



## Full length article

# Financial benefits from corporate announced practice of industrial waste recycling: Empirical evidence from chemical industry in China

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## ABSTRACT

This paper empirically examines the relationship between corporate financial performance and adoption of industrial waste recycling in Chinese chemical industry. We employ an event study methodology with the application of propensity score matching to establish the comparison group for our analyses. The result shows that corporate internal operating characteristics such as cost intensity and asset turnover, rather than environmental management experience, are key determinants of industrial waste recycling adoption. Reputation effect from industrial waste recycling adoption is significant as evidenced with an increase of sales growth at the adoption year from our data analyses. However, the reputation effect lapses without significant change after the adoption year. There is a lack of performance effect of industrial waste recycling adoption with corporate cost saving and profitability for Chinese chemical industries to enhance their competency in these performance parameters.

## 1. Introduction

Industrial waste is a “dumped mine” with growing attention by scholars and industrial firms beyond environmental interest groups. The waste is no longer considered having little or no value (Corder et al., 2015). Some wastes become accessible and valuable mineral resources for reuse and recycling. The industrial waste generated by one firm could be useful or acceptable input materials for another firm. Industrial ecology provides a theoretical system on how to recycle the industrial waste systematically and efficiently within local industrial community (Weisz et al., 2015). Increasing number of individual firms also recollect their own industrial waste by closed loop production process and reverse logistics (Abdulrahman et al., 2014). Particularly in certain countries deficient in natural resources such as China, industrial waste recycling is actively promoted in support of their sustainable development.

Both economic concerns and sustainability are objectives for industrial waste recycling. da Cruz et al. (2014) highlighted the environmental impacts in waste management besides of taking note of who is paying for the incremental costs of recycling. Industrial waste recycling is beneficial for sustainable production and lessening environmental damages through efficient use of resources. Using metal waste as an example, Grimes et al. (2008) showed that there is a much

lower energy footprint for recycling waste metals than producing metals from virgin ores. Also in Nigeria, recycling the recyclable waste materials could save 1046.43 GWh of energy per annum in comparison to an producing new products from the virgin materials (Ayodele et al., 2018). Emission mitigation is another environmental advantage from recyclable municipal solid waste. Total mitigation potentials for the accumulative sulfur dioxide and nitrogen oxide emissions are  $85.6 \times 10^9$  t,  $1.6 \times 10^3$  t and  $2.9 \times 10^3$  t, respectively during 2016–2025 in the city of case study of China (Wang et al., 2018).

Relative to the widely accepted environmental benefits from industrial waste recycling, the corporate financial benefits for the firms embarking on industrial waste recycling is uncertain. Some scholars indicate that reproduction or remanufacturing with industrial waste as input could bring new profitable business opportunity for industrial firms. Dong et al. (2013) provided a case study on iron & steel industry in Liuzhou, China, and showed that the economic revenue from by-product/waste exchange reaches 36.55 million USD for the company. However, the above study only reported the revenue from trading the by-product/waste. It is unclear regarding the cost and investment associated with the industrial waste recycling. Also, it is important to know whether there is any improvement in other financial indicators such as corporate profitability and sales growth. Additionally, certain types of industrial waste are less valuable or even toxic, particularly in

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the chemical industry. High cost will be incurred for recycling and processing these wastes (Samanlioglu, 2013). Recycling industrial wastes can be a financial burden for industrial firms to shoulder the responsibility for environmental protection.

Moreover, most previous studies focused on the performance of operations of industrial waste recycling (e.g. Hayami et al., 2015; Wijayasundara et al., 2016), but neglected the effect from the announcement of industrial waste recycling. However, the announced practice of industrial waste recycling provides a signal of corporate responsibility on sustainable consumption of resources. Adopters of industrial waste recycling are often considered as competent and responsible participants for environmentally friendly production. Waste recycling is beneficial for corporate environmental image to gain public support, which can subsequently benefit corporate financial performance outcomes (Flammer, 2013), including corporate profitability and sales growth. Yet, there is a dearth of empirical evidence on whether the reputation effect for performance through improved corporate environmental image exist due to the announced adoption of industrial waste recycling.

Additionally, the thresholds of viable recycling business are different for various industries because of the differences in waste types, production techniques and industrial agglomeration (Lyons, 2007). The industrial wastes in chemical industry are often toxic and difficult for disposal. It needs more technical supports for waste recycling as compared to other industries such as iron & steel manufacturers. Empirical evidence for the financial effect from industrial waste recycling in chemical industry remains lacking.

