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Institutional-based antecedents and performance outcomes of internal and external green supply chain management practices

Qinghua Zhu [a,*], Joseph Sarkis [b,1], Kee-hung Lai [c,2]

[a] School of Business Management, Dalian University of Technology, Dalian, Liaoning Province 116024, PR China
[b] Graduate School of Management, Clark University 950 Main Street, Worcester, MA 01610-1477, USA
[c] Department of Logistics and Maritime Studies, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong

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ABSTRACT

Green supply chain management (GSCM) has been a developing topic for at least a couple of decades. Over this time, significant complexities have been observed in its management. Helping to simplify and understand these complexities is necessary from both a practical and research perspective. Given this situation and to further enhance understanding of the topic and even supply chain management in general, this paper develops and empirically tests a theoretical model on the different types of institutional pressures motivating manufacturing enterprises to pursue green supply chain management (GSCM) practices and commensurate performance outcomes. Using a sample of 396 Chinese manufacturers, path analysis is used to evaluate the many structural links. The statistic results show that institutional pressures have driven the manufacturer adoption of internal GSCM practices which in turn relate to their external GSCM practices adoption. The statistic results also suggest that GSCM practices do not directly affect economic performance, but can improve it indirectly. This research contributes to the literature on institutional theory in corporate environmental practices. The research findings provide useful insights for managers seeking to adopt GSCM practices. The results also provide policy insights for professional organizations, regulators, and legislators to further promote GSCM.

1. Introduction

Stricter environmental regulations and potential competitive gains from embracing environmental practices have caused manufacturers to adopt various environmental management practices. In collaboration with their supply chain partners, suppliers and customers, manufacturers can command a better strategic and competitive position if they implement environmental management in a cost-effective manner (Vachon and Klassen, 2006). Collaborative organizational actions to lessen product and process environmental burdens can help reduce unnecessary wastes and improve supply chain efficiencies (Seuring and Muller, 2008). A supply chain-wide management approach for environmental management in the form of green supply chain management (GSCM) has gained in popularity for manufacturers in the hopes of mitigating their environmental damages while achieving operational performance gains (Zhu et al., 2008, 2012a, 2012b; Svensson, 2007).

A variety of stakeholder and institutional pressures are major motivating forces that lead enterprises to pursue GSCM related practices (Tate et al., 2010). Governmental or regulatory institutional pressure is a key driver motivating the implementation of external GSCM practices (Gonzalez-Benito and Gonzalez-Benito, 2006). Commercial competitive pressures have caused organizations to pursue internal eco-design initiatives (Chung and Wee, 2008). Other studies have examined relationships of institutional pressure, particularly regulatory pressure, with environmental management practices such as internal GSCM practice on ISO14001 certification (Quazi et al., 2001) and external GSCM practice on investment recovery (Mitra, 2009). This line of institution-theoretic investigation requires a systematic analysis to further understand and promote proactive environmental management practices such as GSCM (Beskovnik and Jakomin, 2010).

The first objective of this paper is to parlay institutional theory understanding to systematically evaluate three kinds of institutional pressures, namely, normative, coercive, and mimetic pressures (DiMaggio and Powell, 1983) on the implementation of GSCM practices in the Chinese context. It is further examined whether GSCM practices implementation by manufacturing enterprises in China is motivated by a specific and individual institutional pressure or collectively by all of them.

* Corresponding author. Tel.: +86 411 8470 6018; fax: +86 411 8470 8342.
E-mail addresses: zhuqh@dlut.edu.cn (Q. Zhu), jsarkis@clarku.edu (J. Sarkis), lgtmlai@polyu.edu.hk (K.-h. Lai).
[1] Tel.: +508 793 7659; fax: +508 793 8822.
[2] Tel.: +852 2766 7920; fax: +852 2330 2704.

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The extent of GSCM practices contributing to organizational performance improvements is also unclear. Economic performance has traditionally been, and continues to be a top management priority for manufacturers. GSCM is significantly related to economic performance (Carter et al., 2000). GSCM related practices can enhance the ability of organizations to compete which certainly includes economic performance improvements (Yang et al., 2010; deBrito and Berardi, 2010). Studies have shown that GSCM practices can provide 'win-win' opportunities with both environmental performance and economic benefits (Chien and Shih, 2007). A third dimension of performance, operational performance, has not seen as much research (Corbett and Klassen, 2006). Thus, another major objective of this study is to identify the ways, and to determine if, GSCM practices can contribute to economic performance or deliver additional benefits through improved environmental and operational performance.

Using previous fragmented and disjointed studies which sometimes show conflicting results, this study develops and empirically evaluates a comprehensive model explaining various theoretical linkages of GSCM. These linkages include the relationships between pressures/drivers, GSCM practices implementation, and performance outcomes. Survey data collected from a corporate level sample of Chinese manufacturing organizations is used to investigate these linkages. The model contributes to theoretic development on diffusion and performance outcomes from implementing GSCM.

The findings also provide implications for regulators in both developed and developing countries on how to promote GSCM practices among manufacturers by creating awareness of environmental protection and institutionalizing pressures on them to further embark on implementation of GSCM for performance gains. The empirically tested theoretical relationships on the implementation of GSCM provide practical implications for manufacturers to identify ways for improving environmental and operational performance as well as economic benefits through proper design of GSCM practices.

2. Theoretical development and hypotheses

Using the organizational boundary of a manufacturer, GSCM can be broadly classified into internal and external practices. Both internal and external GSCM practices may be driven by institutional pressures encompassing the normative, coercive, and mimetic pressures. In this paper, internal GSCM practices are defined as practices that can be implemented and managed independently by individual manufacturers. External GSCM practices typically require some level of cooperation with external stakeholders or partners such as suppliers and customers.

