How environmental management driving forces affect environmental and economic performance of SMEs: a study in the Northern China district

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ABSTRACT

Small- and medium-sized enterprises (SMEs) form the core of societal and economic development. However, most people query on the implementation and performance of environmental management. In this paper, the manufacturing SMEs in Northern China with different pollution levels are studied to explore the main forces (e.g., government, society, market, and enterprise itself) driving SMEs for promoting environmental management. It focuses on the correlation between environmental management and economic performance for SMEs at different pollution levels. The results show that SMEs of different pollution levels have significant differences in the relationship of driving forces and performance. First, for SMEs with high-pollution levels, social and market driving forces and government incentives are revealed having a significant effect on their environmental performance. Driving forces from within the enterprise itself and the market provide a positive effect on the economic performance, while social forces have a negative effect. Second, for SMEs with light pollution, social and market driving forces, and government assistance play a supporting role on corporate environmental performance improvement. It is also found that the driving force of the enterprise itself does not have a significant effect on the environmental performance for SMEs with different pollution levels. In addition, the environmental performance and economic performance for SMEs with high or light-pollution levels are positively correlated. Further, it shows that the environmental performance is moderately correlated with financial indices, but not significantly with the non-financial indices.

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1. Introduction

The trend of stricter international regulations, conventions for environmental protection, and the rise of consumer environmentalism impose great challenges to enterprises (Chen et al., 2006), especially for the small- and medium-sized enterprises (SMEs) (Peres and Stumpo, 2000). Because of some endogenous and exogenous reasons, the performance of environmental management of SMEs is still not satisfactory, and serious pollution accidents have been recorded from time to time (Shi et al., 2008; Cordano et al., 2010), which seriously damaged the natural environment and aroused safety hazards due to pollution generated as a consequence of companies' operations, leading to environmental accidents such as excess emissions of waste water, gas or other solid waste pollutants.

In China, according to the latest law on promotion of small- and medium-sized enterprises in 2003, manufacturing SMEs[1] are defined as those with fewer than 2000 employees, an annual turnover of less than or equal to RMB Yuan 300 million, or a total asset of less than or equal to RMB Yuan 400 million (Zeng et al., 2010b). SMEs accounted for more than 90% of the total number of manufacturing establishments in China in 2010, and they contribute significantly to social and economic development. However, SMEs has created significant negative environmental impacts, which may harm neighboring residents' health due to

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[1] According to the law of SMEs promotion in China in 2003, the characteristics of the number of employees, the annual revenues and total assets are used as criteria to define SMEs. For the manufacturing industry, SME is defined as either less than 2000 employees, an annual turnover of no more than RMB Yuan 300 million, or a total asset of no more than RMB Yuan 400 million. While medium-sized enterprises are defined as those having more than 300 employees, an annual turnover of more than RMB Yuan 30 million, and a total asset of more than RMB Yuan 40 million, others are defined as small businesses.

obsolete equipment, inexperienced labor, or insufficient financial resources, especially in the most energy-intensive and polluting industries in China (Diao et al., 2009; Shi et al., 2008). It was reported by China Environmental Protection Administration that there are 40–50 percent of environmental pollution brought about by SMEs in China, and among the 30 million SMEs, 80 percent of them produced environmental pollution (Zhou, 2005).

There are increasing pressures on Chinese firms from a number of different sources, such as governmental regulations, community participation and market demand, to ask for environmental initiatives in China, among which, larger sized firms are more active (Zhang et al., 2008). For the Chinese SMEs, however, the underlying barriers to adoption of cleaner production include the lack of economic incentive policies, lax environmental enforcement, and high initial capital cost (Shi et al., 2008). Therefore, owing to the lack of effective corporate environmental management systems and incentive mechanism, it is difficult to overcome the adverse effects of unreasonable utilization of resources and insufficient adoption of environment-friendly technologies (Zeng et al., 2005).

Most of the previous studies show that the scale of enterprises is positively correlated to their environmental management capacities as larger sized enterprises can easily get access to resources (Jesus and Junquera, 2003; Zeng et al., 2010a) and external support (Darnall and Edwards, 2006). SMEs, however, exhibit some passive environmental management behavior in dealing with environmental laws and regulations, which may be resulted from the lack of effective driving forces (Zeng et al., 2005), that is, the lack of effective pressures or forces that drive firms to promote environmental management.

There is, to our knowledge, a paucity of studies in exploring impacts of driving forces of environmental management on the environmental and the economic performance of SMEs (Liu et al., 2010). In this paper, a survey is conducted, aiming to explore how the driving forces (i.e., from the government, society, market and enterprise itself) of environmental management affect environmental and economic performances of SMEs of different levels of pollution (i.e., light and high). This study aims to provide answers to the following questions:

- How environmental management driving forces affect corporate environmental and economic performances of SMEs?
- What is the relation of different pollution levels to environmental performance and economic performance of SMEs?
- For different pollution levels of SMEs, what is the correlation of environmental performance and economic performance?

2. Previous works

2.1. Driving forces on environmental management

Driving forces, pushing enterprises to implement environmental management, are divided into two types: internal and external (Montiel and Husted, 2010; Qi et al., 2010).

2.1.1. Internal driving forces

Internal driving forces are resulted from company's internal motivation (enterprise itself), such as internationalization of seeking to enter the international market (King and Lenox, 2001), reputation of the enterprise (Bansal and Hunter, 2003), valuing systems of management (Egri and Herman, 2000), and the corporate environmental responsibility for employees' health (Roome and Wijen, 2006). These forces work because environmental pollution prevention can provide a better performance to enterprises (King and Lenox, 2000).

Enterprises will actively adopt the strategies of implementing environmental management when gaining competitive advantages (Aragon-Correa et al., 2008); for example, clean production technologies (Zeng et al., 2010c), product re-design, change of production process, improvement of resource utilization (Ramus and Steger, 2000), and reduction of production cost can build up company's competitive advantages (Sharma, 2000).

2.1.2. external driving forces

Driving forces coming from externalities (Delmas, 2002) are very important in promoting environmental management of enterprises (Branzei et al., 2004; Moffat and Auer, 2006). They can be divided into three aspects: the government driving force (Zeng et al., 2003), the market driving force and the social driving force (Kassinis and Vafeas, 2006).

Enterprises, barely meeting the requirements of mandatory government environmental regulations, can escape from environmental punishment. Thus, it is well acknowledged the importance of government environmental regulations for guiding corporate environmental management. To avoid environmental penalties, fines and violation costs, enterprises must comply with these environmental regulations.

The market driving force includes two aspects: competitors' and buyers' requirements (Shrivastava, 1995). For example, enterprises can improve market competitiveness after implementing environmental management by reducing manufacturing waste (Zeng et al., 2008).

The social driving forces including those from public media and certain industrial associations are also important as enterprises' commitment to eco-responsibility can help them gain social reputation (Hart, 1995).

2.2. Corporate environmental and economic performance

The relationship between corporate environmental and economic performances has always been the core issue of environmental management research (Menguc et al., 2010; Russo and Fouts, 1997). However, previous studies give mixed results. Business performance can be measured in terms of the gross profit margin, market share, sales per capita, etc. (Henri and Journeault, 2008; Naveh and Marcus, 2005).

Porter and van der Linde (1995) addressed that environmental regulations could improve the competitiveness of enterprises; therefore, the environmental and economic performances were positively related as confirmed by other researchers (Hart, 1995; Klassen and Whybark, 1999; Russo and Fouts, 1997; Sharma and Vredenburg, 1998). However, this has faced some challenges. Some research identified that the relationship between corporate environmental and economic performances was not significant, some even with negative correlation because implementing environmental management needs to invest extra resources, including funds, technologies and human resources, leading to extra costs. Therefore, environmental management may extrude other potential investments and reduce the corporate sustainable competition (Sarkis and Dijkshoorn, 2007; Wagner, 2008).

