information Disclosure and PRTR in TEDA**

Since 2008, TEDA has started from the government to develop a special portal and disclose environmental information, and issued the Drafted Work Plan for Environmental Information Disclosure in TEDA. In 2009, TEDA began to encourage industrial companies to voluntarily disclose their environmental information, and sixteen companies were involved in the governmental promotion. With the development of environmental information disclosure, more and more actors, such as social groups, NGOs, business association and academic have participated, and thirty-one companies of TEDA were influenced and published their annual environmental information report in 2012.

Since 2013, funded and supported by the EU, TEDA has implemented the EGP - PRTR project to further improve its environmental information disclosure scheme. Benefited from this on-going two-year project, TEDA has hereby 1) learned from the foreign management models in implementing environmental information disclosure; 2) carried out research to establish a guideline for company-level environmental information disclosure suitable for the special condition of China; 3) trained and promoted companies to disclose their environmental information voluntarily and enhance their capacity in environmental management as well as pollution and emission reduction; and 4) reported emission data, along with other environmental information, to the public. In this way, it facilitated their participation and assisting social supervision on corporate behaviours. Benefited from this project and the combined efforts of government, business and social organizations, TEDA has gained significant achievements as 48 companies have publically disclosed their environmental information, and 36 of them have submitted standard PRTR reporting forms for the year of 2012. (TEDA, 2013)

*Table 5-5. The Operating Details of TEDA PRTR*

<b>Why Pursue A PRTR?</b>
<p>TEDA has been ranked the top for 15 years among all state-level economic development areas, and has incentive to improve environmental regulation and achieve better corporate environmental performance. Most of the companies in TEDA keep compliance with environmental legislation for business operation. They have widely participated in environmental information disclosure in the form of annual environmental reports or reports of corporate social responsibility since 2008. (Xiuchun Xu, 2013)</p> <p>However, there is a strong need to improve the environmental information disclosure in TEDA which has faced the problems of: 1) varied qualities of corporate environmental reports; 2) limited and in-complete reported pollutants; 3) no identification on the data sources and unable to ensure or authorize the credibility of reported data; 4) most of the information disclosed by companies are positive instead of publicizing quantitative emission data. (TEDA, 2013)</p> <p>As a trial case for national imitation, the “Environmental Governance Programme—Developing a Pilot Regional Pollutant Release and Transfer Register in Tianjin Binhai New Area, China” (EGP – PRTR project) has been launched in Tianjin Economic-Technological Development Area (TEDA), also asking for a pilot implementation of PRTRs.</p>
<b>Who Is Registered for PRTR?</b>
<p>As a trial case for generating experience, the PRTR in TEDA has no employee, sector-specific or other reporting thresholds. Instead, it attracts and promotes most companies to join and implement the PRTR scheme.</p> <p>However, TEDA has set a list of key promoting companies for PRTR, which cover foreign-owned worldwide famous companies, companies with hazardous pollutant related production, and companies with both evident and less environmental influence, aiming to reduce the pollutant emission and also enlarge the scope and influence of trial TEDA PRTR.</p>
<b>What Pollutants Are Registered for PRTR?</b>
<p>Fundamentally, the PRTRs in OECD countries basically cover pollutant release, transfer and the emission from diffuse sources, such as pollutant discharge from transportation. However, considering the feasibility for implementing the pilot case and aiming to generate preliminary experience for establishing a PRTR in China, TEDA PRTR mainly registers release data, simply tracing the transferred pollutant, but doesn’t involve emission from diffuse sources.</p> <p>The TEDA PRTR registers the pollutants included in the China PRTR Pollutant List (proposal), which is formed of two parts. The first part of the list is the conventional pollutant factor, including three kinds of water pollutants (chemical oxygen demand related pollutants, ammonia nitrogen and total phosphorus), five kinds of air pollutants (sulphur dioxide, nitrogen oxides, particulate matter, smoke dust and volatile organic compounds), and other pollutant factors and hazardous waste emission and transfers identified by environmental impact reports of facilities; The second part is the list of PRTR hazardous materials, which is composed of 94 categories, including key control list of chemicals posing environmental risks as proposed in the national Twelfth Five-year Plan, persistent organic pollutants (POP), heavy metals, greenhouse gases (GHG).</p> <p>Significantly, the first part of the list is to be mandatorily disclosed by the companies and the second part of the list is voluntarily publicized.</p>
<b>How Often Are Data Registered for PRTR?</b>
<p>Annually.</p> <p>Companies are required to submit the PRTR forms by June annually, and the condition of PRTR reporting for the last year is disclosed on June 5th during the TEDA Environmental Information Disclosure Press Conference.</p>
<b>How to Generate the Data of PRTR?</b>
<p>The companies are asked to fill in the PRTR reporting form and are encouraged to follow the TBNA Environmental Information Disclosure Guideline for Industrial Companies (Trial).</p> <p>TEDA PRTR, with the reporting form and disclosure guideline, specifies two databases for generating PRTR data.</p> <p>Database 1: Gained from declaration or auditing, which includes: 1) Enterprises’ annual emission declaration; 2) Cleaner production auditing; 3) Third party auditing; 4) Others (reports’ explanation needed)</p> <p>Database 2: Gained from calculation, which includes: a. Calculate based on concentration: 5) Supervisory monitoring data of EPB; 6) Online monitoring data of EPB; 7) Authorized monitoring data; 8) Self-testing data; b. Calculate based on consumption: 9) Material balance method of a third party; 10) Material balance method of facilities; 11) Others (reports’ explanation needed)</p> <p>c. Description choice “The quantity ought to include the whole discharge and transfer amount of all the facility activities purposely, accidently, conventionally or unconventionally.”</p>

d. Description choice “The quantity of all the harmful chemicals transferred to waste treatment plant by effluent”
<b>How to Monitor and Audit for PRTR?</b>
There is currently a lack of monitoring and auditing schemes for the TEDA PRTR (Xiuchun Xu, 2013) However, since 2012, TEDA has been promoting third party auditing as the main mechanism to monitor and audit. By June 2013, the third party auditing has covered five reporting companies for the PRTR data of 2012.
<b>How to Report and Publicize the Data of PRTR?</b>
TEDA has made a specific PRTR website (prtr.ecoteda.org) for publically disclosing corporate environmental information, which is assisted by GIS, helping the reader to locate pollutant sources. At the same time, the websites of TEPA and TEPB, websites of related companies and the media also disclosed PRTR information. However, there is no specified reporting mechanism for TEDA PRTR, and the companies mainly submit the reporting forms and other related documents by e-mails.

Source: The Author

### 5.3.2 The Implementation Mechanisms for PRTR in TEDA

During the process of promoting environmental information disclosure and implementing PRTR, especially based on the survey findings on the corporate prospects of environmental information disclosure, TEDA has established a typical implementation model. The TEDA PRTR model can be explained by the SWOT findings of this thesis research, since it exploits the strength factors, addresses the weakness factors, fosters the opportunity factors and weakens the threat factors for companies for to accept a PRTR. The model is formed by mechanisms of setting a diverse platform, preparing adequate guidance, improving the promotion for companies including providing fundamental training and establishing cooperative communication mechanism, and offering incentives to promote the implementation.

Table 5-6. The Implementation Mechanisms for PRTR in TEDA

(Abbreviations: S. for Strengths; W. for Weaknesses; O. for Opportunities; T. for Threats)

<b>Mechanism 1. Establishing a diverse platform for cooperative environmental protection, instead of depending on traditional governmental administration.</b>	
<b>Explanation</b>	In TEDA, the government aims to formulate a cooperative platform with enterprises, promoting law enforcement, encouraging outstanding facilities in PRTR reporting, and forming chances for mutual learning among companies in TEDA. (Jun Zhang, 2013)  Organizing the TEDA EPA, which includes and organizes the companies in TEDA to achieve collaborative environmental protection behaviours;  Establishing and supporting TEDA Eco Centre, which is a communicative platform for industry cooperation and international knowledge and experience transformation.
<b>SWOT Analysis</b>	Exploit the S. 1: Environmental self-awareness and possessing corporate social responsibility Foster the O. 2: Responding to the policy call of environmental protection authorities Weaken the T. 2: Potential risk of data misrepresentation by media or the public Weaken the T. 3: Potential risks related to harm to the enterprise’ s reputation due to information availability
<b>Mechanism 2. Proposing the China PRTR Pollutant List (proposal)</b>	
<b>Explanation</b>	On the afternoon of Mar. 20th, 2013, the Experts’ Discussion Meeting on Suggested PRTR Pollutant List of the EGP - PRTR project was held in Beijing.  Based on the meeting, further according to the related requirements of EU PRTR and US TRI on emission categories and reporting threshold, project partners drafted a suggested PRTR pollutant list for China, which can be first tested in Tianjin Binhai New Area, especially in TEDA. The board meeting elaborately dealt with the issues of pollutant categories, the voluntary mechanism of enterprise reporting and the feasibility of data, which are related to the