Both internal and external GSCM practices may result in environmental, operational, and economic performance improvements (Seuring and Muller, 2008). Simultaneously, economic performance improvement can result from environmental performance improvement due to waste reduction and resources conservation. Operational performance improvement, for example from decreased inventory levels and improved product quality in environmentally based supply chain collaborative actions can also contribute to economic performance improvement (Zhu et al., 2005).

Given these myriad relationships, this paper introduces a conceptual model that identifies the structural relationships linking the antecedents for implementing the different elements of internal and external GSCM practices and their relationships to the performance outcomes from the implementation by manufacturing enterprises. This model is depicted in Fig. 1.

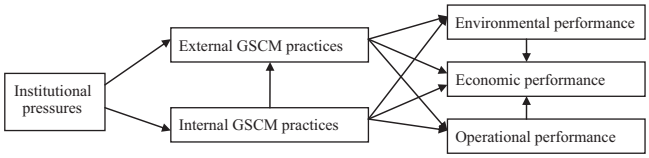

Fig. 1. The structural relationships of pressures, practices, and performance of GSCM.

2.1. Institutional pressures and GSCM practices

2.1.1. Institutional pressures

Institutional theory posits that organizational competitive environmental alignment may be influenced by three institutional isomorphic pressures, namely normative, coercive, and mimetic pressures (DiMaggio and Powell, 1983; Sarkis et al., 2011).

Coercive pressure is usually an important factor that drives environmental management practices among manufacturers in developing countries such as China. Government agencies are examples of powerful groups that may influence the actions of an organization (Rivera, 2004). In this paper, environmental regulations are defined as the coercive pressures driving the implementation of GSCM by Chinese manufacturing managers in hopes of improving their performance.

With decreasing resources and increasing environmental damage, both central and local governments in China have established many environmental regulations. Manufacturers, as the main polluters and resource consumers, have experienced greater pressures from environmental protection regulations.

Global regulations have also caused an increased institutional pressure for improved environmental management by Chinese firms. Many of these regulations typically surpass local requirements. For example, the European Community Directive on Waste Electrical and Electronic Equipment (WEEE) now requires Chinese manufacturers to take back used products or pay premiums when they export electrical and electronic equipment to Europe (Yu et al., 2008). This international regulatory policy is a substantial economic market pressure since nearly one quarter of exported electronic/electrical appliances in China are sold to the European Community. Chinese electronic manufacturers, especially those exporting products to Europe, have paid increasing attention to GSCM practices (Lai and Wong, 2012).

Normative pressures cause organizations to conform to social legitimacy concerns in organizational practices. This pressure may be exerted by external stakeholders who have a direct or indirect interest in the organization. Customer and market requirements (social norms) and their increasing environmental expectation form the core normative pressure for Chinese manufacturers to implement GSCM. Specifically, exports and sales to foreign customers are two main drivers that may prompt Chinese manufacturers to adopt environmental management and GSCM practices (Christmann and Taylor, 2001; Lai et al., 2012). Chinese consumers, as they become more affluent, have increasingly heightened environmental awareness and are starting to opt for green products (Harris, 2006; Lo and Leung, 2000). This situation is in line with trends in other countries such as the USA, in which an estimated 75% of consumers made their purchasing decisions with the enterprises' environmental reputation in mind and 80% of consumers were willing to pay more for environmentally friendly products (Carter et al., 2000).

Mimetic pressures occur when an organization imitates the actions of successful competitors in the industry. Firms may follow or 'mimic' competitors merely because of their success. In operations and manufacturing, such action is typically defined

as competitive benchmarking. The rationale is simply to follow actions of successful competitors to repeat their successful path. Globalization has created opportunities for Chinese manufacturers to learn from their foreign competitors, especially those operating in China (Christmann and Taylor, 2001).

2.1.2. Relationships between institutional pressures and GSCM practices

A number of external and internal groups or "stakeholders" exert pressures for manufacturers to adopt environmental management practices. The literature has identified a number of potential groups that will influence organizational adoption of internal or external GSCM and other environmental management practices.

Using China as an example, international trade barriers motivate manufacturers to implement GSCM practices (DiMaggio and Powell, 1983). Other than export and sales to foreign customers (DiMaggio and Powell, 1983), there are evolving consumer pressures and drivers. Chinese consumers, especially the younger generations, have increasingly developed environmental awareness with preference for 'green' products (Liu et al., 2009; Lo and Leung, 2000). The scarcity of resources, degradation of the living environment, and increasing pressure from Chinese consumers have prompted the Chinese government, both local and national, to exert pressures on manufacturers through increasing environmental regulatory and tax policies (Bai and Imura, 2001; MacBean, 2007).

Institutional theory suggests that a firm will consider the actions of other organizations when they determine their organizational practices. In addition to competing for resources and customers, a firm will value political power and institutional legitimacy for social and economic rewards (DiMaggio and Powell, 1983). In the manufacturing context, a firm will seek to conform to norms and rules for the purpose of legitimization. Growing concerns for environmental protection in view of the growing regulations and market expectations for environmentally based corporate social responsibility is necessary for social legitimacy (Boiral, 2007).

Significant variations in organizational environmental management practices are associated with differences in institutional pressures (Darnall et al., 2009, 2010). Pressures can work in two ways, both to limit and expand organizational GSCM practice acceptance. For example, coercive pressure narrows organizational choices on GSCM practices such as product recovery due to constrained freedom for network structure and capabilities. Organizational ability to attain the best possible performance improvement can be compromised if a mimetic approach to implement GSCM practices is chosen (Miemczyk, 2008).