In fact, the relationship between environment management and corporate performance may be more complex. Adoption of cutting-edge technology costs more and good environmental performance can reduce corporate profits, and thus the environmental and economic performances could have an inverse relationship. However, some studies (Sharma and Vredenburg, 1998; Buysse and Verbeke, 2003) show that improvement in environmental performance is a potential competitive advantage (e.g., new technologies to cost reduction, innovative products, and attracting more environment-friendly consumers). Therefore, improvement in

environment management and competitiveness of enterprises are not in conflict (Lee et al., 2006; Andersson and Bateman, 2000). Adopting proactive environmental management including environmental auditing programs and management systems has been found to be associated with strong financial performance (Darnall et al., 2010). Waddock and Smith (2000) conducted a case study with a description of how an internal environmental audit led to improved waste reduction practices, increased plant capacity, and significant cost savings. Adopting environmental management systems which exceed legal requirements could decrease enterprises' toxic emissions levels and realize lower capital costs (Feldman et al., 1997; Sharfman and Fernando, 2008). Progressive environmental management also leads to opportunities to work with external environmental stakeholder groups, and to take part in high-profile environmental programs from government (Miles and Covin, 2000). As a result, enlightened environmental management can improve financial and reputational competitive advantages (Petrick et al., 1999). Murphy (2002) made a good summary of twenty leading empirical studies on the correlation of environmental/ financial performances and found that positive environmental performance is linked with positive financial results, indicating that the conventional 'cost' view is outdated in some sense. In a long-term perspective, corporate environmental management and competitiveness could be a "win–win" relationship (Juan and Enrique, 2007; Porter and van der Linde, 1995; Shrivastava, 1995; Christmann, 2000).

3. Model development and hypotheses

3.1. A conceptual model

According to the literature review, the driving forces for environmental management of Chinese SME can be categorized into four dimensions: government, market, society, and enterprise. The performance is decomposed into environmental performance and business performance.

A conceptual model of driving forces on environmental management performance is developed as shown in Fig. 1.

In Fig. 1, the environmental performance is measured in terms of contamination control and contamination prevention. Contamination control includes reducing contamination release, energy consumption, and selecting suppliers with good environmental protection records (Lopez-Gamero and Molina-Azorín, 2009). Contamination prevention is a long-term measure, which includes carrying out ISO 14001, cleaner production activities, staff training, and environmental audit. Economic performance can directly be reflected by financial and non-financial indices. Financial indices refer to sales, profitability, inventory turnover, and ROE while non-financial indices refer to market share, sale region, and the number of customers (Earnhart and Lizal, 2010).

As for external and internal driving forces in Fig. 1, the driving force from the government includes government incentives, regulations, and assistance. Government incentive is the major motivation for SME, for instance, in terms of tax reduction and subsidy, etc. (Zeng et al., 2003). The government can reward environment-friendly SMEs according to China's Cleaner Production Promotion Law, and SME Promotion Law in 2003, which applies to all regions of China supporting SMEs with tax reduction and subsidy, venture capital and investment guarantees or other financial support, and opportunities to the undertake Government's environmental projects. Government regulations mean that when enterprises violate the law or fail in achieving the standard, the government would compel enterprises to follow by imposing a penalty, even stopping their businesses. Government assistance is defined as assistance in the forms of technologies, information about environmental protection, project finance, and other supports for corporate environmental green products and technologies.

Market driving forces include two aspects: competitors' and buyers' requirements. The driving force of competitors refers to environmental protection practices and the related pressure brought about by competitors of the same industry. Buyers' requirements are the forces imposed by purchasers or customers. If production of the final products (such as food, medicine, textile, paper, etc.) is closer to consumers, businesses may feel more pressure. When an enterprise can improve its reputation, it would be more motivated to adopt environmental management.

Society driving forces are composed of many elements: community requirements, environmental associations, and media exposure. Community requirements are made up of suggestions
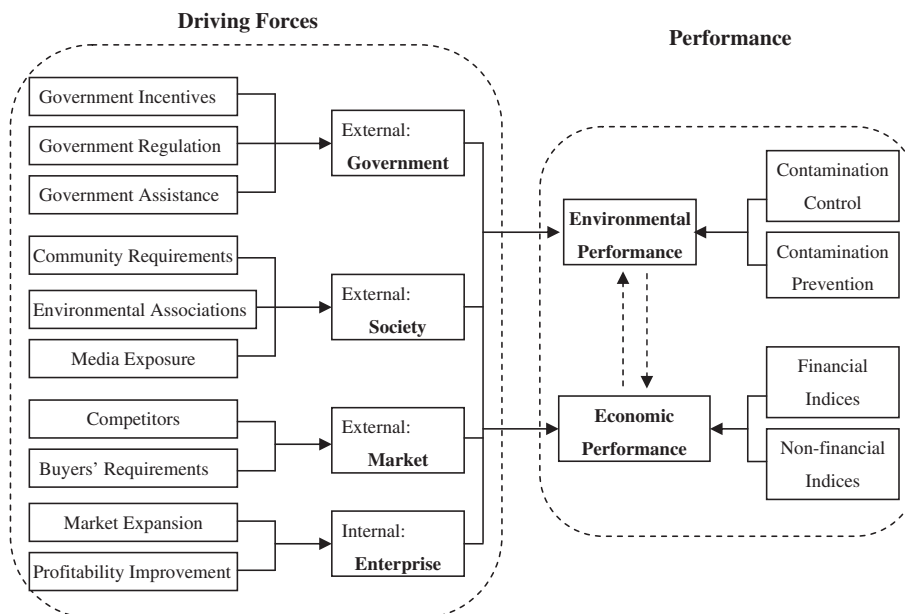

Fig. 1. Conceptual model of driving forces affecting performance of SMEs.

from the community and complaints about environmental problems. Environmental associations are the social association, calling for protecting the environment, and imposing their requirements on enterprises. Media exposure is the exposure of various media, such as television, broadcasting companies, newspapers and online media. Currently, once a company is exposed by the public media, local governments would be subject to the pressure from the public and the higher-level government may impose severe penalties on the companies.

To better achieve the strategic objectives (i.e., profitability and market expansion), enterprises can be motivated to implement environmental management. Financial goals consist of sales, profitability, and return on equity (ROE). The expansion of market share and number of customers are the representative indices for market expansion. Because of the close relationship between financial promotion and market expansion, the programs or planning for the above aspects will form a combined index for measuring the enterprises' driving force.

3.2. Hypotheses development

To study the driving forces for SMEs' environmental management, enterprises are divided into high and light-pollution according to their contamination levels. High-pollution enterprises are defined as those causing severe contamination to the environment, while the light-pollution ones causing less severe pollution.

3.2.1. Driving forces and environmental performance

The relationship between environmental performance and the four driving forces (government, society, market and enterprises) will be discussed below, and hypotheses will be developed accordingly.

Increasingly strict regulations of the government are the primary motivation to drive enterprises to improve their environmental performance. The mandatory rules cause enterprises participating in voluntary environmental activities in order to achieving standards beyond the requirement of these strict rules (Segerson and Miceli, 1998). In addition, the lower cost for consumers and the government accessing enterprises' information can induce a greater power to drive enterprises to voluntarily reduce contamination for the sake of their reputation (Segerson and Miceli, 1998).

The adoption of environmental management system for enterprises is related to the community commitment to the relevant stakeholders (Florida and Davison, 2001). Enterprises would significantly reduce toxic emission, which could attract attention of a lot of environmental interest groups (Maxwell and Decker, 2006).