	<p>suggested PRTR pollutant list.</p> <p>The meeting was supported and funded by EGP – PRTR, and organized by Eco – TEDA. More than twenty experts from environmental authorities in both central and local levels, professional research institutes, international organizations, NGO and law offices, participated in the meeting and joined discussion.</p>
<b>SWOT Analysis</b>	<p>Address the W. 1: Belief that company has no adverse operational impact on the environment</p> <p>Foster the O. 1: Meeting the requirements of the national environmental binding rules</p> <p>Foster the O. 3: Satisfying the needs of headquarters, parent company and/or the supply chain</p> <p>Weaken the T. 2: Potential risk of data misrepresentation by media or the public</p>
<b>Mechanism 3. Stipulating the TBNA Environmental Information Disclosure Guideline for Industrial Companies (Trial)</b>	
<b>Explanation</b>	<p>The guideline was drafted based on adequate consultation with experts, business, academics and the public.</p> <p>Based on the former guideline, it further improves the data form, at the same time; enhance the recognition of facility data, as the automatic on-line monitoring data, manual monitoring data, material balance data or produce-emission ratio data.</p>
<b>SWOT Analysis</b>	<p>Address the W. 1: Belief that company has no adverse operational impact on the environment</p> <p>Address the W. 3: Perceptions of No/Weak social pressure exerted to disclose environmental information</p> <p>Foster the O. 2: Responding to the policy call of environmental protection authorities</p> <p>Weaken the T. 2: Potential risk of data misrepresentation by media or the public</p>
<b>Mechanism 4. Providing the standard corporate PRTR reporting form.</b>	
<b>Explanation</b>	<p>The TEDA PRTR reporting form, in Appendix III, was made based on foreign experience learning by the IPE, who is the leading institute of researching on environmental information disclosure in China and also the project partner of EGP – PRTR.</p> <p>With the standard PRTR reporting form, facilities are asked to report conventional pollutant factor and industry specified pollutant factor as hazardous materials. The reporting scheme also requires specifying the data collection method, resources and calculation details. Furthermore, it shows such information as pollutant transfer details and contacts of reporting person.</p> <p>Currently, TEDA is promoting companies to do third party certification for PRTR reporting to ensure the credibility and accuracy of the data disclosed.</p>
<b>SWOT Analysis</b>	<p>Exploit the S. 1: Environmental self-awareness and possessing corporate social responsibility</p> <p>Foster the O. 2: Responding to the policy call of environmental protection authorities</p> <p>Weaken the T. 2: Potential risk of data misrepresentation by media or the public</p>
<b>Mechanism 5. Providing adequate training as preparation for implementing a PRTR.</b>	
<b>Explanation</b>	<p>TEDA provides free training of PRTRs, free guidance of reporting PRTR forms and other approaches of environmental information disclosure, and free on-site conduction for environmental information supervision and data monitoring.</p> <p>The trainings inform and help the corporations understand the fundamental information of PRTRs, such as the essence of PRTRs, the mechanism for implementing PRTRs, what to disclose, and how to disclose.</p>
<b>SWOT Analysis</b>	<p>Exploit the S. 2: Belief that PRTR fits the enterprise’s operation and development needs</p> <p>Exploit the S. 3: Requirements of the enterprises’ environmental management systems</p> <p>Weaken the T. 2: Potential risk of data misrepresentation by media or the public</p>
<b>Mechanism 6. Organize appointed meetings / symposiums with companies.</b>	
<b>Explanation</b>	<p>Considering business corporations as the main players of economic development and the main body for environmental pollution, TEDA has found a special communication approach to promote companies to improve their environmental information disclosure behaviours.</p> <p>By appointment, TEDA organized meetings with main directors of the companies from certain industries or those with related similarity, joined by influential governmental officers, and</p>

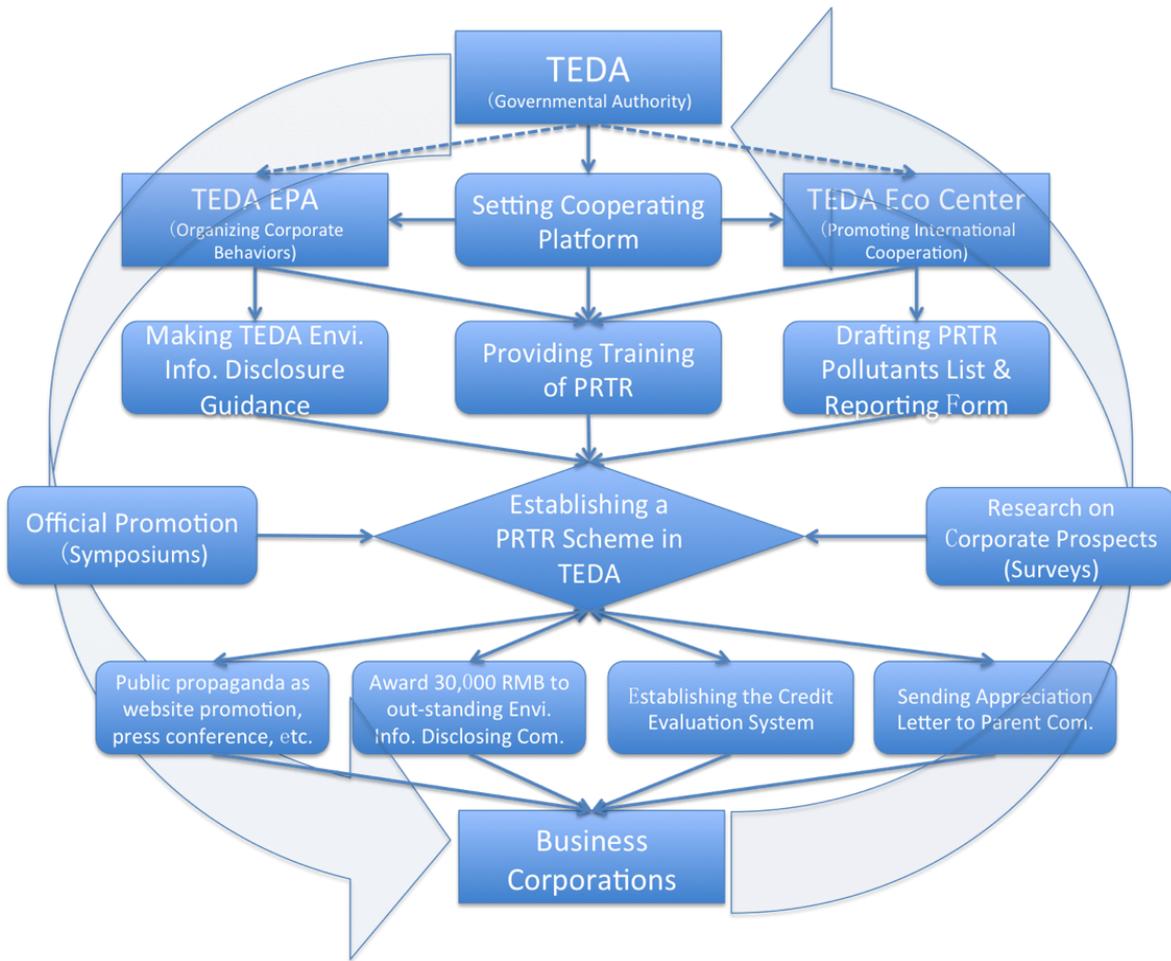
	representatives from other sectors. Besides the meetings, there were other activities, such as governmental treat lunch, socialized conversation, together with the symposiums. With the influence of the shadow of hierarchy (Adrienne Dirk, 2008; Patrick Schroeder & Sander Chan, 2012), this mechanism is effective in persuading companies to accept a PRTR, as lots of corporate leaders have directly promised to join the PRTR scheme during the symposiums.
<b>SWOT Analysis</b>	Exploit the S. 1: Environmental self-awareness and possessing corporate social responsibility Foster the O. 1: Meeting the requirements of the national environmental binding rules Foster the O. 2: Responding to the policy call of environmental protection authorities
<b>Mechanism 7. Making a list of “Key Promotion Companies” for PRTRs.</b>	
<b>Explanation</b>	With an aim to smoothly establish a scheme of PRTR, expanding the influence of PRTR, gaining the trust of companies and gathering the experience for future development, TEDA has formed a list of “Key Promotion Companies” for PRTRs for the primary implementing period.  The list consists of 1) mandatorily required reporting companies (heavy polluting, hazardous pollutant related and listed companies), 2) world-famous companies, which have been used to PRTR schemes abroad and have strong incentive to improving corporate image, and 3) companies with less environmental influence, that are incentive to PRTR reporting and thus easy to accept.
<b>SWOT Analysis</b>	Exploit the S. 1: Environmental self-awareness and possessing corporate social responsibility Address the W. 1: Belief that company has no adverse operational impact on the environment Foster the O. 2: Responding to the policy call of environmental protection authorities
<b>Mechanism 8. Convening Annual Press Conference on 5th June, the World Environment Day.</b>	
<b>Explanation</b>	Annually, TEDA holds PRTR Press Conference for the Disclosure of Environmental Information of Enterprises, with an aim to publish the news and information on environmental information disclosure of related companies. The press conference provides incentive and even risks for companies, since it will disclose their environmental efforts and achievements.  Especially in TEDA, the companies are always the leading ones in certain industries of China, who ought to play the leading roles in PRTRs nationwide as well. (Yuyan Song, 2013) For instance, Samsung has been treated as the action model and represented all the companies of TEDA to give speech on the conference, since Samsung has published their Environmental Responsibility Reports for three years based on third party certification and played the leading role in TBNA by positively fulfilling corporate social responsibility for environment and formally participated in voluntary company environmental information disclosure. (Samsung, 2013)
<b>SWOT Analysis</b>	Exploit the S. 1: Environmental self-awareness and possessing corporate social responsibility Address the W. 2: Belief that there is no commercial return from establishing investment and implementing cost Address the W. 3: Perceptions of No/Weak social pressure exerted to disclose environmental information Weaken the T. 3: Potential risks related to harm to the enterprise’ s reputation due to information availability
<b>Mechanism 9. Offering subsidized monetary award (30,000 RMB) to outstanding companies who continuously publish their environmental information for three years.</b>	
<b>Explanation</b>	This awarding policy is stipulated by the Interim Provision for Promoting Energy Saving and Environmental Protection of TEDA. (Revision and establishment of policy incentives) Furthermore, the awarded companies will be disclosed and promoted publically by various approaches such as press conference and website.
<b>SWOT Analysis</b>	Address the W. 2: Belief that there is no commercial return from establishing investment and implementing cost Address the W. 3: Perceptions of No/Weak social pressure exerted to disclose environmental information Foster the O. 2: Responding to the policy call of environmental protection authorities
<b>Mechanism 10. Sending appreciation letter to the company and its parent company in the name of local</b>	