A previous study showed that with environmental requirements and support from customers, along with government pressures, companies are likely motivated to implement GSCM (Su-Yol, 2008). Research has also shown a heterogeneous response to these various institutional pressures, where some have found that regulatory pressure, but not customer pressure, cause adoption of green practices among logistics service providers (Lin and Ho, 2011) while another study considers all these pressures valid motivators for green practices adoption (Lai et al., 2011). Thus, there are situations where positive, negative, and no relationships may exist between various pressures and adoption of specific GSCM practices.

The influence of institutional pressures on the pursuit of environmental management practices is particularly salient in the manufacturing industry of China. Institutional isomorphism may explain structural changes in the operations of Chinese manufacturers. These changes are especially evident when organizations seek to cope rationally with the rising expectation of environmental protection by the different stakeholder groups.

There will be operational changes by Chinese manufacturers with increasing attention on environmental protection from these institutional pressures. These forces also cause Chinese manufacturers to model their practices on international counterparts practices. Since Chinese manufacturers have experienced increasing institutional pressure for environmental management practices, they will initiate both internal and external GSCM practices for conformance to the norms, rules, and requirements of different international trade communities for environmentally friendly operations (Zhu et al., 2005).

Institutional drivers can result from varying sources and with differing effects when implementing GSCM practices (Darnall et al., 2008). Normative institutional isomorphic pressures from, for example, markets require manufacturers to be perceived as having organizational routines that contribute to organizational legitimacy (e.g., industry wide eco-labeling standards). Coercive institutional drivers such as mandatory regulatory acts may force manufacturers to implement GSCM practices (e.g., reduction of certain chemicals when eco-designing products). Mimetic institutional isomorphic pressures and drivers encourage manufacturers to imitate successful competitors to adopt GSCM practices for improved competitiveness (e.g., developing reverse logistics networks for a new product environment). Normative and coercive drivers tend to occur at domestic levels while mimetic drivers can take place at global levels (Escobar and Vredenburg, 2011).

Chinese manufacturers have encountered differing levels of experience with the three institutional isomorphic pressures (Liu et al., 2010). Chinese companies' GSCM practices are significantly shaped by external pressures from regulatory requirements, domestic clients, and business competitors (Liu et al., 2012). Given the three different and varying isomorphic pressures exerted on Chinese manufacturers, the first hypothesis is posited:

Hypothesis 1. There exist three kinds of institutional pressures for environmental management and their effects vary on manufacturing enterprise GSCM practices implementation.

2.2. Cross-influence of GSCM practices

A manufacturing supply chain encompasses a number of different participants including the focal manufacturer and its suppliers, distributors, and customers (Bowersox and Closs, 1996). Proactive manufacturers will strive to implement internal GSCM practices with an extension to their external parties. Furthermore, external supply chain environmental initiatives should be based on, and require coordination with, internal environmental management support such as commitment from senior managers, cross-functional cooperation, and eco-design, to be successfully implemented (Walton et al., 1998). Organizations in developed countries such as Japan begin with implementing internal GSCM practices. These internal GSCM practices subsequently facilitate extension to adoption of external GSCM practices (Zhu et al., 2010). This type of relationship between internal practices influencing adoption of external GSCM practices has also been found in the automotive industry in Spain (Gonzalez et al., 2008).

In fact, one of the major tenets of supply chain management is coordination among the various participating organizations but also within and between internal and external practices (da Silveira and Arkader, 2007; Mentzer et al., 2001). The foundation of 'having your house in order' and building internal resources, usually sets the stage for increased requirements and adoption for

external environmentally oriented organizational practices (Sarkis et al., 2010). Thus, the following hypothesis is posited:

Hypothesis 2. Implementing internal GSCM practices enhances the level of external GSCM practices implementation.

2.3. GSCM practices and economic performance

Economic performance is an important reason why manufacturing enterprises seek to implement environmental management practices. Previous studies show that success in addressing environmental issues may provide new opportunities for competition, and new ways to add value to core business programs (Hansmann and Kroger, 2001; Wagner and Schaltegger, 2006; Lai et al., 2010). Studies have shown that corporate environmental management practices such as internal and external GSCM have a positive relationship with an organization's economic performance as part of 'win-win' propositions (Gil et al., 2001; Montabon et al., 2007; Rao and Holt, 2005; Wong et al., 2012b).

Most companies can gain performance benefits through internal GSCM practices such as ISO14001 (Segarra-Ona et al., 2012; Prajogo et al., 2012). Sustainable management practices with a long term orientation can bring significant sales growth, return on assets, profit before taxation, and cash flows from operations (Ameer and Othman, 2012). Inter-organizational relationships may provide formal and informal mechanisms that promote trust, reduce risk, and in turn increase innovation and profitability (Dyer and Singh, 1998; Leung et al., 2011; Yang et al., 2008). Sustainable supplier cooperation is found to have positive significant effects on economic performance (Hollos et al., 2012). Thus given these many study findings, the third hypothesis is posited:

Hypothesis 3. GSCM practices are directly associated with economic performance.

Both internal and external GSCM can potentially improve environmental performance. Inter-organizational linkages facilitated by proximity can lead to improvement in environmental performance since it is easier for customers and suppliers to communicate each other's operational requirements and then improve cooperation (Frosch, 1994). Closer bonds between suppliers and customers, which can facilitate cleaner production, are the trend in manufacturing as leading enterprises need similar close collaborative relationships with suppliers to incorporate management strategies such as JIT, continuous improvement, and total quality management all which can contribute to improved environmental performance (Florida, 1996; Gunasekaran et al., 2008). The roles and relationships of various elements within GSCM and across organizations can also synergistically contribute to improved environmental programs and performance (Darnall et al., 2008; Gonzalez et al., 2008).