Market pressure is one of the factors affecting enterprises' environmental performance. Some research explain the internal motivation of enterprises in implementing environmental management from different perspectives, e.g., organizational structure (Ramus and Steger, 2000), organizational learning (Marcus and Nichols, 1999), values of leadership (Egri and Herman, 2000), and attitudes of managers toward the environment (Cordano and Frieze, 2000; Sharma, 2000). Based on the cost-profit theory of economics, managers make decisions either regarding the relevant costs, risks and benefits, or focusing on enterprises' competitive advantage, i.e., improving corporate image through proactive environmental strategy, green differentiation strategy to expand market share (Branzei et al., 2004; Chen et al. 2006).

From previous studies, it is noted that the force imposed by the government on enterprises is thought to be the most conspicuous driving factor, especially in the forms of incentives and regulations on SMEs. However, the government's effort on SMEs has led to unsatisfactory results as the driving force of government on SMEs

mainly relies on regulations in the recent decade in China. It thus leads to the questions of whether the government's incentive schemes and regulations would still bring better results and whether the current social pressure, market competition and internal enterprise driving forces could lead to better environmental performance. Hence, it is proposed for SMEs at different contamination level that:

H$_{1a}$. Levels of the government driving force positively influence the environmental performance of SMEs.
H$_{1b}$. Levels of society driving force are positively associated with the environmental performance of SMEs.
H$_{1c}$. Levels of market driving force are positively associated with the environmental performance of SMEs.
H$_{1d}$. Levels of enterprise driving force are positively associated with the environmental performance of SMEs.

3.2.2. Driving forces and economic performance

Existing literatures suggest that government regulations, market and social pressure, corporate proactive environmental strategies impel corporate environmental management practices, i.e., adopting new environmental practices to reduce pollution source, more environmentally friendly ways of operation, etc., which can reduce waste disposal costs, and penalty, bringing about effective economic benefits for enterprises (Aragon-Correa et al., 2008; Delmas, 2002; Moffat and Auer, 2006).

Internationalization is the key factor for enterprises to introduce environmental management systems widely (Zeng et al., 2003), which indicates that international environmental regulations and consideration for market expansion could model enterprises' behavior and thus affect their economic performance. Zeng et al. (2003) concluded that the most important driving force for Chinese construction enterprises was "seeking to enter the international construction market".

Green consumption of the market contributes to new cleaner products and contamination reduction. Green preference of the market could make enterprises to win the market and improve economic performance by product differentiation (Cordano et al., 2010).

For enterprises, implementation of integrated environmental management can lower the business risk from the environmental perspective, and thus they can be easier to get insurance and commercial loan. Environmental crises also have a negative impact on businesses (Klassen and McLaughlin, 1996), which would be reflected from the abnormal negative return in the stock market.

In general, the driving force of government has a significant effect on SMEs' economic performance, because the positive ways (such as tax reduction and subsidy) and the negative ways (like penalty and shutdown for reformation) could greatly influence enterprises' economic performance. Nevertheless, some managers of SMEs and environment consultants, whom we interviewed, generally accepted that neither government's incentives and regulations, nor government's assistance have conspicuous effects on the economic performance of SMEs. Thus, it leads to the question on whether government's incentives have enough attraction to SMEs, and the regulations could powerfully stimulate them, and the government's assistance could also achieve the expected results. The market competition and social pressure, and the enterprise itself (e.g., competition with differentiation, and consideration for lower financing costs) may have a significant impact on the economic performance. However, there exists inadequate investigation toward the driving forces on the economic performance of SMEs at different contamination levels. Hence, for the SMEs, the following hypotheses are proposed:

H₂a: Government's driving forces impact significantly on the economic performance of SMEs.

H₂b: Society driving forces impact significantly on the economic performance of SMEs.

H₂c: Market driving forces impact significantly on the economic performance of SMEs.

H₂d: Enterprise driving forces impact significantly on the economic performance of SMEs.

3.2.3. Environmental and economic performance

The results of studies on corporate environmental performance and economic performance are controversial.

Klassen and McLaughlin (1996) found that environmental management and economic performance have a positive correlation. Montabon et al. (2007) revealed that environmental management was positively correlated to economic performance. Proactive environmental management could lead to better performance (Claver et al., 2007), of which enterprises were more inclined to take proactive environmental management with a precautionary combination of environmental control technology. However, some researchers argue that there lacks a correlation or even exhibits a negative correlation. Sarkis and Dijkshoorn (2007) found that when the environmental performance was improved, the economic performance had not improved significantly. Sarkis (2006) revealed that additional investments on the environment in a project at the early stage might be unable to provide better economic performance within a short period of time. Link and Naveh (2006) addressed that implementation of an environmental management system was unassociated with business performance.

In fact, enterprises of different contamination levels will have different costs and benefits resulted from improving the environmental performance (Sharma and Vredenburg, 1998; Juan and Enrique, 2007). Hence, it is proposed:

H₃a: For SMEs with high-pollution level: environmental performance is positively associated with their economic performance.

H₃b: For SMEs with light-pollution level: environmental performance is positively associated with their economic performance.

H₃c: For SMEs of the two pollution levels: high-pollution and light-pollution enterprises, the relationship between environmental performance and economic performance is different.

4. Research Methodology

4.1. Measurement

4.1.1. Dependent variable

The dependent variable is enterprises' performance. The enterprises' performance is measured by two aspects: environmental and economic performance.

Environmental performance consists of short-term contamination control measures and long-term contamination preventions. Contamination control is measured by three indices: reduction in contamination release, energy consumption, and selecting suppliers with good environmental protection records. Contamination prevention has four components: carrying out ISO 14001 environmental management system, conducting cleaner production activities, staff training, and environmental auditing.

Economic performance comprises financial and non-financial indices. The financial index is surveyed in a form of sales, profitability, inventory turnover, and ROE while the non-financial index is measured by market shares, sale region, and the number of customers.

4.1.2. Independent variables

Independent variables are the government's driving forces, society driving forces, market driving forces, and enterprises' driving forces.

Government's driving forces are divided into three dimensions: incentives, regulations, and government's assistance. Market driving forces include competitors' and buyers' requirements. Society driving forces include community requirements, environmental associations, and media exposure. Enterprise driving forces are represented by five indices: overall planning for sales, overall planning for profitability, overall planning for ROE, overall planning for market share expansion, and overall planning for the increase in the number of customers.

4.1.3. Control variables

To avoid the relationship between driving forces and enterprises' performance influenced by total assets, past sales, the number of employees, and ages of SMEs, they are set as control variables.

Multiple regression analysis and factor analysis are used to study the relationship. In this study, software programs SPSS 15.0 is used.

4.2. Survey

In this paper, classification of SMEs is based on the industry-category standard declared by the National Statistical Bureau of China. SMEs are classified into high-pollution and light-pollution enterprises for contrast and analysis. High-pollution enterprises with waste water or gas or other solid waste pollutants (e.g., sulfur dioxide, nitrogen oxides, coal dust, mineral oils, cyanide, mercury and arsenic) seriously damaging the natural environment and arousing safety hazards. In 2008, China's State Environmental Protection Administration announced the first group of "high pollution, high environmental risk" products directory, involving a total of 141 categories of products, mainly related to pesticides, batteries, dyes, inorganic salt, paints, organic arsenic, etc. However, there still lacks comprehensive, authoritative and accurate criteria for classifying the level of high-pollution enterprises. In fact, high-pollution enterprises are often identified by the fact of whether a company falls into a high-pollution industry. China's State Environmental Protection Administration issued a regulation on environmental protection verification in 2007 and a guidance on Green Security in 2008, which provisionally identified 13 kinds of high-pollution industries (i.e., metallurgical, chemical, petrochemical, coal, thermal power, building materials, paper making, brewing, pharmaceutical, fermentation, textile, leather and mining), and has imposed strict monitoring on enterprises falling into these high-pollution industries since 2008. Based on the guidance issued by China's State Environmental Protection Administration in 2008, high-pollution enterprises fall into one of the five sectors: medicine and chemistry, printing and dyeing or leather-production, metallurgical, materials production for building and cement industry, oil refining and cooking industries (Zeng et al., 2010b). While light-pollution enterprises are one of the following five: agricultural byproduct, weaving and cloth, machinery manufacturing, hardware machining, and electronic component industries.