<b>Chinese government.</b>	
<b>Explanation</b>	<p>Considering the special situation of TEDA that most of the companies here are local branch companies of international corporations who appreciate the praise and approval from parent company, TEDA will write and send appreciation letter to CEO and Headquarters (HQ) of their parent companies for those outstanding companies in environmental information disclosure to promote the implementation of PRTR.</p> <p>Furthermore, international enterprises have widely implemented their development strategies, which fundamentally include “CSR” and “sustainability”. Local branches can gain support and guidance from parent companies to facilitate their own PRTRs. (Yuyan Song, 2013)</p> <p>The letter is written differently according to various industry groups, including illegal enterprises, hazardous pollutant related facilities, listed companies, lead related and light industry.</p>
<b>SWOT Analysis</b>	<p>Exploit the S. 1: Environmental self-awareness and possessing corporate social responsibility</p> <p>Address the W. 2: Belief that there is no commercial return from establishing investment and implementing cost</p> <p>Address the W. 3: Perceptions of No/Weak social pressure exerted to disclose environmental information</p> <p>Foster the O. 2: Responding to the policy call of environmental protection authorities</p> <p>Foster the O. 3: Satisfying the needs of headquarters, parent company and/or the supply chain</p>
<b>Mechanism 11. Establishing the Environment Credit Evaluation System.</b>	
<b>Explanation</b>	<p>The system has been established since 2009 and most of companies in TEDA have been covered. (TEDA, 2013)</p> <p>Integrating the evaluation factors of corporate social responsibility, supply chain management, green credit into the Environment Credit Evaluation System, in order to promote and facilitate the improvement of corporate environmental protection behaviours.</p> <p>As stipulated by the Opinions on Promoting the Evaluation Works on Corporate Environmental Behaviours and the Technical Manual of Evaluating the Corporate Environmental Behaviours, the TEDA Environmental Credit Evaluation System ranks the companies into five levels, very good, good, normal, bad and very bad, which are marked by colours of green, blue, yellow, red and black, based on eleven legal criteria and seven encouraging criteria.</p>
<b>SWOT Analysis</b>	<p>Exploit the S. 1: Environmental self-awareness and possessing corporate social responsibility</p> <p>Address the W. 1: Belief that company has no adverse operational impact on the environment</p> <p>Address the W. 3: Perceptions of No/Weak social pressure exerted to disclose environmental information</p> <p>Weaken the T. 3: Potential risks related to harm to the enterprise’ s reputation due to information availability</p>

Source: The Author

With the environmental protection efforts for years, TEDA has formed a promotion mechanism (See Figure 5-1), which is the summary of experience practice in the distinctive context of China. The TEDA mechanism has been effectively applied to the implementation of the PRTR regionally and can be therefore learned by other parts of China.

Figure 5-1. TEDA Promoting Mechanisms for PRTRs



Source: The Author

## 6 Discussion

This chapter discusses the implementation of PRTR in TEDA from two perspectives. Firstly, based on the current form of the TEDA PRTR identified by the research, the thesis author refers to related PRTRs experience of OECD countries and suggests areas for further improvement of PRTR in China. Secondly, based on the achievements gained by TEDA PRTR, this thesis concludes the experience of TEDA and discusses the possibility and barriers to spread the TEDA PRTR model into other contexts of China. Furthermore, according to the research limitations identified, this chapter expounds how to continue, improve and develop related research in the same field.

### 6.1 Improve the PRTR in China based on OECD Experience

With a trend of setting up an information disclosure mechanism to facilitate environmental regulation, many developed countries have established PRTRs that are facility-specific, internet-based, free of charge, and accessible. Basically, PRTRs cover point, transfer and diffuse sources and distinguish the pollutant emission into air, land and water. Furthermore, the PRTR schemes of typical OECD countries generally combine mandatory and voluntary reporting mechanisms, with clearly defined reporting thresholds and limited provisions, aiming to gain standardized and timely corporate environmental information. Comparatively, a legislative basis for environmental information disclosure has been established in China and TEDA has formed mechanisms facilitating the implementation of PRTRs. However, as in the case of TEDA PRTR, there are evident deficiencies as no reporting thresholds, a lack of monitoring and auditing schemes, weak public participation and incomplete scope which only covers emission with release and transfer sources. It is therefore necessary for China to refer to the experiences of implementing PRTR in OECD countries.

As indicated by Aarhus Convention, public access to environmental information, public participation and justice of environmental rights form the three bases of environmental information disclosure. (OECD, 1998; UNECE PRTR, 2013) Based on the PRTR practice experiences of OECD countries with a consideration of the Chinese context, the implementation details, such as setting reporting procedures, forming monitoring and auditing schemes, facilitating public participation, are of significant relevance to help set the basis of environmental information disclosure and benefit the improvement of PRTR mechanism first in TEDA, then across China.

In detail, the following experience of PRTRs in OECD countries may have significant meaning for the development of PRTRs in China:

Firstly, it is necessary to set up an on-line reporting system and clarify reporting procedures. According to the experience of OECD countries, an internet-based reporting scheme has been widely established, which is feasible and convenient to monitor reporting status, check errors and collect standardized information. However, in the case of TEDA, where the PRTR forms were submitted mainly by e-mails with unspecified procedures, lots of problems have risen. For examples, the companies submitted the PRTR forms to different governmental authorities, which had to be made up by coordination among different environmental authorities; companies submitted documents mainly by e-mails resulting in extended communication and tracing activities; As lacking of checking mechanisms, the reported PRTRs gained by TEDA are not standardized due to lots of filling errors and vacant columns.

Secondly, it is necessary to form a permit system as the basis of a PRTR system. In the OECD countries, the enterprises within reporting threshold may risk regulatory sanction unless they follow the PRTR reporting requirements. At the same time, the judicial system plays a

significant role in guaranteeing the implementation of administrative means. Under current condition that no binding legislation is stipulated for the implementation of PRTR, the PRTR in China has to be established by a voluntary mechanism and made up by strong incentives and facilitating efforts as made by TEDA, this resulted in problems of TEDA PRTR, such as bad quality, low utility of reported data and limited reporting scope with no set reporting threshold.

Moreover, considering the practice of OECD countries, the PRTR data is generally too hard and professional to be understood by the public. Therefore, public organizations, such as NGOs, NPOs and academic institutions, need to play an essential role to interpret the PRTR information to arouse public awareness. In the special context of China, NGOs have not well developed due to the administrative regime and financial dependence. Instead, according to the experience of TEDA, where TEDA Eco Centre plays an essential role in implementing PRTR, the NPOs, with the governmental support and public affairs solving expertise, can play a role of a bridge between the government, enterprises and the public. (DMEI Conference, 2009)

For other PRTR related factors like what to register, it is necessary to keep compliance with the TEDA PRTR, which registers the pollutants annually according to the China PRTR Pollutant List (proposal). (See Table 5-5) However, according to the OECD experience, China needs to set up a mechanism to adjust and extend the reporting scope continuously and classify the reported data according to the industry classification based on the methods provided by the National Bureau of Statistics of China. (See Table 4-2) Furthermore, the Chinese government also needs to clarify the conception and scope of business confidential information to resolve the threats companies perceived for engaging in a PRTR. As to when to register, it is urgent to set clearly the reporting dates and information-publicizing period. In the case of TEDA PRTR, the PRTR reporting forms, together with corporate annual environmental reports, are mainly submitted by June. After preliminary checking and authorizing, the environmental reports were attached to the specified TEDA Corporate Environmental Information Disclosure website for public access. An official Environmental Information Disclosure Press Conference will be held on 5th June annually, by which TEDA publically discloses the corporate reporting information for the past year, attracts public participation and awards the outstanding companies who have continuously disclosed environmental information for three years.

Overall, it is fundamental to improve and coordinate the tripartite relationship among government, business and the public. Instead of functioning as monitoring authority and regulative controller with absolutistic administrative powers, the government needs to promote the facilities to take more social responsibilities, at the same time, attract and support public participation and the development of social organizations. In order to achieve this, there is a challenging barrier generated from the pressure of keeping rapid economic development. Instead of keeping the rapid development and GDP growth, governments need to take efforts to ensure the public awareness of pollutant information for environmental protection. At the same time, the business needs to be transparent to the public for improving environmental performance. Fortunately, there has been a trend that more and more business corporations are fulfilling their responsibility of disclosing environmental information to the public. For instance, Dongsheng Li, the chairman of TCL Group, submitted a proposal named “Achieving cleaner China by the establishment of public information access mechanism” in the National People’s Congress of 2013. (Financial Network, 2013)

## 6.2 Spread the TEDA PRTR Experience to Other Contexts of China

As to the implementation of a PRTR, TEDA has gained significant achievements. For example, it has formed PRTR guidance and reporting form, set the specified website for corporate environmental information disclosure, and by June 2013, 36 companies in TEDA have submitted standard PRTR reporting forms for the year of 2012. (TEDA, 2013) More importantly, TEDA has adjusted the implementation of PRTR, based on business prospects and foreign experience learning, which has been concluded by this thesis. With an aim to spread the TEDA mechanism to other parts of China for national imitation, several challenges have to be addressed.