With improved environmental image, manufacturers may enlarge their market share. In the UK, researchers, Haji-Gazali and Simula, showed in 1994 that on average consumers were willing to pay approximately 13% more for green products (Varangis et al., 1995). Environmental management practices can improve corporate reputation and customer satisfaction which can in turn bring economic performance (Tang et al., 2012). Integration of strategic issues and environmental management are associated with improved economic and environmental performance (Ameer and Othman, 2012). However, both internal and external GSCM practices can directly improve environmental performance and indirectly benefit economic performance (De Giovanni, 2012). Based on the above discussions, the following hypothesis is put forward.

Hypothesis 4. GSCM practices can indirectly affect economic performance in a positive manner through improved environmental performance.

Limited research still indicates a positive relationship between environmental management and operational performance. An environmental management system is an innovative environmental practice and information management tool (Szwilski, 2000). Also environmental management systems have been shown to improve operational performance of a firm (Tooru, 2001). In addition, strong relationships between meeting operational goals and staff involvement on environmental management have been determined (Hanna and Newman, 1996). In general, over the past decade, several studies have argued for and shown a strong relationship between lean (operational) and green (environmental) practices internal to organizations and across the supply chain (Rothenberg et al., 2001; Seuring and Muller, 2008; Simpson and Power, 2005).

There is also an "eco-efficiency" argument where operational performance improvement can reduce consumption for materials and waste generation, and thus cut down the costs for materials purchase and waste treatment or discharge (Porter and Vanderlinde, 1995). Environmentally sustainable initiatives can improve resource efficiency, also relate to improved economic performance (Zhang et al., 2012). Sustainable business management can improve competitiveness through higher eco-efficiency (Iasevoli and Massi, 2012). There is an established research stream on the basic characteristics of the standard 'win-win' argument which states that there are positive relationships between good corporate social responsibility (environmental management practices) and economic and operational performance (Klassen and McLaughlin, 1996; Seuring and Muller, 2008; Nakao et al., 2007). Therefore, the last hypothesis is put forward:

Hypothesis 5. GSCM practices can indirectly affect economic performance in a positive manner through improved operational performance.

3. Research design

3.1. The survey instrument

The major components and relationships of the constructs of this study are shown in Fig. 1. Three institutional pressure components correspond to the isomorphic forces from the institutional theory (DiMaggio and Powell, 1983).

GSCM practice and performance components are developed on the basis of previous study (Zhu et al., 2005). Two GSCM practices, namely eco-design (ECO) and internal environmental management (IEM), can be implemented and managed by an individual manufacturer. Accordingly, ECO and IEM are defined as internal GSCM practices.

Green purchasing (GP) and customer cooperation with environmental concerns (CC) involves cooperation with supply chain partners, whereas investment recovery (IR) needs partial cooperation with customers. Thus, GP, CC, and IR are defined as three external GSCM practices.

The three dimensions of performance outcomes include direct environmental (with an emphasis on pollution reduction), economic, and operational performance outcomes from adoption of the GSCM practices. Due to complex (moderating) effects of other organizational practices, e.g., quality management and just-in-time practices (Zhu and Sarkis, 2004), it is sometimes difficult to evaluate common organizational-level economic performance indicators such as sales and profit resulting from GSCM for one manufacturer. Thus, similar to a previous study (Wagner, 2011),

this study uses self-reported data including direct operational cost reduction and avoidance due to GSCM practices as economic performance variables.

The measurement items for evaluating GSCM pressures/drivers, practices, and performance are summarized in the Appendix. The initial section of the questionnaire focused on providing definitions and the purpose of this study.

The GSCM pressures/drivers items were identified and developed with reference to the three isomorphic forces within institutional theory which include normative, coercive, and mimetic forces (DiMaggio and Powell, 1983). Respondents were asked to evaluate the importance of each pressure/driver on GSCM practices adoption. The five point scale for evaluating the pressures/drivers ranges from 1 = unimportant to 5 = very important.

GSCM practice and performance items were developed using previous measurement scales (Zhu et al., 2005). A five point (1–5) interval scale for evaluating GSCM practice items provided, and the range was from 1 = no implementation to 5 = implemented fully. Respondents were asked to evaluate the significance level of performance improvement due to GSCM practices with a five point scale ranging from 1 = none, to 5 = very significant.

3.2. Samples

This study mainly surveyed respondents from four major industries including the chemical/petrochemical, electronic, automobile, and mechanical industries. These industries are focused on because they have been traditionally associated with higher than average resource consumption, waste generation, and implementation of environmental management practices.

China was chosen as the empirical setting for this study due to the global importance of Chinese manufacturers in terms of their share of the world's total manufacturing outputs and resource requirements (Mckay and Song, 2010). The survey was mainly administered to manufacturers at the corporate level. The targeted research locations focused on Chinese companies and industries around major cities and industrial zones. Mail survey questionnaires were used in Suzhou of Jiangsu Province in Southeast China, Dalian of Liaoning Province in Northeast China, and Tianjin in Mid-east of China.

Using pollution emissions and energy consumption measures, each local government within the target cities provided a list of 200 manufacturers with manufacturer contact information and a support letter. Six hundred questionnaires were delivered to mid-level or senior managers through emails and postal mails. Ninety-eight usable questionnaires were received within two weeks. Manufacturers that did not respond to the mailings were further contacted by calling them on the phone. In total, 396 unique and usable organizational enterprise responses were received.

Mean values for all GSCM practices and institutional pressures items were compared between the questionnaires received within two weeks and those obtained after phone calls. No significant differences were found at the $p < 0.05$ level and thus considered non-response bias not a serious issue in this study.