The survey was conducted in the Northern China district (including Beijing, Tianjing, and Hebei Province), named as the Bohai Bay economic circle. Northern China is facing serious environmental problems where there is serious pollution from SMEs. The survey was pre-tested by thirty environmental experts and consultants and revised according to their comments. In 2009, surveys were sent to managers or individuals who worked in manufacturing SMEs and were responsible for the firm's

environmental activities. The manufacturing sector was selected because it produces more air, land, and water pollution than the service sector in China. Respondents were identified from public database; for instance, the Hebei province population was identified using data from the directory of SMEs from the Small- and medium-sized Business Administration. From a total of 116,000 manufacturing SMEs in these three provinces, we randomly selected 500 SMEs. Five hundred questionnaires were sent with 137 received. The response rate was 27.4%, which is consistent with previous studies of organizations' environmental practices (e.g., Christmann, 2000; Darnall et al., 2010). One hundred and four valid questionnaires were used for analysis, including 39 high-pollution SMEs and 65 light-pollution SMEs. Among the three investigating ways of mailing, direct visiting and telephone, the rate of e-mail feedback questionnaire is low. The reasons of the invalid questionnaires are that the characteristics of enterprises (e.g., number of employees or the annual revenues) were beyond the definition of SMEs, and those export-oriented enterprises with a proportion of export value of more than 20% of their total turnover had been subjected to great influence due to the financial crisis in 2008, and those with incomplete information in the questionnaires. In this study, a five-point scale is used to assess the enterprises' response to the driving forces, environmental and economic performances.

5. Results and analysis

5.1. Reliability and validity

5.1.1. Reliability analysis

In this paper, Cronbach Alpha coefficient (α coefficient) is used for checking the internal consistency of items, which is a widely accepted reliability test. Reliability refers to the characteristics of the measurement results with consistency and stability. The higher the reliability of measurement, the more stable and reliable measurement results will be. However, the acceptable value of Cronbach α coefficient lacks a unified standard. It is usually considered that the coefficient of reliability falling into the range of 0.6–0.8 is enough. In practice, it is good when the value of consistency coefficient is above 0.7 (Peter, 1979). By running the modules of reliability analysis in SPSS 15.0, a value of Cronbach α coefficient for every item of driving forces and performance is obtained. Table 1 tabulates the Cronbach α coefficients for measuring each dimension of driving forces and performance.

The values of α coefficient in both driving forces and performance are larger than 0.6, with the exception of the market forces of high-pollution enterprises and contamination control of light-pollution enterprises, in where the Cronbach α coefficient is comparatively low.

5.1.2. Validity analysis

As the indicators of driving forces and the performance are based on the existing research results, the content validity of the indicators is satisfactory.

In this paper, confirmatory factor analysis (CFA) is employed to test the construct validity. Common factors are calculated by the way of Varimax rotation. Before factor analysis, the relativity among items using methods of KMO sample test and Bartlett sphericity test is used to find out whether it is suitable to use factor analysis. The results of tests suggest that it is proper to carry out the CFA. From the correlation matrix of the observable items, "% of variance explained" of the first factor, is collected (see Table 2).

Both for the high- and light-pollution SMEs, the driving forces of government, market, and enterprise, are able to extract the first factor with a high degree of explanation. In performance,

Table 1
Reliability analysis of driving forces and performance.

		Light-pollution enterprises[a]	High-pollution enterprises
		Cronbach's α	Cronbach's α
Driving Forces	Government Driving Force	0.655	0.475
	Market Driving Force	0.529	0.323
	Society Driving Force[b]	–	–
	Enterprise Driving Force	0.884	0.844
Environmental Performance	Contamination Control	0.389	0.499
	Contamination Prevention	0.897	0.899
Economic Performance	Financial Indices[c]	0.785	0.824
	Non-financial Indices	0.675	0.624

[a] Each dimension of *Driving Forces*, *Environmental Performance*, and *Economic Performance* calculates Cronbach's α coefficient for light and high-pollution enterprises respectively.
[b] Because of the small scale nature of SMEs and underground occurrence of contamination, choices for the "Environmental Associations" and "Media Exposure" are usually filled with "None" under the society driving forces. Therefore, these two aspects affect Cronbach's α coefficient for measuring the society driving forces and the values of CITC (Corrected Item–Total Correlation) are less than 0.3. It is clear that there is obvious difference in the values of Cronbach's α coefficient after the item is deleted. So the items of "Environmental Associations" and "Media Exposure" are eliminated, the social driving forces only include community requirements, which stands for the driving forces of Society. As there is only one indicator left, it does not need reliability testing.
[c] Taking reliability test and principal component analysis into consideration, we can find that the CITC for the item "inventory turnover" of financial indices is less than 0.3. If the item for measure is removed, the Cronbach's α coefficient would rise. Therefore, the financial performance is measured using the remaining items of Sales, Profitability and ROE. After removal, it shows a much greater internal consistency of the three items.

contamination control and contamination prevention, and financial and non-financial indices, are also able to find a factor with high degree variance explanation.

In the following multiple regression analysis, the score of the first factor can be regarded as the value of the composite indicator, and then as control variables which are used to analyze the specific impact of other driving forces on performance. Since there is no "% of variance" of each factor reaching 85% or more, there is no severe violation of multicollinearity among similar indices in any one construct.

Table 2
Total variance explained by the first factor.

		Light-pollution SMEs (% of Variance of the first factor)	High-pollution SMEs (% of Variance of the first factor)
Driving Forces	Government Driving Force	60.75%	49.27%
	Market Driving Force	68.62%	59.75%
	Society Driving Force[a]	–	–
	Enterprise Driving Force	68.83%	62.08%
Environmental Performance	Contamination Control	49.45%	50.21%
	Contamination Prevention	77.22%	78.84%
Economic Performance	Financial Indices[b]	70.08%	74.08%
	Non-financial Indices	60.71%	57.66%

[a] As the social driving forces only include the item of "community requirement", factor analysis is not needed as well.
[b] The financial indices analyzed by factor analysis include Sales, Profitability and ROE, but without "inventory turnover". Likewise, the next section on the multiple regression analysis is so treated.

5.2. Results and analysis

5.2.1. Driving forces on environmental performance

5.2.1.1. Relationship between driving forces and contamination control. The number of employees, past sales, total assets and firm ages are set as the control variables. Multiple regression analysis is used and the dependent variable is contamination control in this part. For the independent variables, the driving forces of government, market, society, and enterprise itself are used respectively; for example, the driving forces of government is focused first, that is, the impact of government incentives, government regulations and government assistance on contamination control. The integrated factor score of the other three driving forces then serves as the control variable. By controlling the three driving forces, the relationship between contamination control and the government driving forces is analyzed. Similarly, other driving forces are analyzed. The results are shown in Table 3.