Firstly, the difference between international business corporations and Chinese local companies forms a significant barrier, at the same time, poses an opportunity for the development of the PRTR in China. Playing as the international gateway and an economic developing engine for the current China, TEDA has attracted over 3,300 foreign invested companies, among which there are 82 Fortune Five Hundred companies invested 185 projects in TEDA. (TEDA, 2013) With strengths of environmental self-awareness and group internal environmental management system for PRTR, foreign companies have been the main actors of the TEDA PRTR. For example, 29 out of the 36 companies submitted their PRTR reporting forms for the year of 2012 are foreign-owned companies or joint ventures. Considering that Chinese local companies have comparatively low awareness of environmental issues and less incentive for environmental protection or information disclosure, spreading the TEDA mechanisms of implementing PRTR to other contexts of China, especially other economic development areas formed mainly by local companies, will have to resolve challenges which are not covered by this research and the pilot PRTR case in TEDA. However, at the same time, the difference can also bring positive influence on the development of the PRTR in China. For example, it helps preliminarily establish a PRTR in China and generate implementation experience. With established PRTR scheme to refer to, other parts of China are facilitated to implement a PRTR locally, and the public awareness is raised exerting pressure on Chinese companies. As market competitors, if foreign companies have widely established a PRTR, Chinese companies, especially the state-owned companies, are easily to follow.

Secondly, there are different development approaches for corporate environmental information disclosure in different parts of China, which forms another significant challenge to be resolved. Currently, different Chinese cities or parts of China develop their corporate environmental information disclosures with various mechanisms and disclosing forms. For instances, Shanghai, with its associated economic development areas, has been the leading zone of fulfilling corporate social responsibility. (Xiuchun Xu, 2013) During the visit to TEDA and PRTR experience seminar on 17th July 2013, the EPA of Suzhou Industrial Zone, which is currently ranked the 2nd leading state-level economic development zone in China after TEDA (The State Department of Commerce, 2013), states that Suzhou, together with other cities of Jiangsu Province, treats the corporate social credit evaluating system as the main approach to exert pressure on companies to reduce emission. Moreover, the Dongying City of Shandong Province also shared knowledge and different experience on 20th August 2013 during another seminar with TEDA, showing they have made efforts on improving the industrial environmental performance by transferring environmental techniques based on a China-US Cooperative Project. Therefore, how to coordinate the environmental regulation of different local governments in China and stipulate a state-level scheme for environmental information disclosure is an urgent task for coordinating the efforts of local governments nationwide.

However, considering the Pollutant Release and Transfer Registers (PRTRs) have widely been adopted in developed countries since 1970s and helped stimulate public participation, facilitated environmental regulation and promoted industrial transformation, it is necessary for Chinese governments to establish and facilitate the implementation of a PRTR in China. In the pilot case of TEDA, the governmental agency has put efforts on implementing the PRTR and generated significant experience for national imitation. Essentially, this thesis concludes the TEDA experience and suggests an action model, which elaborates the necessary tasks and steps for implementing a PRTR in other contexts of China.

### **6.3 Research Gap and Suggestions for Further Study**

As one part of the whole project, this research departs from a practical need to engage Chinese companies in PRTR schemes and a knowledge gap on potential mechanisms to facilitate the implementation of a PRTR in China under the current absence of any binding legislation in the area. Consequently, there remain a number of areas where research work can be of great relevance.

Firstly, the mechanisms on publicizing PRTR data and facilitating the public participation on environmental issues are a lack of current research. In the case of TEDA, promoting the corporate participation and establishing the PRTR scheme have been the main achievements with most of the efforts. However, other essential factors of a PRTR, such as public participation and environmental justice, have not been addressed significantly in the development of a Chinese PRTR. For example, for the established PRTR, TEDA only collected and documented the PRTR data reported from 36 companies by June. However, it hasn't disclosed this information publically by 25th August 2013. For one reason, the TEDA environmental authorities, especially the TEDA Eco Centre, has no expertise in checking or authorizing the reported data before disclosing. For another reason, the reported companies negotiated and thought it was too early to disclose as the first batch, considering the threats of leaking business information and criticism from the media or public.

Furthermore, this thesis mainly examines the corporate prospects of a PRTR and discusses how to adjust implementation mechanisms under the condition that no binding legislation for PRTR exists in China. However, most of the OECD countries have set up mandatory PRTR scheme based on specified legislations. With a background rapid economic development and huge policy context change in China, there is a trend to establish and enhance a mandatory PRTR scheme in China. For example, the scope of CEMS has been expanding, by which, the common citizens can be informed of the continuous emission data. (Jun Zhang, 2013) Moreover, 15,797 Key State-owned Enterprises have been required to monitor and disclose pollutant emission data to the public by January 2014. (MEP, 2013e) Influenced by these, the TEDA PRTR mechanism may only play as an interim model for the current period when the corporate environmental information disclosure is largely voluntary, and generates experience for further research or application efforts. Therefore, such questions as how will the PRTR work under a condition that China forms PRTR binding rules and how will the local government and companies perceive a mandatory PRTR in China are significantly relevant for further study.

## 7 Conclusions

Facing a worsening environment and a strong need for environmental protection, China urgently needs to learn the successful experiences from other countries to improve its governmental environmental regulation as well as corporate performance. According to the experiences of OECD countries, implementing a PRTR has a potential to deliver a number of benefits for different social sectors, such as assisting the environmental management of governments, improving the operating performance of business, facilitating the public participation on environmental issues, and setting the basis for societal consensus and collaborative actions.

Departing from a knowledge gap of understanding the implementing context in China from the corporate perspective, this researcher performed a case study and field research in TEDA and identified twelve key factors, structured by SWOT categories, for general Chinese business corporations to implement a PRTR scheme.

### ➤ **Strengths for Chinese business corporations to implement a PRTR:**

- Environmental self-awareness and fulfilling corporate social responsibility
- Belief that PRTR fits the enterprise's operation and development needs
- Requirements of the enterprise's environmental management systems

### ➤ **Weaknesses for Chinese business corporations to implement a PRTR:**

- Belief that company has no adverse operational impacts on the environment or upon human health
- Belief there is no commercial return from investment and implementing cost
- Perceptions of No/Weak social pressure exerted to disclose environmental information

### ➤ **Opportunities for Chinese business corporations to implement a PRTR:**

- Meeting the requirements of the national environmentally binding rules
- Responding to the policy call of environmental protection authorities
- Satisfying the needs of headquarters, parent company and/or the supply chain

### ➤ **Threats for Chinese business corporations to implement a PRTR:**

- Competitive issues and concerns related to the leaking of information to competitors via PRTR reporting
- Potential risk of data misrepresentation by the media or the public
- Potential risks related to harm to the enterprise's reputation due to information availability

As the core trial area of EGP - PRTR project, TEDA has formed an effective governmental environmental mechanism to facilitate the implementation of PRTRs and gained lots of meaningful experience.

***The TEDA PRTR facilitating mechanism consists of:***

- Establishing a diverse platform for cooperative environmental protection
- Setting a corporate social credit system for evaluating companies
- Proposing the Chinese PRTR Pollutant List (Proposal)
- Releasing the TBNA Environmental Information Disclosure Guideline for Industrial Companies (Trial)
- Making the List of Key Promotion Companies for implementing a PRTR and organizing meetings accordingly
- Providing a standard corporate PRTR reporting form
- Offering a number of free trainings in PRTRs to companies
- Convening annual press conferences to promote PRTRs through the media
- Offering subsidised monetary award (30,000 RMB) to outstanding companies in environmental information disclosure
- Sending appreciation letter to the outstanding company and its parent company in the name of the local Chinese government

The TEDA PRTR facilitating mechanism indeed seems to be seeking to exploit the strengths, addresses the weaknesses, fosters the opportunities and weakens the threats for companies to implement a PRTR. While it has achieved significant results, it only represents the first step for the development of a PRTR in China. A range of challenges have been identified that need to be incorporated in the on-going pilot work and related governmental regulation.

Moreover, many perceived difficulties are likely to become clearer as the TEDA PRTR progresses while other new difficulties may arise. Therefore, for improving the PRTR in TEDA and developing a PRTR in other contexts of China, this thesis author found it currently necessary to form a mandatory permitting system as the basis of a PRTR, to set up an internet-based PRTR scheme and clarify reporting procedures, as well as to facilitate the public participation in China.

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## Appendix I

### Survey about conducting environmental information disclosure in TEDA

#### Questionnaire on the Impetus and Obstacles for Enterprises to Launch Environmental Information Disclosure

Dear enterprise representatives:

Tianjin Economic-Technological Development Area EPB and TEDA ECO Centre are carrying out a research and survey on the current situation, impetus and the main obstacles faced for the enterprises in the area to develop environmental information disclosure, which is meant to allow us to formulate relevant policies targeting better in future. We sincerely invite you to fill in this questionnaire and hand it over to a staff or leave it on the seat at the conference, or send it to \*\*\* by fax or to \*\*\* by email after the conference. Thank you for your support and participation!

