



Research article

Extended Producer Responsibility and corporate performance: Effects of environmental regulation and environmental strategy



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ABSTRACT

While contemporary manufacturing technologies stimulate the industrial revolution and promote the rapidly changing global economy, it has caused enormous environmental negative externalities and managing the industrial waste remains a primary challenge, especially for fast developing countries such as China. Though existing studies explored the influence of Extended Producer Responsibility (EPR) legislations on environmental externalities, only fewer researches aimed at policy issues. Particularly, the relationship among environmental regulations, environmental strategies and corporate performance in the EPR system has not been deeply investigated. To fill this gap, this research will focus to assess the economic aspect and environmental performance associated with the environmental regulations and strategies. For this purpose, 208 cross-sectional questionnaires were administered with three major high-pollution industries, electrical and electronic, automobile and lead-acid storage battery industries. To accomplish this study objective, we employ a two-step approach: firstly, validity tests for environmental regulation and environmental strategy along with the corporate performance are performed by the factor analysis method, and secondly, the structural equation model is utilized to test the study hypotheses. Results reveal that command and control (CAC) and market-based incentive (MBI) environmental regulations are significantly impacting on the reactive environmental strategy (RES); however, the proactive environmental strategy (PES) only has a significant relationship with MBI regulation. On the other hand, RES only has a significant relationship with the enterprises economics performance, while PES has a statistically significant relationship with both economic and environmental performance of enterprises. Therefore, the central government and its local offices are strongly urged to coordinate the industries by making, implementing and monitoring necessary and feasible environmental laws and regulations.

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1. Introduction

The industrial sector is the largest contributor in economic growth of China; however, increasing production of industrial products such as electronic products, electrical products, and automobiles is also playing havoc with the environment directly and indirectly (Nnorom and Osibanjo, 2008). The main stakeholders of the ecology-animal and human are suffering due to industrial environmental externalities. For instance, larger amount of electronic equipment may impact negatively on human health if not

properly managed and disposed in open air (Nnorom and Osibanjo, 2008).

1.1. The severity of the pollution

To describe the severity of the pollution, we begin with an illustration of the situation in Chaozhou region, Guangdong province of China. Chaozhou has received an international attraction due to its electronic waste trading in international markets by the Basin Action Network (BAN) system. The majority of the waste in whole China is in practice of open air burning to reduce volume of waste to be transported internationally such as, burning of copper wire, plastic, computer hard wears and batteries (Liu et al., 2006;

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Wong et al., 2007). However, the wastewater from the solid waste is leaching down into ground water and was discharged into nearby stream of river or lake. Consequently, the heavy metals caused the ground drinking water polluted in Chaozhou, which has posed a significant threat to food safety such as farming, animal husbandry and fishery (Leung et al., 2006; Wong et al., 2007). Adverse health problems such as, kidney stones and increasing respiratory tract infections have also been reported among the employees working in Chaozhou or vicinities of the region (Asente-Duah et al., 1992; Liu et al., 2006).

Nationwide, concerning the air pollution, a recent study suggested that only 55 of 366 districts in China had an average annual concentration of particulate matter PM_{2.5} less than 10 mg/m³ while over 50% of these districts had average annual PM_{2.5} concentrations greater than 35 mg/m³ (the WHO Interim Target 1) (Ngo et al., 2018). Besides, according to a recent report from World Bank, *The cost of air pollution: Strengthening the economic case for action*, the latest estimations indicate that in 2013, approximately 1.6 M people died in China, accounting for 29% of the total number in the world, could be attributed to air pollution (World Bank, 2016). In addition, land degradation is still a pressing issue in spite of the increased areas of cultivated land. The *China Statistical Yearbook on Environment: 2016 Report* pointed that the areas of land degradation has peaked at 4.65 M km² due to excessive exploitation and utilization, for example building factories. To sum up, Chinese environmental conditions remain severe in recent years.