For different pollution levels of SMEs, the effects of government and market driving forces on contamination control are different. For high-pollution enterprises, government incentives have obvious effects. But for the light-pollution enterprises, government assistances play a more important role. Government regulations to enterprises of the two contamination levels have no discernible effect. For high-pollution enterprises, competitors of the market driving force have evidential influence. While for the light-pollution enterprises, buyers' requirements can drive enterprises to improve the levels of contamination control. For the two types of SMEs, social driving forces have positive influences on

enhancement of contamination control, while enterprises' driving forces have no significant effects in improving the contamination control.

5.2.1.2. Relationship between driving forces and contamination prevention. From the regression results of high-pollution enterprises (see Table 4), only the driving force of the market has a significantly positive impact on SMEs in upgrading the level of pollution prevention at $p < 0.05$ level. However, government driving forces, social driving forces and enterprise driving forces do not show significantly positive roles. As for the government driving forces, only the government incentive is significant at a level of 0.10.

Regression results of light-pollution enterprises also show that only the market driving force has a significantly positive influence on the environment performance in contamination prevention. Further, the influence of the market driving force for the two types of SMEs mainly comes from competitors' pressure instead of buyers' requirements.

As shown in Tables 3 and 4, with an increasing awareness of environmental protection, social driving forces have become stronger for SMEs, and the government can play a significant role, and the effect of market is stronger. Whether for light- or high-pollution SMEs, government, market and society are three important driving forces, which support hypotheses 1a, 1b, and 1c. It is clear that the contamination control, traditionally under the governmental regulations, is transiting to be driven by the government, market and community. However, enterprises' driving forces for SMEs at different pollution levels do not motivate SMEs to

Table 3
Results of regression analyses: effects of driving forces on contamination control.

Dependent Variable: Contamination Control (CC) of Environmental Performance						
	(CC-Government Driving Force)		(CC-Market Driving Force)		(CC-Enterprise Driving Force)	
	M_{a1} (Light)	M_{a2} (High)	M_{b1} (Light)	M_{b2} (High)	M_{c1} (Light)	M_{c2} (High)
Control Variables:						
Constant	2.46***	1.11*	2.44***	1.13*	2.43+	1.33*
Number of Employees	−0.06+	0.23+	−0.05	0.23+	−0.05	0.21
Sales in 2008	0.18	−0.15	0.17+	−0.14	0.18+	−0.14
Total Assets	−0.13	0.03	−0.11	0.02	−0.13	0.04
Firm Ages	−0.06	0.07	−0.07	0.07	−0.06	0.05
Driving Forces:						
Government			0.17+	0.19	0.21*	0.19
Government Incentive	***−0.06***	***0.16+***				
Government Regulations	***0***	***0***				
Government Assistance	***0.16*****	***0.08***				
Market	0.20**	0.18*			0.20**	0.21*
Competitors			***0.06***	***0.10+***		
Buyers' Requirements			***0.13*****	***0.09***		
Society						
Community Requirements	0.26**	0.32+	0.26**	0.30+	0.24*	0.22
Enterprise	−0.1	0.08	−0.08	0.1		
Sales					***0.06***	***−0.03***
Profitability					***−0.11***	***0.14***
ROE					***0.05***	***−0.14***
Market Share					***−0.06***	***0.06***
Number of Customers					***−0.03***	***0.05***
R	0.81	0.81	0.8	0.79	0.8	0.81
R^2	0.66	0.65	0.64	0.63	0.64	0.66
Adjusted R^2	0.59	0.53	0.58	0.52	0.56	0.5
F	10.24***	5.27***	10.61***	5.51***	7.67***	4.15***

"Light " stands for "Light-pollution SMEs", and "High " stands for "High-pollution SMEs".
+$p < 0.10$, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.
The dependent variable of the model M_{a1} and M_{a2} is Contamination Control (CC). The independent variables, we focused on, are the government driving forces. Then, the impact of government incentives, government regulations and government assistance on contamination control is studied. The first factor of the other three driving forces was treated as the control variable. Similarly, for model M_{b1} and M_{b2}, the market driving forces are treated as the independent variables. Meanwhile, the impact of competitors' and buyers' requirements on contamination control is explored. For the model M_{c1} and M_{c2}, the independent variable is the enterprise driving force. Then, the influences are analyzed respectively for the strength of planning for Sales, Profitability, ROE, market share and number of customers on contamination control. The integrated factor score of the other three driving forces serves as the control variables.

Table 4
Results of regression analyses: effects of driving forces on contamination preventing.

Dependent Variable: Contamination Prevention (CP) of Environmental Performance						
	(CP-Government Driving Force)		(CP-Market Driving Force)		(CP-Enterprise Driving Force)	
	1	2	1	2	1	2
	(Light)	(High)	(Light)	(High)	(Light)	(High)
Control Variables:						
Constant	1.14	0.16	1.25$^+$	−0.13	1.41$^+$	0.13
Number of Employees	−0.04	0.44	−0.07	0.3	0.04	0.31
Sales in 2008	0.02	−0.21	0.04	−0.05	−0.07	−0.07
Total Assets	0.3	0.21	0.25	0.06	0.36$^+$	0.13
Firm Ages	0.08	−0.01	0.1	0.07	0.11	−0.02
Driving Forces:						
Government			−0.19	0.23	−0.18	0.3
Government Incentive	*0.21*	*0.36*$^+$				
Government Regulations	*0.07*	*−0.06*				
Government Assistance	*−0.24*	*0.05*				
Market	0.52***	0.42*			0.53***	0.47*
Competitors			*0.42*$_{***}$	*0.49*$_{***}$		
Buyer Requirements			*0.14*	*−0.08*		
Society	0.15	−0.11	0.14	0.22	0.14	−0.06
Community Requirements						
Enterprise	−0.07	0.11	−0.11	0.16		
Sales					*0.32*	*−0.22*
Profitability					*−0.26*	*−0.03*
ROE					*0.14*	*0.29*
Market Share					*−0.32*	*−0.07*
Number of Customers					*−0.15*	*0.18*
R	0.67	0.69	0.68	0.78	0.69	0.7
R²	0.45	0.48	0.46	0.62	0.48	0.49
Adjusted *R²*	0.34	0.3	0.37	0.5	0.36	0.25
F	4.36***	2.59*	5.17***	5.14***	4.03***	2.04$^+$

"Light " stands for "Light-pollution SMEs", and "High " stands for "High-pollution SMEs.
$^+p < 0.10$, $^*p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

significantly improve their environment performance in contamination control. Thus, hypothesis 1d is not supported.

For the short-term contamination control, influence of community requirements for high-pollution and light-pollution enterprises is almost the same, while there is a difference between the market and government driving forces.

Owing to the low degree of attention to light-pollution enterprises, competitors give little effect on the environmental protection of these SMEs. Therefore, competitors' pressure on contamination control of light-pollution enterprises is low. On the contrary, high-pollution enterprises are strictly supervised by the environmental protection departments, which lead to high level of environmental protection in the industry. To survive, high-pollution enterprises need to practice contamination control proactively under the high competitors' pressure.

Considering the driving force of government, most SMEs are township-run enterprises, and there exist difficulties in supervision and create problems of local protectionism. So high-pollution enterprises are motivated to control and prevent contamination by the government incentives. Nevertheless, the government supervision cannot give them sufficient pressure. Considering light-pollution enterprises, they do not make much pollution and the impacts of government incentives and regulations for them are very low, while government assistances can promote pollution control and prevention. Government incentives can bring better results than government regulations on environmental management of SMEs for the high-pollution enterprises. However, for light-pollution enterprises, government incentives and regulations have no better effect than the government assistance.