Enterprise name: \_\_\_\_\_

Filled by: \_\_\_\_\_

Department: \_\_\_\_\_

Contact: \_\_\_\_\_

**Is your enterprise disclosing environmental information on a voluntary basis?**

\_\_\_\_\_

**Does your enterprise wish to participate in “Tianjin Binhai New Area Pilot PRTR project on Environmental Information Disclosure”?**

\_\_\_\_\_

**The main factors restraining your enterprise from developing environmental information disclosure (please fill in “X”, or change the colour at corresponding options)**

Influencing factors	Not important	Less important	Medium important	Quite important	Most important
1. The enterprise has no adverse impact on the environment	0	1	2	3	4
2. The disclosure of environmental information brings no competitive advantage or commercial return	0	1	2	3	4
3. The disclosure of environmental information needs to increase operating cost	0	1	2	3	4
4. Now, the enterprise hasn't collected relevant environmental information	0	1	2	3	4
5. There isn't any law or regulation on environmental protection requiring enterprises to disclose environmental information	0	1	2	3	4
6. Afraid to disclose sensitive information to the outside	0	1	2	3	4
7. Avoid disclosing information to rivals	0	1	2	3	4
8. Worry that the disclosure of environmental information may harm the enterprise's reputation	0	1	2	3	4
9. The society doesn't require the enterprise of environmental information	0	1	2	3	4
10. Worry that the media or other users have other interpretations to the environmental information disclosed	0	1	2	3	4
11. Others, please specify them in details:					

The main factors that may encourage your enterprise to carry out environmental information disclosure in future (please fill in “X”, or change the color at corresponding options)

Influencing factors	Not important	Less important	Medium important	Quite important	Most important
1. Due to the enterprise’s operation and development needs	0	1	2	3	4
2. As required by the enterprise’s environmental management system (such as ISO14001)	0	1	2	3	4
3. The enterprise’s leaders are quite environmentally conscious and responsible	0	1	2	3	4
4. The enterprises’ staffs are quite environmentally conscious and responsible	0	1	2	3	4
5. In response to the company’s headquarters’ or the parent company’s demand	0	1	2	3	4
6. As required by the enterprise’s culture/ethics	0	1	2	3	4
7. To satisfy the requirements of the state’s environmental laws and regulations	0	1	2	3	4
8. In response to the call of the policies of environmental departments	0	1	2	3	4
9. Being awarded financial incentive on the disclosure of environmental information by the local government	0	1	2	3	4
10. Influenced by the enterprises of the same trade (or local enterprises)	0	1	2	3	4
11. Influenced by environmental protection associations/chambers of commerce	0	1	2	3	4
12. To satisfy consumers’ requirements and to facilitate marketing	0	1	2	3	4
13. To satisfy the requirements of the enterprise’s shareholders/investors on environmental information	0	1	2	3	4
14. To satisfy the information requirement for banks to examine for providing loans	0	1	2	3	4

15. To satisfy the requirement of environmental protection by the enterprises at the upper and lower reaches of the supply chain	0	1	2	3	4
16. To satisfy the media's demand of increasing environmental information	0	1	2	3	4
17. To strengthen the relation with local community	0	1	2	3	4
18. Others, please specify them in details:					

**The assistance that your enterprise needs to carry out environmental information disclosure in future (please fill in “X”, or change the colour at corresponding options)**

Influencing factors	Not important	Less important	Medium important	Quite important	Most important
1. The special training on relevant environmental information disclosure organized by TEDA Environmental Protection Association	0	1	2	3	4
2. Learn from other local enterprises experienced in developing environmental information disclosure	0	1	2	3	4
3. The technical instruction and experience exchange provided by the enterprise's headquarters	0	1	2	3	4
4. The specialists' on-site guidance aiming at the control and disclosure of enterprises' environmental information	0	1	2	3	4
5. “Guide on the Preparation of TEDA Enterprises' Environmental Information Disclosure” and best cases	0	1	2	3	4
6. The financial support of TEDA Management Committee on enterprises' environmental information disclosure	0	1	2	3	4
7. Others, please specify them in details:					

## Appendix II

### Related Companies of the PRTR Trial Project in TEDA

Company Name	Nationality / Industry	Survey Joined	Symposiums Joined / Attendee / Abbreviation	PRTR Related Information
<b>PPG Coating (Tianjin) Co., Ltd</b>	U.S. / Coating	YES	YES Symposium 2 / HSE Manager / PPG	Voluntary engaged in the pilot PRTR since 2012; Continuously publically disclosed environmental information including emission data for 3 years.
<b>Novozymes (China) Biotech Co., Ltd</b>	Denmark / Biotech	YES	No	Voluntary engaged in the pilot PRTR since 2012 ; Continuously publically disclosed environmental information including emission data for 3 years.
<b>Cabot (Chemical) Tianjin Co., Ltd</b>	U.S. / Chemical	YES	No	Voluntary engaged in the pilot PRTR since 2012; Continuously publically disclosed environmental information including emission data for 3 years.
<b>Cabot High-performance Materials (Tianjin) Co., Ltd</b>	U.S. / Chemical Materials	No	No	Voluntary engaged in the pilot PRTR since 2012; Continuously publically disclosed environmental information including emission data for 3 years.
<b>Tianjin TEDA Veolia Water Co., Ltd</b>	China & France / Waste Water Treatment	YES	No	Voluntary engaged in the pilot PRTR since 2012; Continuously publically disclosed environmental information including emission data for 3 years.
<b>Motorola Mobile Tech (China) Co., Ltd</b>	U.S. / Electrics	YES	No	Voluntary engaged in the pilot PRTR since 2012; Continuously publically disclosed environmental information including emission data for 3 years.
<b>Tianjin Tsingyi Food Co., Ltd</b>	Taiwan / Foods	No	No	Voluntary engaged in the pilot PRTR since 2012; Continuously publically disclosed environmental information including emission data for 3 years.
<b>Tianjin Samsung Electronics Co., Ltd and Eight other Samsung (Tianjin) companies.</b>	Korea / Electrics	YES (4 / 8)	No	Voluntary engaged in the pilot PRTR since 2012; Continuously publically disclosed environmental information including emission data for 3 years.
<b>Owenscorning (Tianjin) Construction Materials Co., Ltd</b>	U.S. / Construction Materials	YES	No	Voluntary engaged in the pilot PRTR since 2012; Continuously publically disclosed environmental information including emission data for 3 years.
<b>ROHM Semiconductor (China) Co., Ltd</b>	Japan / Semiconductor	YES	No	Voluntary engaged in the pilot PRTR since 2012; Continuously publically disclosed environmental information including emission data for 3 years.

<b>Tianjin Fengxing Electronics Co., Ltd</b>	China / Electrics	YES	No	Voluntary engaged in the pilot PRTR since 2012; Continuously publicly disclosed environmental information including emission data for 3 years.
<b>Tianjin Binhai Mass Transit Development Co., Ltd</b>	China / Transportation	No	No	Voluntary engaged in the pilot PRTR since 2012; Continuously publicly disclosed environmental information including emission data for 3 years.
<b>Tianjin Binhai Energy &amp; Development Co., Ltd</b>	China / Energy	YES	No	Voluntary engaged in the pilot PRTR since 2012; Continuously publicly disclosed environmental information including emission data for 3 years.
<b>Tianjin Dai-Ichi Fine Chemicals Co., Ltd</b>	China / Fine Chemicals	No	No	Voluntary engaged in the pilot PRTR since 2012; Continuously publicly disclosed environmental information including emission data for 3 years.
<b>Kumho Tires (Tianjin) Co., Ltd</b>	Hong Kong / Tires	YES	No	Voluntary engaged in the pilot PRTR since 2012; Continuously publicly disclosed environmental information including emission data for 3 years.
<b>GlaxoSmithKline (Tianjin) Co., Ltd</b>	England / Pharm.	No	No	Voluntary engaged in the pilot PRTR since 2012; Continuously publicly disclosed environmental information including emission data for 3 years.
<b>Tianjin LG DAGU Chemical Co., Ltd</b>	Korea & China / Chemicals	YES	No	Voluntary engaged in the pilot PRTR since 2012; Continuously publicly disclosed environmental information including emission data for 3 years.
<b>Tianjin GS Battery Co., Ltd</b>	Japan / Battery	YES	YES Symposium 2 / N/A / GS	Voluntary engaged in the pilot PRTR since 2012; Continuously publicly disclosed environmental information including emission data for 3 years.
<b>Taiding (Tianjin) Environment Tech. Co., Ltd</b>	China / Waste Treatment	YES	No	Voluntary engaged in the pilot PRTR since 2012; Continuously publicly disclosed environmental information including emission data for 3 years.
<b>Tianjin Hejia Veolia Environmental Service Co., Ltd</b>	China & France / Environmental Services	No	No	Voluntary engaged in the pilot PRTR since 2012.
<b>Tianjin Denso Electronics Co., Ltd</b>	Korea & China / Electrics	No	No	Voluntary engaged in the pilot PRTR since 2012.
<b>Kennametal Inc.</b>	U.S. / Metal	No	No	Voluntary engaged in the pilot PRTR since 2012.
<b>Honeywell (Tianjin) Co., Ltd</b>	U.S. / Materials	No	No	Voluntary engaged in the pilot PRTR since 2012.
<b>Tianjin Stanley Electric Co., Ltd.</b>	U.S. / Electrics	No	YES Symposium 1 / HSE Manager / Stanley	Not engaged in the PRTR system yet.
<b>Tianjin Zhongxin Pharmaceutical Group</b>	China / pharmaceutic al	No	YES Symposium 1 / Vice-director / Zhongxin	Not engaged in the PRTR system yet. Chinese state owned corporation, listed.