Common method bias can be a threat for survey research. To avoid 'item characteristic' effects as one of the key causes for common method bias (Podsakoff et al., 2003) due to ambiguous items that can result in unreliable answers, a pretest for the survey questionnaire (measurement) items were carried out for evaluating the theoretical constructs on the implementation of GSCM and its antecedents and performance outcomes. The pretest was conducted by interviewing two enterprises each from among the four manufacturing industries. The pretest aimed to determine if the questionnaire items could be fully understood and if more items should be included to ensure the completeness of the questionnaire to obtain answers for the research inquiries. Each interview lasted about one morning or one afternoon. According to the suggestions of the interviewees, minor modifications were made, mainly on how to better present the measurement items. Subsequent to the pretest, it was proceeded to administer the survey by postal mail mainly to the sample manufacturers in the four industries.

To avoid 'common rater' effects due to respondent's perceived need to provide consistent or socially desirable answers, options were provided that respondents could choose to give personal information or remain anonymous for both the respondents and the company. Further, a confidentiality statement was also included at the beginning of the questionnaire that it would not be revealed about information of respondents and their companies in the study reports.

Harman's one factor approach was also used as a post-hoc statistical test via confirmatory factor analysis for evaluating GSCM practices, pressure, and performance, respectively. The fit statistics of the one factor model for 34 GSCM items are $\chi^2(\text{df}) = 4164.0\ (527)$, $p = 0.000$; GFI = 0.49; CFI = 0.57; NFI = 0.54; IFI = 0.57; RMR = 0.19; RMSEA = 0.13. The fit statistics for 16 GSCM pressure items are $\chi^2(\text{df}) = 1091.4(104)$, $p = 0.000$; GFI = 0.73; CFI = 0.74; NFI = 0.74; IFI = 0.76; RMR = 0.09; RMSEA = 0.15. The fit statistics for 17 GSCM performance items are $\chi^2(\text{df}) = 1468.1(119)$, $p = 0.000$; GFI = 0.60; CFI = 0.68; NFI = 0.67; IFI = 0.68; RMR = 0.48; RMSEA = 0.17. All these results indicate a poor model fit, suggesting that the possibility for common method bias in the survey data is low.

Table 1 shows the characteristics of the organizational respondents in terms of their industry types, ownership, and employee establishment. Among the 396 responses, 124 (31.3%) were from the chemical/petrochemical industry, 68 (17.2%) were from the electronic industry, 80 belonged to the automobile industry (20.2%), 72 (18.2%) served the mechanical industry, and 52 (13.1%) worked in other industries. This study targeted manufacturers with different types of ownership and organizational size in terms of employee establishment. The respondents included 166 state-owned manufacturers (41.9%), 118 private Chinese manufacturers (29.8%), and 112 foreign manufacturers or joint ventures (28.3%). In terms of organizational size, manufacturers were grouped according to the organizational criteria put forward by the State Economic and Trade Commission in China (2003). The study sample included 135 (34.1%) small manufacturers with less than 300 employees, 137 (34.6%) medium-sized manufacturers with employees between 300 and 2000, and 124 (31.3%) large manufacturers with over 2000 employees.

Table 1
Respondent profile by industry, size, and ownership.

Industry	Total	Percentage (%)
Chemical/Petroleum	124	31.3
Automobile	80	20.2
Electronic	68	17.2
Mechanical	72	18.2
Other	52	13.1
Total	396	100
Size (number of employees)		
> 2000	124	31.3
300–2000	137	34.6
< 300	135	34.1
Total	396	100
Ownership		
State-owned	166	41.9
Private Chinese	118	29.8
Foreign or Joint ventures	112	28.3
Total	396	100

3.3. Reliability and validity of the measurement

The content validity of the measurement items was assured by an extensive review of the literature together with expert judgment by environmental and operations management professionals in the four targeted industries, that is, the chemical/petrochemical, electronic, automobile, and mechanical industries.

The construct validity of the theoretical constructs, operationalized in the form of a survey questionnaire, was assessed by using exploratory factor analysis. The factor loading indicates the correlation between an indicator (measurement item) and its corresponding factor. A high factor loading gives evidence of construct validity. All of the constructs have an average factor loading of 0.63 or above, indicating a satisfactory representation by their indicators (Kline, 1994). The total variance explained by the factors for all the constructs is higher than 67.9%, which ensures the practical significance of the derived factors (Hair et al., 2010).

Cronbach's alpha values for all the construct scales on pressures/drivers ranged from 0.75 to 0.88, with an average value of 0.84. The Cronbach's alpha values for the GSCM practices are high, ranging from 0.85 to 0.95, with an average value of 0.89. The Cronbach's alpha values for the constructs on GSCM caused environmental, economic, and operational performance are 0.88, 0.89, and 0.90, respectively. In sum, the overall reliability for the study constructs on GSCM pressures/drivers, practices, and performance can be considered satisfactory (Nunnally, 1978; Litwin, 1995).

The discriminant validity of the constructs was examined with Confirmatory Factor Analysis (CFA) using AMOS 7.0. Discriminant validity can be judged by fixing the correlation between any two theoretical constructs to 1.0, then re-estimating the fixed model. A significant difference in the chi-square statistics between the fixed and the unconstrained models indicates discriminant validity between the theoretical constructs (Chau, 1997). By pairing all possible combinations of the constructs for separate comparisons and fixing their correlations to the perfect value of 1.0, the chi-square values increased substantially, ranging from 9.2 to 65.9, with an average change of 31.2. For the changes at one degree of freedom, these values were significant at $p < 0.01$ ($\chi^2 > 6.635$).

3.4. Path analysis for structural relationships

Path analysis was considered as a modeling technique that can be used to understand and explain relationships that exist among elements of organizational systems such as a supply chain. The empirical data on these variables relating to GSCM implementation were analyzed on the basis of a linear equation system. Path analysis was chosen for examining causal relationships between these variables due to power constraints related to sample size as well as model complexity in the estimation. Another advantage of using path analysis is concerned with its ability in analyzing causal relationships among variables while estimating relative importance of individual paths in the model. While structural equation modeling (SEM) can perform similar functions, path analysis is valuable for examining less established models that are too complex for estimation. Such issue is particularly acute for SEM if a model involves numerous latent constructs and indicators, which can easily result in identification problem and lead to model rejection regardless of its validity in the estimation.