For the long-term pollution prevention, pressure from competitors in the market has a certain degree of influence on light-pollution enterprises in enhancing contamination prevention. However, competitors of light-pollution enterprises are not enthusiastic about the overall industrial environment. Therefore, in-depth studies on how to protect the environment for light-pollution enterprises are needed in the future. For the high-pollution enterprises, government incentives and competition continue to be the two most critical elements affecting pollution prevention.

5.2.2. Driving force on economic performance
5.2.2.1. Relationship between driving forces and financial indices.
From the regression results of high-pollution enterprises (see Table 5), the driving force within enterprises has a significant effect on financial indices. While the pressure from the government, market and society has little impact on the financial indices.

As shown in the regression results of light-pollution enterprises, the driving forces from within enterprises also exert a significant influence on the achievement of financial targets while the government, market and social pressure do not have significant impacts.

5.2.2.2. Relationship between driving forces and non-financial indices.
From the regression results of high-pollution enterprises, the driving forces within enterprises and from the society and market have significant impacts on the improvement of enterprises' non-financial indices. However, the impact of the community requirements is significantly negative. The market driving forces also come from the competitors. From the regression results of light-pollution enterprises, adjusted R^2 and F test are not significant; therefore, all the driving forces have no significant effect on the non-financial indices for light-pollution enterprises (see Table 5).

Table 5
Results of regression analyses: effects of driving forces on economic performance.

	Dependent Variable: Financial Indexes (FI)						Dependent Variable: Non-financial Indexes (NFI)					
	FI-Government Driving Force		FI- Market Driving Force		FI- Enterprise Driving Force		NFI-Government Driving Force		NFI- Market Driving Force		NFI- Enterprise Driving Force	
	1 (Light)	2 (High)	1 (Light)	2 (High)	1 (Light)	2 (High)	1 (Light)	2 (High)	1 (Light)	2 (High)	1 (Light)	2 (High)
Control Variables:												
Constant	1.75***	0.6	1.58***	0.5	1.91***	0.91+	3.48***	2.98***	3.47***	2.84***	3.38***	3.08***
Number of Employees	−0.02	0.05	−0.02	0.01	0.02	0.03	0.06	−0.07	0.09	−0.12	0.11	−0.12
Sales in 2008	0.18	0.1	0.22+	0.13	0.12**	0.07	0.13	−0.02	0.11	0.03	0.05	0
Total Assets	−0.09	−0.03	−0.12	−0.05	−0.09	0.02	−0.08	0.02	−0.03	−0.01	−0.06	0.03
Firm Ages	−0.06	0.18*	−0.04	0.20**	−0.03	0.18**	−0.1	−0.15*	−0.12+	−0.12*	−0.11+	−0.14*
Driving Forces:												
Government			−0.02	−0.02	0.11	−0.09			−0.32*	−0.07	−0.27+	−0.07
Government Incentive	**0.11**	**−0.03**					**−0.16**	**−0.05**				
Government Regulations	**−0.17**	**−0.05**					**−0.11**	**−0.1**				
Government Assistance	**0.05**	**0.02**					**−0.04**	**0.02**				
Market	0.01	0.11			0.04	0.1	−0.06	0.13+			−0.07	0.12+
Competitors			**−0.06**	**0.08+**					**−0.14+**	**0.11***		
Buyers' Requirements			**0.08**	**0.02**					**0.04**	**0.01**		
Society Community Requirements	0.13	−0.07	0.09	−0.03	0.05	−0.03	0.28+	−0.29+	0.31*	−0.23	0.31*	−0.26+
Enterprise	0.51***	0.61***	0.56***	0.61***			0.16	0.47***	0.17	0.49***		
Sales					**0.39**	**0.14**					**0.13**	**0.04**
Profitability					**0.04**	**0.33****					**0.09**	**0.20+**
ROE					**0.12**	**0.07**					**−0.13**	**0.15**
Market Share					**−0.1**	**−0.03**					**−0.08**	**0.02**
Number of Customers					**−0.04**	**0.03**					**0.2**	**0.03**
R	0.75	0.87	0.74	0.88	0.78	0.91	0.41	0.83	0.45	0.84	0.45	0.85
R^2	0.56	0.76	0.55	0.77	0.61	0.82	0.16	0.69	0.2	0.7	0.21	0.71
Adjusted R^2	0.48	0.68	0.48	0.69	0.52	0.74	0.01	0.58	0.07	0.61	0.02	0.58
F	6.84***	9.03***	7.44***	10.52***	6.76***	9.89***	1.06	6.33***	1.51	7.62***	1.12	5.41***

Note: $+p < 0.10$, $*p < 0.05$, $**p < 0.01$, $***p < 0.001$.

Table 6
Results of correlation of environment performance and economic performance.

Correlation Coefficient	Light-pollution enterprises				High-pollution enterprises			
	Contamination Control	Contamination Prevention	Financial Indices	Non-financial Indices	Contamination Control	Contamination Prevention	Financial Indices	Non-financial Indices
Contamination Control	1.000				1.000			
Contamination Prevention	0.478***	1.000			0.454***	1.000		
Financial Indices	0.483***	0.187+	1.000		0.290**	0.312**	1.000	
Non-financial Indices	0.064	0.056	0.387**	1.000	0.059	0.190+	0.598***	1.000

Notes: $^{+}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

It is used to think that government incentives and regulations may have great impact on the economical performance of enterprises. However as shown in this study, the government driving forces for these two types of SMEs are not statistically significant, which concurs with the result of the interview to SMEs and environment consultants. Therefore, hypothesis 2a is not supported; that is, the government driving forces do not have significant impact on the economic performance of SMEs. For high-pollution enterprises, the market driving forces from competitors contribute to improvement in financial and non-financial indices (Hypothesis 2c is supported). Meanwhile, community requirements can increase the pressure on enterprises' expansion, and produce a negative effect on the economic performance (Hypotheses 2b and 2d are partially supported).

5.2.3. Correlation of environment performance and economic performance

It is generally accepted that the correlation is strong when the absolute value of correlation coefficient reaches 0.8 or more; the correlation is a mediocre when it ranges from 0.5 to 0.8; a low correlation when it is from 0.3 to 0.5 and a weak correlation when it is from 0 to 0.3. By observing the correlation coefficients between environmental performance indices and economic performance indices, it can be seen that for light-pollution enterprises, there is a medium correlation between contamination control and financial indices (see Table 6). While, there is a low correlation between financial indices and pollution prevention for high-pollution enterprises.

When there is less external pressure, the aim of light-pollution enterprises to implement contamination control is to enhance the profitability and operational ability. There is a positive correlation between the contamination control and the financial indices. While for high-pollution enterprises, contamination prevention can reduce the violation costs, which will create conditions for a steady and continuous development. There is a certain level of correlation between contamination prevention and financial indices. Hypothesis 3c (for SMEs of the two pollution levels of SMEs, high-pollution enterprises and light-pollution enterprises, the relationship between environmental performance and economic performance is different) is supported. There are medium correlations between the environmental performance and the economic performance of SMEs. Further, the correlation mainly appears between environmental performance and financial indices, instead of correlations between environmental performance and non-financial indices (Hypothesis 3a, 3b are partially supported).

6. Discussion and concluding remarks

Market driving forces play an important role in improving performance of contamination control and prevention, in which pressure from competitors is particularly significant. It is obvious that raising the overall level of environmental management in the whole industry has a very big positive effect on driving the SMEs

that have implemented little environmental management to improve. For social driving forces, community requirements of residents for environmental pollution have great influence on contamination control for SMEs. However, the impacts of environmental organizations and media attention on environmental performance for large enterprise are strong, but which are not obvious for SMEs. As for the government driving forces, the effect of the government incentives for contamination control or prevention is greater than that of the government supervision. For enterprise driving forces, that is, the enterprises' own requests have not brought significant improvement on environmental performance.