<b>Rionlon pharmaceutical Co. Ltd.</b>	Hongkong / Fine chemicals	No	YES Symposium 1 /CEO /Rionlon	Not engaged in the PRTR system yet. Export oriented company (70% production for export)
<b>Cenway pharmaceuticals Co. Ltd.</b>	China/Pharmaceuticals	YES	YES Symposium 1 Department Manager/Cenway	Not engaged in the PRTR system yet. Listed Corporations
<b>Life science Kelein (Tianjin) Co. Ltd.</b>	China/Pharmaceuticals	No	YES Symposium 1 / Vice-general manager /Kelein	Not engaged in the PRTR system yet. Private Company / Going to be Listed
<b>Tianjin Motimo Membrane Technology Ltd.</b>	China / Membrane Technology	No	YES Symposium 1 / Vice-general manager /Motimo	Not engaged in the PRTR system yet. State owned company / Listed
<b>Tianjin Jin Yao Biological Technology Co., Ltd.</b>	China/Biological Technology	No	YES Symposium 1 /CEO /Jin Yao	Not engaged in the PRTR system yet. Listed Corporations (60% for export)
<b>Tianjin Toyota Faw Motor Co. Ltd.</b>	Japan & China	Yes	YES Symposium 1 /HSE Manager /Toyota	Not engaged in the PRTR system yet. State shared company
<b>Tianjin Fuji Tongtian Electronic Co., Ltd.</b>	Japan & China / Electronic	YES	YES Symposium 1 /HSE Manager /Fuji	Not engaged in the PRTR system yet.
<b>Nokia &amp; Siemens Communications Co., Ltd.</b>	Europe / Electronic	No	YES Symposium 1 /Vice-CEO /Nokia & Siemens	Not engaged in the PRTR system yet.
<b>Tianjin Donghailihua Automobile Parts Co., Ltd</b>	Japan / Automobile Parts	No	YES Symposium 1 /Vice-CEO /Donghai	Not engaged in the PRTR system yet.
<b>Vestas Wind Technology (China) Co., Ltd.</b>	Denmark / New Energy	No	YES Symposium 1 / N/A /Vestas	Not engaged in the PRTR system yet.
<b>Tianjin Dowill paint Chemical Co., Ltd.</b>	China & US / Painting	No	YES Symposium 2 / N/A /Dowill	Not engaged in the PRTR system yet.
<b>COSCO Kansai paint (Tianjin) Co. Ltd.</b>	Hong kong & Japan & China / Painting	No	YES Symposium 2 / N/A / Kansai	Not engaged in the PRTR system yet.
<b>Fujikura Kasei Chemical Coating (Tianjin) Co. Ltd.</b>	Japan / Coating	No	YES Symposium 2 / N/A / Kasei	Not engaged in the PRTR system yet.
<b>AKZO NOBEL coatings (Tianjin) Co. Ltd.</b>	Netherlands / Coating	No	YES Symposium 2 / N/A / Akzo	Not engaged in the PRTR system yet.
<b>Tianjin Colouroad Coatings &amp; Chemical Co.,</b>	China & Hong Kong / Coating	No	YES Symposium 2 / N/A/ Colouroad	Not engaged in the PRTR system yet.

<b>Ltd.</b>				
<b>Tianjin Yong Fu Kansai Paint Ltd.</b>	Japan & Hong Kong / Painting	No	YES Symposium 2 / N/A /YF	Not engaged in the PRTR system yet.
<b>Qin Wei (Tianjin) Industrial Co., Ltd.</b>	Taiwan / Industrial	No	YES Symposium 2 / N/A /Qin Wei	Not engaged in the PRTR system yet.
<b>Tianjin Jinggong-huahui Plate Making Technology Development Co. Ltd</b>	China & Germany / Plate Making Technology	No	YES Symposium 2 / N/A /Jinggong	Not engaged in the PRTR system yet.
<b>Cargill food (Tianjin) Co. Ltd.</b>	US & China / Foods	No	YES Symposium 2 / N/A /Cargill	Not engaged in the PRTR system yet.
<b>TEDA Hospital</b>	China / Hospital	No	YES Symposium 3 / N/A / TEDAH	Not engaged in the PRTR system yet.
<b>Schlumberger Marine Services Co. Ltd.</b>	U.S. / Oil and gas service	No	YES Symposium 3 / N/A /Schlumberger	Not engaged in the PRTR system yet.
<b>Halliburton Energy Services Co. Ltd.</b>	U.S. / Oil and gas service	No	YES Symposium 3 / N/A / Halliburton	Not engaged in the PRTR system yet.
<b>Yoshida Co. Ltd.</b>	Japan / dental material	No	YES Symposium 3 / N/A /Yoshida	Not engaged in the PRTR system yet.
<b>Fraternity Extruded Core Material Co. Ltd.</b>	Brazil / core material	No	YES Symposium 3 / N/A / {Fraternity}	Not engaged in the PRTR system yet.
<b>John Deere Co. Ltd.</b>	U.S / construction machinery	No	YES Symposium 3 /N/A/John Deere	Not engaged in the PRTR system yet.
<b>OTIS Elevator Company</b>	U.S / Elevator	No	YES Symposium 3 / N/A / Otis	Not engaged in the PRTR system yet.
<b>Dentsply Co. Ltd.</b>	Australia / Dentistry	No	YES Symposium 3 / N/A / Dentsply	Not engaged in the PRTR system yet.
<b>Continental Automotive Co. Ltd.</b>	Germany / Automobile	YES	YES Symposium 3 / N/A / Continental	Not engaged in the PRTR system yet.
<b>Yuasa (Tianjin) Industrial Co., Ltd.</b>	Japan / Electrics	No	YES Symposium 3 / N/A / Yuasa	Not engaged in the PRTR system yet.
<b>Tianjin Futaba-sc Mechanical Co., Ltd.</b>	Japan & China / Mechanical	No	YES Symposium 3 / N/A / Futaba	Not engaged in the PRTR system yet.
<b>Tianjin Yuchuan Microbial Products Co. Ltd.</b>	China / Microbial products	YES	No	Not engaged in the PRTR system yet. Private company
<b>SEW- industrial</b>	Germany /	YES	No	Not engaged in the PRTR system yet.

gear reducer (Tianjin) Co. Ltd.	Industrial gear reducer				
Delta chemical (Tianjin) Co. Ltd.	Taiwan / Chemical	YES	No		Not engaged in the PRTR system yet.
Volclay (Tianjin) Industrial Minerals Co., Ltd.	US / Industrial Minerals	YES	No		Not engaged in the PRTR system yet.
Tianjin Foqiang Renewable Resources & Environmental Technology Co., Ltd.	China / Renewable Resources & Environment al Tech.	YES	No		Not engaged in the PRTR system yet. Private Company
Lizhong Wheel Group Ltd.	China / Wheel	YES	No		Not engaged in the PRTR system yet. Private Company
Golden Bridge Welding Materials	China / Welding Materials	YES	No		Not engaged in the PRTR system yet. Private Company
Nestlé (Tianjin) Company Limited	Switzerland / Foods	YES	YES Symposium 4 / General Manager / Nestlé		Not engaged in the PRTR system yet.
The Crane Island Tianjin Agricultural Science and Technology Co., Ltd.	China / Agricultural Tech.	YES	No		Not engaged in the PRTR system yet. Private Company
Ada Automatic Transmission	Japan & China / automatic transmission	YES	No		Not engaged in the PRTR system yet.
Tianjin Jianfeng Natural Product R&D Co. Ltd.	China / Foods	YES	No		Not engaged in the PRTR system yet. Private Company
Cappelle pigments (Tianjin) Co. Ltd.	Germany / Pigments	YES	No		Not engaged in the PRTR system yet.
American Standard (Tianjin) Ceramic Co., Ltd.	US / Ceramic	YES	No		Not engaged in the PRTR system yet.
Tianjin Pinghe Chemical Co. Ltd.	Korea / Chemicals	YES	No		Not engaged in the PRTR system yet.
Yaguang Nypro precision molding (Tianjin) Co. Ltd.	China & US / Molding	YES	No		Not engaged in the PRTR system yet.
Tianjin Chang	China /	YES	No		Not engaged in the PRTR system yet.

<b>Wei Technology Co., Ltd.</b>	Electrics			Private Company
<b>Tianjin Zhongxing Automotive Components Company Limited</b>	China / Automotive Components	YES	No	Not engaged in the PRTR system yet.
<b>Kenos (China) sulfate Technology Co. Ltd.</b>	France / Sulfate	YES	No	Not engaged in the PRTR system yet.
<b>Tsingjin (Tianjin) Foods Co. Ltd.</b>	Taiwan / Foods	No	YES Symposium 4 / CEO / Tsingjin	Not engaged in the PRTR system yet.
<b>Otsuka (Tianjin) Foods Co. Ltd.</b>	Japan / Foods	No	YES Symposium 4 / Vice – CEO / Otsuka	Not engaged in the PRTR system yet.
<b>Energizer Battery (China) Co. Ltd.</b>	US / Battery	No	YES Symposium 4 / HSE Manager / Energizer	Not engaged in the PRTR system yet.
<b>Tianjin Toyota Faw Dies Co. Ltd.</b>	China & Japan / Moulding	No	YES Symposium 4 / HSE Manager / Toyota Faw Dies	Not engaged in the PRTR system yet. State – owned Company
<b>Tianjin Pepsi Cola Beverage Co. Ltd.</b>	US / Foods	No	YES Symposium 4 / HSE Manager / Pepsi	Not engaged in the PRTR system yet.
<b>Tianjin Tingzheng Packaging Printing Materials Co., Ltd.</b>	Taiwan / Packaging	No	YES Symposium 4 / CEO / Tingzheng	Not engaged in the PRTR system yet.
<b>Amcol (Tianjin) Industrial Minerals Co., Ltd.</b>	US / Mining	No	YES Symposium 4 / General Manager / Amcol	Not engaged in the PRTR system yet.
<b>Idemitsu Lubricating Oil Co. Ltd.</b>	Japan / Lubricating Oil	No	YES Symposium 4 / CEO & HSE Manager / Idemitsu	Not engaged in the PRTR system yet.
<b>Dana Beh Sitte Sensor Industrial Control Co. Ltd.</b>	US / Industrial Sensor Control	No	YES Symposium 4 / HSE Vice-Manager / Dana	Not engaged in the PRTR system yet.