To the best of our knowledge, there is a void of empirical studies examining economic effect of announced industrial waste recycling using corporate financial data. To fill this research gap, we investigate corporate announced practices of industrial waste recycling in Chinese chemical industry with a survey of related corporate/industrial news together with an event study approach for analyzing the financial effect due to the announced adoption. The rest of this paper is organized as follows. In Section 2, we establish our hypothesis concerning the effect of industrial waste recycling on financial performance of adopter firms. In Section 3, we introduce the event study approach for analysis and describe the data and variables used. We report the estimation result in Section 4 and present our conclusions in Section 5.

## 2. Theory and hypotheses

Economic performance in waste sector has been a growing focus of academic research (Simões and Marques, 2012). There are many aspects and measurement for economic performance. Some studies concerned about the efficiency and productivity (Xu and Chen, 2018; Yang and Li, 2018). Some scholars focused on the profitability (Cristóbal et al., 2018). Rui and Simões (2008) presented a set of performance indicators focused on the quality of service. The purpose of this study is to examine financial benefits from corporate announced adoption of industrial waste recycling. Thus, we focused on financial indicators using objective evidence from corporate financial reports.

Fig. 1 shows the research framework guiding this study. To begin with, we discussed the relationship between industrial waste recycling and corporate cost saving from the perspective of raw materials substitution. Applying the signaling theory, we then determined whether there is reputation effect for performance due to industrial waste recycling and how corporate sales growth is affected. Finally, we tested whether the announced adoption of industrial waste recycling affects corporate profitability.

Generally, industrial waste recycling provides a solution for firms to recollect their wasted resources and reuse them for their production. The cost will be saved from materials expenditure by substituting raw materials with recycled wastes. Particularly when raw materials are expensive, a lower overall economic cost could be achieved under an optimal recycling rate (Highfill and McAsey, 2001). Taking the example

of *Jinan Iron & Steel Group* which is a state owned company located in Shandong province of China, the reuse and recycle wasted energy and material both inside the company and inter-firms, the energy consumption reduced 60 kgce<sup>1</sup>/ton in the past decades, and water consumption reduced 5.7 million ton annually (Dong et al., 2013). Additionally, industrial waste recycling decrease the quantity of waste disposal. Potential financial saving will be achieved with less waste landfilling and harmless disposal. According to Rao (2004), cost savings could come from the industrial waste management in corporate outbound activities such as reverse logistics of waste recovery and waste exchange for reuse. Adopters of industrial waste recycling, as a result, afford less cost burden than those non-adopters.

Thus, we propose the following hypothesis.

**H1.** Adoption of industrial waste recycling lowers corporate cost.

To enhance our understanding on the performance value of industrial waste recycling, we gain insights from the signaling theory and integrate them into our research framework. Signaling theory is rooted in management research concerning reduction of information asymmetry (Spence, 2002). A signal can be any action which provides a direct or indirect indication of goals, motivations or internal situations to guide the operations of a firm. Corporate internal information such as product quality and firm reputation can be conveyed by signals from some corporate actions (Engers, 1987; Fombrun and Shanley, 1990). Industrial waste recycling can be considered as a signal of a firm to take environmental responsibility for improving its operations. Adopters of environmental activities can often reap reputation benefits from improving their corporate social image and hence gain more support from shareholders in the public (Stern et al., 2014). Firms undertaking industrial waste recycling signal their responsibility and competency in environmentally friendly operations. A better corporate image will attract more customers to buy corporate products, and make an increase in corporate sale.

Public announcement on the news or corporate report is a valid way to diffuse corporate practice of industrial waste recycling to the public. The shareholders and potential customers will understand corporate environmental performance from the announcement, which results in good public impression on corporate environmental management efforts. The enhanced environmental image will promote support from shareholders and potential customers. Customers often prefer the producers taking greater environmental responsibility, if their product price and quality are on par with the competition (Dummett, 2006). Thus, firms with the announcement of industrial waste recycling earn such advantage in reputation and would attract more customers. Their growth in product demand will commensurate with an increase in sales growth.

From the above analysis, we conjecture the following hypothesis:

**H2.** Announced adoption of industrial waste recycling is positively associated with corporate sales growth.

From the resource-based view perspective, the internal source of a firm's valuable and inimitable resources and capabilities determine the sustainable competitive advantage of the firm (Kraaijenbrink et al., 2010). Industrial waste recycling helps a firm to acquire and control these resources by recycling the materials that would otherwise be dumped, particularly when the resources are rare and non-substitutable. Thus, firms with application of industrial waste recycling have advantage in resource availability and achieve stronger business competitiveness. Additionally, the capacity of industrial waste recycling itself could be considered as a valuable internal resource. Firms that take more capabilities can reap performance advantages over those lacking such capability (Helfat and Peteraf, 2003). Accordingly, the corporate profitability would be improved if there are practices of

<sup>1</sup> The unit of consumed energy, which means "kg standard coal equivalent".

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