Viewing from the economic performance, there is no doubt that enterprises' driving forces of the high-pollution SMEs have a significant effect on both financial and non-financial indices. In addition, competitors' pressures also play an important role in the improvement of economic performance. Upgrading the concept of industry-wide environmental protection can bring up the level of overall profitability and overall market expansion while the community requirements of environment for high-pollution enterprise generate some obstacles for market expansion. Environmental performance and economic performance of high-pollution enterprises have a certain degree of positive correlation.

The practical implications for high-pollution SMEs to enhance environmental management level are:

First, the government needs to strengthen the role of government incentives to encourage enterprises to participate in the implementation of environmental management. The government tends to pay more attention in supervising the larger sized enterprises, but lacks monitoring the large number of SMEs. Therefore, only a few extreme SMEs whose production has caused serious environmental accidents would be regulated. Therefore, the government should devise special environmental management measures for those high-pollution SMEs, and give sufficient financial support (e.g., tax breaks, subsidies) and other measures to motivate them to implement environmental management.

Second, it needs to enhance the status of industrial association and take measures to come up with consensus on environment issues within the industry and implement industrial self-discipline.

Third, it needs to pay better respect to buyers' opinions. Many overseas customers consider the environmental factor as an important selection criterion in selecting suppliers from China, which however has not been paid sufficient attention by local Chinese buyers and customers. The government should encourage green purchasing through some tangible (economic ways) and intangible (such as media campaigns) incentives.

The society, market and government play an important role in environmental performance for light-pollution SMEs. Community requirements promote contamination control. Buyers' demands in the market can improve contamination control, which manifests

short-term effects of downstream enterprises for SMEs environmental management, while competitors can upgrade the level of contamination prevention, a long-term impact of environmental management. Government aids could improve the performance of contamination control because the light-pollution enterprises would try to avoid legal penalties and enjoy preferential policies of the government. Therefore, technology, information, and financing assistance from the government can be often able to achieve better contamination control.

Enterprises' driving forces are not directly related to the environmental performance, which means contamination pollution prevention and control cannot achieve the business development goals.

For economic performance, only the enterprises' driving forces have some positive correlation with the financial indices. However, the government, market and social driving forces on economic performance are not significant. Environmental performance and economic performance of light-pollution enterprises also have a certain degree of positive correlation.

Though the light-pollution enterprises do not impose much burden on the environment, their activities should not also be overlooked because of their weak awareness of environmental protection. The practical implications for light-pollution enterprises to enhance environmental management level are:

First, the government needs to strengthen the role of government assistance. It may be one of the most effective ways for light-pollution enterprises because most of them are out of the scope of governmental incentive plans and supervision. The Government should provide more channels for supporting environmental protection, such as promotion of new environmental technologies, introduction of cleaner production and implementation of environmental management system, information channels of environmental protection facilities purchasing, loans for environmental management, etc. These assistances will not consume much money from the government, but can effectively enhance the level of environmental control and prevention for light-pollution SMEs through long-term support of technical, information, financial services.

Second, it needs to raise the environmental awareness. Managers of light-pollution SMEs may not pay much attention to environmental management of their business. As the results shown, the financial indicators have significantly positive correlations with pollution prevention for light-pollution enterprises, indicating that though the implementation of pollution prevention (e.g., waste water re-use, dust recycling, and reducing energy consumption) requires some resource input, it can however profit from positive economic benefits.

As this study is based on the investigation of SMEs in the region of Northern China, validation of studies from other areas is required. In addition, from the statistical analysis, it is found that the control variables such as firm ages and others also provide significant impact on environmental performance and economic performance for SMEs; therefore, the mechanism of these factors need further empirical research.

Acknowledgments

References

Andersson, L.M., Bateman, T.S., 2000. Individual environmental initiative: championing natural environmental issues in U.S. business organizations. Academy of Management Journal 43 (4), 548–570.

Aragon-Correa, J., Hurtado-Torres, A.N., Sharma, S., Garcia-Morales, V.J., 2008. Environmental strategy and performance in small firms: a resource-based perspective. Journal of Environmental Management 86, 88–103.

Bansal, P., Hunter, T., 2003. Strategic explanations for the early adoption of ISO 14001. Journal of Business Ethics 46, 289–299.

Branzei, O., Urstacki-bryant, T.J., Vertinsky, I., Zhang, W.J., 2004. The formation of green strategies in Chinese firms: matching corporate environmental responses and individual principles. Strategic Management Journal 25, 1075–1093.

Buysse, K., Verbeke, A., 2003. Proactive environmental strategies: a stakeholder management perspective. Strategic Management Journal 24, 453–470.

Chen, Y.S., Lai, S.B., Wen, C.T., 2006. The influence of green innovation performance on corporate advantage in Taiwan. Journal of Business Ethics 67, 331–339.

Christmann, P., 2000. Effects of "best practices" of environmental management on cost advantage: the role of complementary assets. Academy of Management Journal 43 (4), 663–680.

Claver, E., Lopez, M.D., Molina, J.F., 2007. Environmental management and firm performance: a case study. Journal of Environmental Management 84 (4), 606–619.

Cordano, M., Frieze, I.H., 2000. Pollution reduction preferences of US environmental managers: applying Ajzen's theory of planned behavior. Academy of Management Journal 43, 627–641.

Cordano, M., Marshall, R.S., Silverman, M., 2010. How do small and medium enterprises go "green"? A study of environmental management programs in the US wine industry. Journal of Business Ethics 92 (3), 463–478.

Darnall, N., Edwards, D., 2006. Predicting the cost of environmental management system adoption: the role of capabilities, resources and ownership structure. Strategic Management Journal 27, 301–320.

Darnall, N., Henriques, I., Sadorsky, P., 2010. Adopting proactive environmental strategy: the influence of stakeholders and firm size. Journal of Management Studies 47 (6), 1072–1094.

Delmas, M.A., 2002. The diffusion of environmental management standards in Europe and the United States: an institutional perspective. Policy Sciences 35, 91–119.

Diao, X.D., Zeng, S.X., Tam, C.M., Tam, V.W.Y., 2009. EKC analysis for studying economic growth and environmental quality: a case study in China. Journal of Cleaner Production 17 (5), 541–548.

Earnhart, D., Lizal, L., 2010. Effect of corporate economics performance on firm-level environmental performance in a transition economy. Environmental & Resource Economics 46 (3), 303–329.

Egri, C.P., Herman, S., 2000. Leadership in the North American environmental sector: values, leadership styles and contexts of environmental leaders and their organizations. Academy of Management Journal 43 (4), 571–604.

Feldman, S.J., Soyka, P.A., Ameer, P.G., 1997. Does improving environmental management systems and performance result in higher stock price? Journal of Investing 6 (4), 87–97.

Florida, R., Davison, D., 2001. Gaining from green management: environmental management systems inside and outside the factory. California Management Review 43 (3), 64–84.

Hart, S., 1995. A natural-resource-based view of the firm. Academy of Management Review 20, 986–1014.

Henri, J.F., Journeault, M., 2008. Environmental performance indicators: an empirical study of Canadian manufacturing firms. Journal of Environmental Management 87, 165–176.

Jesus, A.B., Junquera, B., 2003. A review of the literature on environmental innovation management in SMEs: implications for public policies. Technovation 23, 939–948.

Juan, A.A., Enrique, A.R., 2007. Proactive corporate environmental strategies: myths and misunderstandings. Long Range Planning 40 (3), 357–381.

Kassinis, G., Vafeas, N., 2006. Stakeholder pressures and environmental performance. Academy of Management Journal 49 (1), 145–159.