## Appendix III The TEDA PRTR Reporting Form

Company Name (Chinese):	Listed or not: If yes, please fill: Listed Company Name (Chinese): Listed Company Name (English):			
Company Name (English):				
Address				
Reporting Year:		Listing location:		
Wastewater discharge direction:		Transaction Code:		
Contractor Name:				
Contractor Position:	Please select your industry:	Industry:		
Contractor Contacts:		Sub Sectors:		

Inputs	Water Consumption	Numerical Value	Energy consumption	Numerical Value	Raw material	Numerical Value
	Fresh water consumption	million tons		Fuel coal	tons	
includes: Tap Water	million tons		Fuel oil	tons		tons
Surface Water	million tons		Coal oil	tons		tons
Underground water	million tons		Includes: Heavy oil	tons		tons
Others	million tons		Diesel oil	tons		tons
Reuse water	million tons		Liquefied gas	cubic meters		tons
Water consumption per million RMB output value	tons		Coal gas	cubic meters		tons
			Natural gas	cubic meters		tons
			Energy per m. RMB	tons	Recyclable raw material ratio	%
Outputs	Waste water	million tons	Solid waste	tons	Hazardous waste	tons
	Waste air	standard cubic meters	Includes: resource	tons	Includes: resource	tons
			Final disposal	tons	Final disposal	tons

Pollutant			Annual Release Quantity (tons/year) <sup>(1)</sup>						Annual Transfer Quantity (tons/year) <sup>(1)</sup>		
No.	Name	CAS No.	To Air	Method Used <sup>(2)</sup>	To water	Method Used <sup>(2)</sup>	To Land	Method Used <sup>(2)</sup>	Transfer quantity <sup>(3)</sup>	Method Used <sup>(2)</sup>	Transfer To
The conventional factors (Required)											
1	COD										
2	NH <sub>3</sub> -N										
3	Total phosphorous										
4	SO <sub>2</sub>										
5	Nox										
6	PM										
7	Soot										
8	VOC										
The environmental impact assessment characteristic factors (Required)											
9											
10											
11											
Harmful chemicals (Optional, choose from appendix 1)											
19											
20											
21											
Notes:											
(1) Refer to OECD classification											
(2) Please select the data base											
Data base: 1. Gained from declaration or audit											
A. Enterprises annual emission declaration; B. Cleaner production auditing; C. Third party audit; D. Others (Please explain)											
Data base: 2. Gained from calculation											
1) Calculate based on concentration; E. Supervisory monitoring data of EPB; F. Online monitoring data of EPB; G. Authorized monitoring data; H. Self testing data;											
2) Calculate based on consumption: I. Material balance method of third party; J. Material balance method of facilities; K. Others (Please explain)											
3), 4) The quantity oughts to include the whole discharge and transfer amount of all the facility activities purposely, accidentally, conventionally or unconventionally.											
5) The quantity of all the harmful chemicals transferred to waste treatment plant by effluent											

## Appendix IV

### Contact List for PRTR of Main OECD Countries

**Australia:** National Pollutant Inventory

Australian Government  
NPI and Hazardous Waste Section Department of Sustainability, Environment, Water, Population and Communities GPO  
Box 787 Canberra ACT 2601  
Phone: 1800 657 945  
Facsimile: (02) 6274 1164  
Email: [npi@environment.gov.au](mailto:npi@environment.gov.au)  
Website: [www.npi.gov.au](http://www.npi.gov.au)

**Information source:** [www.npi.gov.au](http://www.npi.gov.au) & National Pollutant Inventory Guide (Version 5.3, May. 2012)

**Canada:** National Pollutant Release Inventory

Environment Canada  
Fontaine Building  
200 Sacré Coeur Boulevard  
Gatineau, QC K1A 0H3  
Tel.: 1-877-877-8375  
Fax: 819-953-2347  
Email: [inrp-npri@ec.gc.ca](mailto:inrp-npri@ec.gc.ca)

**Information source:** [www.ec.gc.ca](http://www.ec.gc.ca) & Guide For Reporting To The National Pollutant Release Inventory NPRI 2011

**Japan:** Pollutant Release and Transfer Register

Ministry of the Environment Government of Japan  
Godochosha No. 5  
Kasumigaseki 1-2-2  
Chiyoda-ku, Tokyo 100-8975, Japan  
Tel.: +81-(0)3-3581-3351  
E-mail: [MOE@env.go.jp](mailto:MOE@env.go.jp)

**Information source:** <http://www.env.go.jp/en/chemi/prtr/prtr.html>

**Mexico:** Registro de Emisiones y Transferencia de Contaminantes (RETC)

Bldv. Adolfo Ruiz Cortines # 4209  
Col. Jardines en la Montaña, Deleg.  
Tlalpan Distrito Federal CP. 14210,  
Tel.: (55) 5490-0900

**Information source:** <http://www.semarnat.gob.mx/temas/gestionambiental/calidaddelaire/Paginas/retc.aspx>

**Netherlands:** Emission Register

National Institute for Public Health and the Environment (RIVM)  
P.O. Box 1  
3720 BA Bilthoven  
The Netherlands  
Tel.: + 31 (0) 30 274 9111  
Email: [info@rivm.nl](mailto:info@rivm.nl)

**Information source:** <http://www.rivm.nl/English>

**Sweden:** Swedish Environmental Reports

Stockholm: Valhallavägen 195  
Östersund: Forskarens väg 5 (Campus Östersund, hus Ub)  
SE-106 48 Stockholm.  
Tel.: +46 8 698 10 00.  
FAX: +46 8 20 29 25.

**Information source:** <http://utslappisiffror.naturvardsverket.se/en/>

**Switzerland:** Pollutant Release and Transfer Register

Federal Office for the Environment FOEN  
3003 Bern  
Tel.: +41 (0) 31 322 93 11  
Email: [info@bafu.admin.ch](mailto:info@bafu.admin.ch)

**Information source:** <http://www.bafu.admin.ch/chemikalien/prtr/index.html?lang=en>

**UK:** Pollution Inventory

Environment Agency  
Deanery Road  
Bristol BS1 5AH  
Tel.: 03708 506506  
<http://publications.environment-agency.gov.uk>  
Email: [enquiries@environment-agency.gov.uk](mailto:enquiries@environment-agency.gov.uk)  
[www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)

**Information source:** <http://www.environment-agency.gov.uk/business/topics/pollution/32272.aspx>  
& Pollution inventory reporting - general guidance notes, Environmental Permitting (England and Wales) Regulations 2010 Regulation 60(1) (LIT 7665 - 1200\_10 Version 5 December 2012)

**US:** Toxic Chemical Release & Inventory

Environmental Protection Agency  
(800) 424-9346 - select option 3  
(703) 412-9810 - Wash. DC metro area  
(800) 553-7672 – TDD

**Information source:** <http://www.epa.gov/tri/> & Toxic Chemical Release & Inventory Reporting Forms and Instructions (Revised 2012 Version)

## Appendix V

### Excerpts of Corporate Interviews for Thesis Research

Interview questions for the Corporate Representatives of Companies in TEDA

Field-research in Tianjin: August 2013

Chao Zhang

Interviewee: Minghong Cao

Company (Nationality): Samsung (Tianjin) Communication Technology Co., Ltd

Department & Position: Environment and Safety Department, Department Manager

Contact Details: \*\*\*

Date & Duration: 20th August, 2013 & 25 minutes

#### Introduction

This interview is part of a Masters' research for the International Institute for Industrial Environmental Economics (IIIIEE) at Lund University, based on the research project coordinated by the TEDA Administrative Commission and the TEDA Eco Centre.

The research aim is to identify key facilitating and constraining factors from a business perspective for the implementation of Pollutant Release and Transfer Register (PRTR) in Chinese context. This interview aims to understand and examine the knowledge on PRTR of the companies in TEDA, check more deeply about the corporate prospects and SWOT's findings of a PRTR given by surveys and symposiums.

The interview is expected to be held around duration of 30 minutes. The following are themes and questions that will be posed.

#### Theme: Understand the Knowledge of PRTR

1. *Could you describe your view of / general understanding of a PRTR?*

Little familiar.

Although the Samsung (Tianjin) Company has established well-developed environmental information disclosure system and made adequate efforts, especially has been leading the corporate environmental information disclosure in TEDA since the year of 2009, I haven't yet fully understand the conception of PRTR.

I only know the PRTR is a form of environmental information disclosure, which help the enterprises report their emission data in a detailed form.

**[Before continuing the interview, the interviewer has to guarantee that the interviewee has a fundamental understanding of PRTR. Or else, explain simply.]**

2. *Could you please describe the implications that you believe that PRTRs do, or might have for companies that report to them?*

Firstly, I believe that PRTR is a mechanism assisting the self-control of enterprises, as it can monitor the operation, and check the environmental performance continuously, etc.

Secondly, it provides a standard incentive for companies to further improve their environmental works.

Thirdly, it is significant way for enterprises to take corporate social responsibilities and improve corporate images.

3. *Could you please describe the implications that you believe that PRTRs do, or might have for the public that report to them?*

The PRTR is very important to the general public as well.

Especially, it can help form a phenomenon that people are concerned about environmental issues, companies operate in a transparent and eco-competitive way and governments can easily implement environmental policies.

#### **Theme: Examine the Knowledge of PRTR**

4. *Have you improved your understanding of a PRTR by the promotion of TEDA? Please explain how (if at all) has the promotion by TEDA improved your understanding (making up knowledge gaps) of PRTRs and PRTR processes?*

My understanding of PRTR is being improved in a continuous way.

However, I think, such a name or specified conception is not important, knowing what environmental information disclosure is and how such works can be done is more important to us.

5. *(If the company has joined the EGP-PRTR project to disclose their environmental information) Have you improved your understanding of a PRTR by joining the PRTR scheme? Please explain.*

Yes. I have joined the training seminar organized by TEDA and studied such conception, which benefit me a lot in improving my understanding and awareness evidently.

6. *Have you improved your understanding of a PRTR by other means? Please elaborate.*

Our company has promoted environmental information disclosure with great efforts, influencing me a lot.

#### **Theme: Check the SWOT findings (corporate statements or responses) of PRTR**

7. *The results of the investigation of the EGP – PRTR research group so far have indicated that the three factors, “Environmental self-awareness and possessing corporate social responsibility”, “Fitting the enterprise’s operation and development needs” and “Being required and promoted by the enterprise’s environmental management system” form the main strengths for Chinese companies to join the PRTR scheme. (Strengths means the characteristics of a business that give itself advantage relative to others)*

*Do you agree with this, why / why not, please elaborate & explain?*

Yes, I totally agree.