Path analysis enables the use of regression methods to examine causal relationships between constructs of interest, and its use in this study is consistent with prior works on the operations practices of manufacturing firms (Yeung et al., 2005). Path analysis involves conducting a number of multiple regressions to construct a model of associations among the predictor variables and the criterion. Direct and indirect effects of the predictor variables on the criterion can be calculated, which illustrates more precisely the nature of the relations between the predictors and the criterion. A series of ordinary least squares regressions were conducted to obtain standardized beta weights for each path. Each endogenous variable was treated as the criterion and the variables hypothesized to directly affect it were entered as predictors. In doing so, all the intervening variables were examined as dependent variables in the path analytic model. By calculating the path coefficients, the magnitude of change in each dependent variable predicted by the independent variable can be evaluated in the model.

In the path analysis, the coefficient of determination (R^2) was adopted to evaluate the proportion of the variance in an endogenous variable that is accounted for by a set of predictor variables. In determining the strength of a path, this study relied on standardized partial correlation coefficient, also referred to as path coefficient (P), after controlling the predictive effects of the other predictor variables in stepwise regression models. Following previous studies of similar nature (Yeung et al., 2005), a rather stringent threshold was used, i.e., a significance level of 0.05, to determine whether to retain paths, where this criterion is helpful for establishing validity for structural relationships among the theoretical constructs under this study.

4. Results and the model

4.1. General results and descriptive statistics

Table 2 shows the results of descriptive statistics on GSCM pressures/drivers, practices, and performance. Chinese manufacturers generally encounter all three types of pressures for environment protection, showing mean values over 3.50 (3=neutral; 4=somewhat important) for these constructs. These results include average values of 3.93 for coercive pressure, 3.72 for normative pressure, and 3.61 for mimetic pressure. However, Table 2 shows that Chinese manufacturers only consider internal GSCM practices with two mean values over 3.00 (3=currently considering implementation), that is, 3.04 for ECO, and 3.16 for IEM. All these three mean values on external GSCM practice are in the range between 2.50 and 3.00 (2=some potential implementation consideration; 3=currently considering implementation), that is, 2.65, 2.87, and 2.95 for GP, CC, and IR, respectively.

The results show that Chinese manufacturers implement external GSCM practices at lower levels compared to those internal GSCM practices. A possible reason for such a result may be due to lack of supply chain integration and even institutional/cultural factors. Also, Chinese organizations tend to build their internal capabilities and resources first before focusing on external activities.

These initial GSCM practices as reported by the sample of Chinese manufacturers have resulted in some improvements in all three performance measures with mean values over 3.00 (3=to some degree; 4=significant). It is no surprise that these manufacturers experience greater improvements in environmental performance with a mean value of 3.41, followed by operational performance and economic performance with a mean value of 3.32 and 3.14, respectively.

4.2. Results and hypotheses

The structural relationships among the antecedents and performance outcomes of implementing GSCM based on the path analysis together with their corresponding path coefficients and R^2 are summarized in Fig. 2. The variance inflation factor (VIF),

Table 2
Descriptive statistics on GSCM pressures, practices, and performance.

Factors		Mean	Std. Deviation
Institutional pressure			
	Coercive	3.93	0.92
	Normative	3.72	0.83
	Competitive	3.61	0.92
GSCM practice			
	Eco-design (ECO)	3.04	1.11
	Internal environmental management (IEM)	3.16	1.08
	Green purchasing (GP)	2.65	0.95
	Customer cooperation with environmental concerns (CC)	2.87	0.99
	Investment recovery (IR)	2.95	1.02
Performance			
	Environmental	3.41	0.90
	Operational	3.32	0.85
	Economic	3.14	0.92

Notes:
1) Pressures/drivers, 1= unimportant, 2=somewhat unimportant, 3=neutral, 4=somewhat important, and 5= very important
2) Practices, 1=no implementation consideration, 2=some potential implementation consideration, 3=currently considering implementation, 4=implementation occurring, and 5= implemented fully
3) Performance improvement, 1=not at all, 2=a little bit, 3=to some degree, 4=significant, and 5=very significant

which indicates the degree to which each predictor variable is explained by other predictor variables, is a common measure of multicollinearity in a path analysis (Hair et al., 2010). High multicollinearity can distort the effects of an individual predictor, leading to incorrect estimations of regression weights (Hair et al., 2010). A threshold VIF that is less than or equal to 10.0 is a commonly used criterion to determine the presence of multicollinearity (Asher, 1983; Billings and Wroten, 1978). All VIFs in the path model were less than 2.0, providing evidence against the potential threats from multicollinearity.

The path analytic results show that ECO is related to coercive pressure with the path coefficient (P) of 0.262 ($p < 0.001$). IEM is positively related to normative and competitive pressures with the path coefficients of 0.274 ($p < 0.001$) and 0.141 ($p < 0.05$), respectively. Thus, Hypothesis 1 is supported by the positive relationship between institutional pressures and internal GSCM practices. Hypothesis 1 is also slightly supported by the paths on external GSCM practices but with one negative path coefficient, that is, −0.163 ($p < 0.001$) between coercive pressures and CC. Such results show that institutional pressures have a strong relationship to internal GSCM practices but a weaker relationship to external GSCM practices among Chinese manufacturing enterprises. Interestingly, coercive pressure may discourage CC.