King, A.A., Lenox, M.J., 2000. Industry self-regulation without sanction: the chemical industry's responsible care program. Academy of Management Journal 43 (4), 698–716.

King, A.A., Lenox, M.J., 2001. Lean and green? Exploring the spillovers from lean production to environmental performance. Production and Operations Management 10 (3), 244–256.

Klassen, R.D., McLaughlin, C., 1996. The impact of environmental management on firm performance. Management Science 42 (8), 1199–1214.

Klassen, R.D., Whybark, D.C., 1999. The impact of environmental technologies on manufacturing performance. Academy of Management Journal 42 (6), 599–615.

Lee, J.J., Gemba, K., Kodama, F., 2006. Analyzing the innovation process for environmental performance improvement. Technological Forecasting & Social Change 73, 290–301.

Link, S., Naveh, E., 2006. Standardization and discretion: does the environmental standard ISO14001 lead to performance benefits? IEEE Transaction on Engineering Management 53 (4), 508–519.

Liu, X.B., Liu, B.B., Shishime, T., Yu, Q.Q., Bi, J., Fujitsuka, T., 2010. An empirical study on the driving mechanism of proactive corporate environmental management in China. Journal of Environmental Management 91 (8), 1707–1717.

Lopez-Gamero, M., Molina-Azorín, J., 2009. The whole relationship between environmental variables and firm performance: competitive advantage and firm resources as mediator variables. Journal of Environmental Management 90, 3110–3121.

Marcus, A.A., Nichols, M.L., 1999. On the edge: Heeding the warnings of unusual events. Organization Science 10 (4), 482–499.

Maxwell, J., Decker, C., 2006. Voluntary environmental investment and responsive regulation. Environmental and Resource Economics 33, 425–439.

Menguc, B., Auh, S., Ozanne, L., 2010. The interactive effect of internal and external factors on a proactive environmental strategy and its influence on a firm's performance. Journal of Business Ethics 94 (2), 279–298.

Miles, M.P., Covin, J.G., 2000. Environmental marketing: a source of reputational, competitive, and financial advantage. Journal of Business Ethics 23 (3), 299–311.

Moffat, A., Auer, A., 2006. Corporate Environmental Innovation (CEI): a government initiative to support corporate sustainability leadership. Journal of Cleaner Production 14, 589–600.

Montabon, F., Sroufe, R., Narasimhan, R., 2007. An examination of corporate reporting, environmental management practices and firm performance. Journal of Operations Management 25 (5), 998–1014.

Montiel, I., Husted, B.W., 2010. The adoption of voluntary environmental management programs in Mexico: first movers as institutional entrepreneurs. Journal of Business Ethics 88 (Suppl.2), 349–363.

Murphy, C.J., 2002. The Profitable Correlation: Between Environmental and Financial Performance: a Review of the Research. Light Green Advisors Inc., Seattle, WA.

Naveh, E., Marcus, A., 2005. Achieving competitive advantage through implementing a replicable management standard: Installing and using ISO9000. Journal of Operations Management 24 (1), 1–26.

Peres, W., Stumpo, G., 2000. Small and medium-sized manufacturing enterprises in Latin America and the Caribbean under the new economic model. World Development 28 (9), 1643–1655.

Peter, J.P., 1979. Reliability: a review of psychometric basics and recent marketing practices. Journal of Marketing Research 16, 6–17.

Petrick, J.A., Scherer, R.F., Brodzinski, J.D., Quinn, J.F., 1999. Global leadership skills and reputational capital: intangible resources for sustainable advantage. The Academy of Management Executive 13 (1), 58–69.

Porter, M.E., van der Linde, C., 1995. Green and competitive: ending the stalemate. Harvard Business Review 73 (5), 120–134.

Qi, G.Y., Shen, L.Y., Zeng, S.X., Jorge, O.J., 2010. The drivers for contractors' green innovation: an industry perspective. Journal of Cleaner Production 18 (14), 1358–1365.

Ramus, C.A., Steger, U., 2000. The roles of supervisory support behaviors and environmental policy in employee co-initiatives at leading-edge European companies. Academy of Management Journal 43 (4), 605–626.

Roome, N., Wijen, F., 2006. Stakeholder power and organizational learning in corporate environmental management. Organizational Studies 27 (2), 235–263.

Russo, M., Fouts, P., 1997. A resource-based perspective on corporate environmental performance and profitability. Academy of Management Journal 40 (3), 534–559.

Sarkis, J., 2006. The adoption of environmental and risk management practices: relationships to environmental performance. Annals of Operations Research 145, 367–381.

Sarkis, J., Dijkshoorn, J., 2007. Relationships between solid waste management performance and environmental practice adoption in Welsh small and medium-sized enterprises (SMEs). International Journal of Production Research 45 (21), 4989–5015.

Segerson, K., Miceli, T.J., 1998. Voluntary environmental agreements: good or bad news for environmental protection? Journal of Environmental Economics and Management 36 (2), 109–130.

Sharfman, M.P., Fernando, C.S., 2008. Environmental risk management and the cost of capital. Strategic Management Journal 29, 569–592.

Sharma, S., 2000. Managerial interpretations and organizational context as predictors of corporate choice of environmental strategy. Academy of Management Journal 43 (4), 681–697.

Sharma, S., Vredenburg, H., 1998. Proactive corporate environmental strategy and the development of competitively valuable organizational capabilities. Strategic Management Journal 19 (8), 729–753.

Shi, H., Peng, S.Z., Liu, Y., Zhong, P., 2008. Barriers to the implementation of cleaner production in Chinese SMEs: government, industry and expert stakeholders' perspectives. Journal of Cleaner Production 16, 842–852.

Shrivastava, P., 1995. Environmental technologies and competitive advantage. Strategic Management Journal 16, 183–200.

Waddock, S., Smith, N., 2000. Corporate responsibility audits: doing well by doing good. Sloan Management Review.

Wagner, M., 2008. Innovation and competitive advantages from the integration of strategic aspects with social and environmental management in European firms. Business Strategy and the Environment 18 (5), 291–306.

Zeng, S.X., Tam, C.M., Deng, Z.M., Tam, Vivian W.Y., 2003. ISO 14000 and the construction industry: survey in China. Journal of Management in Engineering 19 (3), 107–115.

Zeng, S.X., Tam, C.M., Tam, Vivian W.Y., Deng, Z.M., 2005. Towards implementation of ISO 14001 environmental management systems in selected industries in China. Journal of Cleaner Production 13 (7), 645–656.

Zeng, S.X., Liu, H.C., Tam, C.M., Shao, Y.K., 2008. Cluster analysis for studying industrial sustainability: an empirical study in Shanghai. Journal of Cleaner Production 16 (10), 1090–1097.

Zeng, S.X., Meng, X.H., Yin, H.T., Tam, C.M., Sun, L., 2010a. Impact of cleaner production on business performance. Journal of Cleaner Production 18 (10/11), 975–983.

Zeng, S.X., Xie, X.M., Tam, C.M., 2010b. Relationship between cooperation networks and innovation performance of SMEs. Technovation 30, 181–194.

Zeng, S.X., Xu, X.D., Dong, Z.Y., Vivian, W.Y., 2010c. Towards corporate environmental information disclosure: an empirical study in China. Journal of Cleaner Production 18 (12), 1142–1148.

Zhang, B., Bi, J., Yuan, Z.W., Ge, J.J., Liu, B.B., Bu, M.L., 2008. Why do firms engage in environmental management? An empirical study in China. Journal of Cleaner Production 16 (10), 1036–1045.

Zhou, G.M., 2005. Comparative study on circular economy. Urban Planning Overseas 20 (6), 6–10 (in Chinese).