Especially, the Samsung (Tianjin) aims to be the leader in the field of corporate social responsibility and environmental protection, which promotes a lot for us to implement adequate environmental works.

We believe, the environmental protection is a social trend, with the adequate public pressure, and the environmental information disclosure ought to be a main job for companies.

8. *The results of the investigation of the EGP – PRTR research group so far have indicated that the three factors, “No adverse impact on the environment, uncalled-for PRTR”, “The disclosure of environmental information brings no competitive advantage or commercial return” and “No social requirement and pressure on enterprises to disclose environmental information” form the main weaknesses for Chinese companies to join the PRTR scheme. (Weaknesses means the characteristics that place the team at a disadvantage compared to others)*

*Do you agree with this, why / why not, please elaborate & explain?*

Probably not.

As to Samsung (Tianjin), we haven't faced such weaknesses as you mentioned. That might be influenced by industry and company characteristics.

9. *The results of the investigation of the EGP – PRTR research group so far have indicated that the three factors, “Meeting the requirements of the national environmental regulations”, “Response to the policy call of environmental protection authorities” and “Response to the company’s headquarters’ or the parent company’s demand or satisfy the requirement of the supply chain” form the main opportunities for Chinese companies to join the PRTR scheme. (Opportunities means “elements that a business could exploit or transferred to its advantage)*

*Do you agree with this, why / why not, please elaborate & explain?*

Yes.

I definitely agree with all the three factors, and they play as the essential incentives for us to implement a PRTR.

Especially, the requirements and promotion of group companies and parent company in the upper level is quite evident. As to Samsung, we have a “North-eastern China coordinating committee” which specially design and draft related policies.

I also want to mention that the Samsung (Tianjin) has started exert pressure on its suppliers, which includes 59 main environmental performance controlling companies currently.

10. *The results of the investigation of the EGP – PRTR research group so far have indicated that the three factors, “Leaking information to competitors”, “The environmental information disclosed might be misinterpreted by media or the public” and “Worrying that the disclosure of environmental information may harm the enterprise’s reputation” form the main threats for Chinese companies to join the PRTR scheme. (Threats means elements in the external environment that could cause trouble or form barrier for the business)*

*Do you agree with this, why / why not, please elaborate & explain?*

Yes, they are true.

Overall, the environmental information disclosure is indeed showing a naked body of companies to the public, we therefore have to face lots of challenges as media misunderstanding, ruining the corporate images or leaking business secrets. However, those heavily depend on individual corporate performances.

### **Theme: SUCCESS OR FAILURE of the TEDA PRTR?**

11. *Please describe how you see the likely development of the PRTR in TEDA and then applying PRTR more broadly within China.*

I believe the environmental protection works, especially the environmental information disclosing; in TEDA has been leading in China. We benefited from this. I therefore wish it could be better and better.

## **Interview questions for the Corporate Representatives of Companies in TEDA**

**Field-research in Tianjin: August 2013**

**Chao Zhang**

Interviewee: Cheng Zheng

Company (Nationality): Cenway (Tianjin) Pharmaceuticals Technology Co., Ltd

Department & Position: HSE Department, Department Officer

Contact Details: \*\*\*

Date & Duration: 21st August, 2013 & 32 minutes

### **Introduction**

This interview is part of a Masters' research for the International Institute for Industrial Environmental Economics (IIIEE) at Lund University, based on the research project coordinated by the TEDA Administrative Commission and the TEDA Eco Centre.

The research aim is to identify key facilitating and constraining factors from a business perspective for the implementation of Pollutant Release and Transfer Register (PRTR) in Chinese context. This interview aims to understand and examine the knowledge on PRTR of the companies in TEDA, check more deeply about the corporate prospects and SWOTs findings of a PRTR given by surveys and symposiums.

The interview is expected to be held around duration of 30 minutes. The following are themes and questions that will be posed.

### **Theme: Understand the Knowledge of PRTR**

1. *Could you describe your view of / general understanding of a PRTR?*

Benefited from joining the training and related activities organized by TEDA, I have heard about the PRTR and know its fundamental meaning. It is a detailed and concrete way of disclosing environmental information.

**[Before continuing the interview, the interviewer has to guarantee that the interviewee has a fundamental understanding of PRTR. Or else, explain simply.]**

2. *Could you please describe the implications that you believe that PRTRs do, or might have for companies that report to them?*

It is a very important way and effective approach to monitor the business corporations. Based on the PRTR, the enterprises themselves can decrease their resources consumption, and increase the production efficiency. At the same time, the governments can implement proper regulation and improve their policy making and administration process.

3. *Could you please describe the implications that you believe that PRTRs do, or might have for the public that report to them?*

The implications that the PRTRs do to the public are very beneficial and obvious. It helps form a transparent business, which will benefit the public, firstly resolving the information asymmetry, then facilitating the public participation and exerting pressure backwards on the business to protect the environment.

**Theme: Examine the Knowledge of PRTR**

4. *Have you improved your understanding of a PRTR by the promotion of TEDA? Please explain how (if at all) has the promotion by TEDA improved your understanding (making up knowledge gaps) of PRTRs and PRTR processes?*

Yes. Obviously.

Fundamentally, it informs me about the PRTR. Without it, I couldn't hear about such a conception as PRTR.

5. *(If the company has joined the EGP-PRTR project to disclose their environmental information) Have you improved your understanding of a PRTR by joining the PRTR scheme? Please explain.*

Yes. As mentioned above.

Furthermore, I think operating such an international cooperative project to help establish an environmental management system and help us learn the foreign experience is very necessary.

6. *Have you improved your understanding of a PRTR by other means? Please elaborate.*

Not yet.

**Theme: Check the SWOT findings (corporate statements or responses) of PRTR**

7. *The results of the investigation of the EGP – PRTR research group so far have indicated that the three factors, “Environmental self-awareness and possessing corporate social responsibility”, “Fitting the enterprise’s operation and development needs” and “Being required and promoted by the enterprise’s environmental management system” form the main strengths for Chinese companies to join the PRTR scheme. (Strengths means the characteristics of a business that give itself advantage relative to others)*

*Do you agree with this, why / why not, please elaborate & explain?*

I basically agree with the three factors.

Especially, I realized that the factor of “Environmental self-awareness” is very important to us. Actually, it is the awareness and preference of corporate leaders that influence the most.

Our company was established by graduates of the Tsinghua University, who were relatively more aware of environmental issues. Currently, our company belongs to the Shiyao Group Co. Ltd., which is a large state-owned company, so that the leaders from the group support us (the HSE department) to improve our environmental performance.

8. *The results of the investigation of the EGP – PRTR research group so far have indicated that the three factors, “No adverse impact on the environment, uncalled-for PRTR”, “The disclosure of environmental information brings no competitive advantage or commercial return” and “No social requirement and pressure on enterprises to disclose environmental information” form the main weaknesses for Chinese companies to join the PRTR scheme. (Weaknesses means the characteristics that place the team at a disadvantage compared to others)*

*Do you agree with this, why / why not, please elaborate & explain?*

As to our company, I haven't realized such weaknesses, since we did well thus won't be afraid of disclosing and being transparent.

However, as I know, the chemical industry is a heavy polluted one that most of our competitors won't publicize their environmental information as they have a bad operating and environmental condition.

9. *The results of the investigation of the EGP – PRTR research group so far have indicated that the three factors, “Meeting the requirements of the national environmental regulations”, “Response to the policy call of environmental protection authorities” and “Response to the company’s headquarters’ or the parent company’s demand or satisfy the requirement of the supply chain” form the main opportunities for Chinese companies to join the PRTR scheme. (Opportunities means “elements that a business could exploit or transferred to its advantage)*

*Do you agree with this, why / why not, please elaborate & explain?*

I agree.

Our company has been engaged into the environmental information disclosure and joined the PRTR scheme for years, the most important incentive comes from the promotion of the TEDA EPB, especially the business exchange symposiums, which my boss attended and decided to join the PRTR, I therefore ought to follow.

Besides the three factors, I want to add one important point, that the PRTR can also assist to reuse the waste and saving cost. This is also a big concern of our company as we generate large quantity of valuable waste and hope to find a mechanism to monitor, trace and publicize the related information.

10. *The results of the investigation of the EGP – PRTR research group so far have indicated that the three factors, “Leaking information to competitors”, “The environmental information disclosed might be misinterpreted by media or the public” and “Worrying that the disclosure of environmental information may harm the enterprise’s reputation” form the main threats for Chinese companies to join the PRTR scheme. (Threats means elements in the external environment that could cause trouble or form barrier for the business)*

*Do you agree with this, why / why not, please elaborate & explain?*

I basically agree, yet doubt to a little extent.

As to the cost, I don't think the enterprises will pay a lot for environmental information disclosure.

As to leaking the business secrets, I think it will be resolved by more proper governmental guidance and legislation. However, I believe the business will be very sensitive and always leak only a part of its whole information considering the interest of the company.

Currently, our company faces the most urgent threat is the poor business condition, even approaching shutting down, of our company, this restricts all the incentives for us to positively join the PRTR scheme.

**Theme: SUCCESS OR FAILURE of the TEDA PRTR?**

11. *Please describe how you see the likely development of the PRTR in TEDA and then applying PRTR more broadly within China.*

The current jobs the TEDA do is very important, yet still need to be improved.

To one point, it can only attract the participation of only one department (the HSE related department) of companies, yet cannot influence the whole parts of certain company or improve the overall business operation. Depending on the internal communication between HSE department with other departments, even the leaders, it will unavoidably be troublesome.