Hypothesis 2 has some significant support. GP is positively related to ECO and IEM practices with the path coefficients of 0.520 and 0.278 ($p < 0.001$), respectively. IR is also positively related to IEM with a path coefficient of 0.248 ($p < 0.001$). CC is only positively related to ECO with a path coefficient of 0.232 ($p < 0.001$). Such results indicate that internal GSCM practices are supportive of external GSCM practices.

Economic performance was found to be negatively related to one internal GSCM practice, ECO, with a significant negative path coefficient of −0.158 ($p < 0.001$). There is partial support for Hypothesis 3 as economic performance is positively related to one external GSCM practice, CC with a path coefficient of 0.123 ($p < 0.01$). Such results indicate that external GSCM practices, which can be enhanced by internal practices as verified in Hypothesis 2, are also associated with economic performance.

Hypothesis 4 receives some support. Environmental performance is positively related to one internal GSCM-IEM (P=0.336, $p < 0.001$), and one external GSCM practice—CC (P=0.162, $p < 0.01$). Further, economic performance is positively related to environmental performance with a path coefficient of 0.283 ($p < 0.001$).

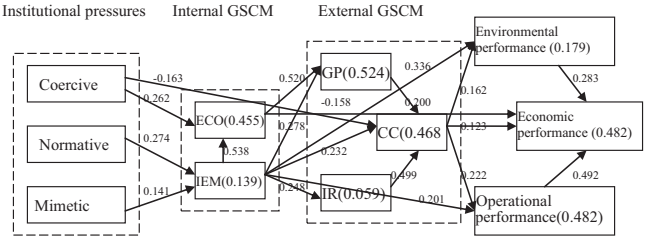

Fig. 2. Path results on the antecedents and performance outcomes of implementing GSCM.
Note: Results beside each endogenous variable in parentheses are adjusted R^2.

Similar to Hypothesis 4, Hypothesis 5 receives support due to a positive relationship of operational performance with IEM and customer cooperation's linkage with environmental concerns. There is also a positive relationship between operational performance and economic performance. Operational performance is positively related to IEM (P=0.201, $p < 0.001$) and CC (P=0.222, $p < 0.001$). Economic performance is also positively related to operational performance with the path coefficient of 0.492 ($p < 0.001$).

A summary of results on Hypotheses tests is shown in Table 3.

5. Discussions

For most manufacturers, especially for those in developing countries such as China, a major objective is to avoid economic loss (risk) due to penalties from any environmentally oriented malfeasance. Alternatively, proactive organizations tend to seek improvements in their economic performance through environmental management practices such as GSCM. Overall, the empirical results show the structural relationships between pressures/drivers, internal and external GSCM practices, environmental and operational performance, to economic performance exist, supporting development of a more proactive stance on environmentally oriented organizational practices.

Table 3
A summary of hypotheses tests.

Hypotheses	Brief description of hypotheses relationships	Results of hypotheses tests
H1	Pressures—internal GSCM practices	Positively supported
	Pressure—external GSCM practices	**Negatively slightly supported**
H2	Internal GSCM practices—external GSCM practices	Supported
H3	Internal GSCM practices—economic performance	**Not supported**
	External GSCM practices—Economic performance	Partially supported
H4	GSCM practices—environmental performance—economic performance	**Supported**
H5	GSCM practices—operational performance—economic performance	**Supported**

5.1. Pressures/drivers and GSCM practice

This study shows that normative, coercive, and mimetic pressures generally relate to Chinese manufacturers implementing internal GSCM including ECO and IEM, but not to their external GSCM practices. Such results may highlight weak pressure for greening and that more efforts are needed for external GSCM practices. Table 2 shows that pressures are not strong enough with all mean values less than 4.00 (4=somewhat important). External GSCM practices generally require more efforts due to the need for cooperating with suppliers and customers than those of internal GSCM practices. Similarly, companies in developed countries such as Japan only implemented internal GSCM practices before the enactment of GSCM related regulations such as the extended producer responsibility law (Zhu et al., 2010). Chinese manufacturers are increasingly confronted with normative, coercive, and mimetic pressures to implement GSCM practices, even though these pressures adoption progress still lags behind (Zhu et al., 2005, 2012b). As we observe, most Chinese manufacturers initiate their internal GSCM practices earlier than other practices mainly due to greater need for control over internal matters.

The statistic findings indicate that coercive pressure relates to ECO. This observation is not surprising since, no matter where in the product life cycle the product lies, most of the environmental impact of this product and its processes are 'locked' into the product at the design stage when materials are selected and product performance is largely determined (Lewis and Harvey, 2001). ECO is a helpful, emerging tool to improve enterprises' environmental performance by addressing product functionality while simultaneously minimizing life cycle environmental damages. Energy saving and emission reduction has become a national strategy in China to achieve sustainable industrial development. To reduce energy consumption, local governments have organized energy audits for those manufacturers consuming excessive energy, and forced these manufacturers to re-design their technologies and products (Zhu and Geng, 2013). The success of ECO requires internal cross-functional cooperation for the entire company as well as external cooperation with other partners in the supply chain as a whole (Lewis and Harvey, 2001). Although environmental performance is not found to have a direct relationship with ECO, the finding (see Fig. 2) shows that ECO may affect environmental performance through GP and CC. These results imply that Chinese designers and product developers are playing an important role in GSCM, where internal cross-functional cooperation and supply chain relationships should also be encouraged.