1.2. Related efforts and established regulations

Globally, the Group on Environmental Measures and International Trade went back to work in 1991, which marks much attention to environmental protection from General Agreement on Tariffs and Trade (GATT)/ World Trade Organization (WTO). Henceforth a substantial number of environmental regulation protocols were issued, such as the *Decision on Trade and Environment* (1993), the *General Agreement on Trade in Services* (1994), the *Agreement on Technical Barriers to Trade* (1995) and the *Agreement on the Application of Sanitary and Phytosanitary Measures* (1995). It is to be observed that the principle of sustainability was stated to realize the optimal utilization of resources in the *Marrakesh Agreement Establishing the World Trade Organization*. In the perspective of environmental regulations and legislation, in the last decade, two EU directives, Directive of Restriction of Use of Certain Hazardous Substances (ROHS) and Waste Electrical and Electronic Equipment (WEEE) have enacted the rules for collection, treatment and recycling of the product with the assistance of their government (Parliament and Council, 2003).

Inspired by the EU policies of environmental regulations, many regions of Asia have been adopted and enacted the similar regulations (Lifset et al., 2013). China is one of them where they passed the rule known as “China WEEE” in 2004 on recycling and treatment of disposed electric products and appliances (Lifset et al., 2013). Similarly, about two years later, to control pollution caused by electronic information products, Chinese government passed the rule in 2006 known as “China ROHS” and it came in action properly in 2007 (Lifset et al., 2013). Furthermore, Chinese government has issued a series of laws, regulations and policy measures to protect the environment and human health since 2000, such as the *Clear Production Promoting Law* (2002), the *Environmental Impact Assessment Law* (2003), the *Circular Economy Promotion Law* (2008), the *Air Pollution Prevention and Control Action Plan* (2013), the *Water Pollution Prevention and Control Action Plan* (2015) and the *Implementation of Extended Producer Responsibility System* (2017). Ministry of Industry and Information Technology cleared access conditions for industries like steel, lead-acid battery,

coke, cement, printing and electrolytic aluminum. Meanwhile, Chinese Ministry of Environmental Protection enacted a series of policies that are based on the market, such as the *Administrative Regulations on Levy and Use of Pollutant Discharge Fee* (2003), the *Measures for Environmental Administrative Punishment* (2010) and the *Guiding Opinions on Further Promoting Compensable Use and Pilot Tests of Emissions Trading* (2014). In summary, the framework of the Chinese environmental protection system integrating mainly command and control (CAC) and market-based incentive (MBI) environmental regulations has formed.

1.3. The existing problem

However, substantial progresses toward a fully operating environmental protection system are not yet observed. In fact, the industrial pollution and post-consumer waste have been substantially increased in the last decade. This arises some immediate questions: Can environmental regulations accelerate the harmonious development between the social-economic demands and environment? Can environmental regulations promote the implement of active environmental strategies in enterprises and finally improve the economic and environmental performance for enterprises? Until now, few scholars have conducted in-depth studies on these questions (Latan et al., 2018), and the relationship among environmental regulations, environmental strategies and corporate performance. Therefore, the purpose of this paper is to estimate the interaction of corporate performance in the EPR system with environmental regulation and environmental strategy, and provide a reference for governmental policy-making and corporate strategy-formulating.

The remainder of the paper is divided into four sections. It begins with the background of study (Section 1), followed by the methodology and research hypotheses (Section 2). In Section 3, we elaborate the empirical results, while in Section 4 we discuss research findings. Finally Section 5 provides conclusions and policy suggestions, and outlines the ensuing future perspectives of research.

2. Research methodology

2.1. The conceptual framework and research hypotheses

According to Rubashkina et al. (2015), environmental regulations refer to a series of behaviors of state powers which aimed at the coordination among environmental safety, economic benefits and social stability. By setting goals of harmonious development between society and environment, it requires that enterprises mechanically and strictly abide by policy stipulations (Ramanathan et al., 2010). Enterprises essentially do not have rights of behavioral selection during environmental protection process (Lei et al., 2017) and they will be severely punished once they violate any environmental regulations (Wang et al., 2011). However, accompanied by development and maturation of market economy and information technology, new types of environmental regulations like incentive regulation (Baumol and Oates, 2004), information disclosure (Lei, 2010) and consciousness guidance (Zhao et al., 2009) are embodying their advantages in the higher efficiency.

On the other hand, economic-type environmental regulations are also becoming the development tendency for its advantages of internalization of external cost, dynamicity and efficiency (Böhringer et al., 2012). However, the Chinese market economy is still in transition phase and needs to achieve many safe environmental targets. Utilization of information technology has not yet been popularized in enterprises. Therefore, according to Weitzman (1974), environmental regulations could be divided into two parts,

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