The results show further that both normative and, to a lesser extent, mimetic pressures relate to IEM. External environmental management usually requires greater organizational efforts for implementation since manufacturers need to cooperate and develop plans and relationships with their suppliers and customers. Due to these additional requirements, IEM is at a more mature adoption level for GSCM practices among Chinese manufacturers. Such results are consistent with findings of previous studies. To ensure environmental excellence, top management must be fully committed and supportive of corporate environmental values (Bansal, 2003). Support from mid-level managers is also key to successful implementation of environmental management practices (Carter et al., 1998). Positive relationships between middle managers' perceptions of corporate environmental proactivity and environmental management were also found (Bowen et al., 2001). Communication between business managers and environmental professionals is also important in developing a successful business and environment relationship (Apsan, 2000).

Only one external GSCM practice, CC, has a direct relationship with the institutional pressures for environmental performance improvement. It is somewhat surprising but consistent with a previous study (Miemczyk, 2008) that coercive pressure has a direct significant and negative relationship to CC. One possible reason is that organizations facing increasingly strict regulations and for liability reasons, would tend to take full responsibility in managing this issue rather than relying on customer collaboration. Another possible reason is that organizations perceive these regulatory (coercive) pressures as inwardly targeted activities (e.g., direct emissions policies) that are not directly influenced by customers. Thus, their internal focus, due to these regulations, may take away time and resources necessary for external customer collaboration.

Another potential issue might be that even if some of these regulatory pressures are 'externally oriented', they may be very novel to the organization. In this situation, organizations may focus on internal activities first to understand the regulatory policy, delaying external activities such as customer collaboration to further address internal issues and build internal capabilities initially. For example, an 'externally' oriented regulation Chinese WEEE was passed on August 20, 2008, publicized on February 25, and enacted on January 1, 2011. From August 2008, WEEE related regulations have been stricter, but Chinese manufacturers have not been more active to cooperate with customers such as taking back used products due to existing informal recyclers and lack of a used products collection system due to their lack of understanding of the implications of this regulation (Chi et al., 2011; Ju et al., 2010).

To promote customer cooperation for addressing regulatory environmental concerns among Chinese manufacturers, the Chinese government may wish to establish supporting systems explaining how external collaborations may actually aid them in meeting regulations.

5.2. GSCM and economic performance

There are two ways that GSCM can lead to economic performance. A first relationship would be one that is directly related to GSCM practice, while the other relationship is through environmental and operational performance.

Only two GSCM practices are directly related to economic performance, one internal GSCM practice of ECO, and one external GSCM practice of CC. However, as at least one other study has shown, proactive environmental management can enhance economic performance but sometimes compromise other performance measures (Gonzalez-Benito and Gonzalez-Benito, 2005).

The empirical results show that ECO has a significant negative relationship with economic performance. ECO requires capital investment while at the same time can result in cost reductions such as decreases in expenses for energy consumption, and lessened fees for waste treatment and discharge. The reason for this negative relationship between ECO and economic performance may be that Chinese manufacturers are still at the early stage of their ECO practice (Zhu et al., 2005; Zhu and Liu, 2010). The mean value of ECO practice is only at 3.04, between no implementation and full implementation. This early stage may require significant start-up investment, while direct cost savings have yet to be achieved. Alternatively the savings in cost may be difficult to trace back to such an early design practice. Though ECO is not found to be directly associated with improved economic performance, it is still necessary to encourage its implementation by manufacturers due to the critical role of ECO in easing environmental burdens over the life cycle of a product. The short term benefits may not be evident, but long term benefits can be accrued.

The empirical results show that customer cooperation is associated with economic performance. Further analysis shows that IEM, GP, and IR all have direct significant positive relationships with customer cooperation. Two possible structural relationships exist for economic performance improvement through customer cooperation. The first one is that either normative or competitive drivers stimulate IEM, and then GP and IR are implemented which bring customer cooperation as the next step. The other one is that coercive pressure prompts manufacturers to implement ECO, and then GP is triggered due to ECO with subsequent customer cooperation.

Through examination, it is suggested that economic performance is clearly not being reaped in short term profitability and sales performance (Bowen et al., 2001). As a result, economic performance may be achieved in the longer term after environmental and operational performance improvements have occurred.

There is consensus within the literature that IEM is key to improving enterprises' performance (Carter et al., 1998). Other than CC, only IEM has a direct significant relationship with both environmental and operational performance. Further analysis shows that both environmental and operational performance has significant direct relationships with economic performance. Thus, a potential indirect path to improve economic performance for Chinese manufacturers can be originated through normative or competitive pressure drivers of international environmental management, which brings both environmental and operational performance improvement. With increasing environmental image and operational performance, Chinese manufacturers can hopefully gain economic performance improvement in the longer term.

6. Conclusions and future research

6.1. Conclusions

Generally, structural relationships exist among GSCM adoption pressures, practices, and performance. The institutional pressures for environmental protection have driven Chinese manufacturers to implement internal GSCM practices, followed by external GSCM practices. The empirical results suggest that GSCM practice does not significantly affect economic performance, but improved environmental and operational performance improvement can bring economic performance in the longer term. Thus, we recommend longitudinal studies to determine if the long-run economic performance is enhanced by some of these emerging GSCM practices.

Coercive pressure relates to manufacturers' implementation of ECO practices. Though ECO may require increased investment and lead to a significant negative relationship with economic performance at the current stage, it can be a valuable resource for manufacturers to gain strategic economic benefits. Further, ECO brings cooperation with suppliers which can indirectly improve economic performance through environmental and operational performance.

Both normative and competitive pressures relate to IEM practices. Due to the requirements from customers or pressures from competitors, Chinese manufacturers have initiated the implementation of IEM to a greater extent than other GSCM practices. Such practice has not directly brought economic performance improvement but it has benefited both environmental and operational performance which then helps to gain economic benefits by enlarging market share or saving costs. In addition, IEM is necessary which is related to three external GSCM practices. One of the external GSCM practices, CC can, either directly or indirectly through environmental and operational performance, bring economic benefits.

This study provides practical implications for both manufacturers and policy makers. It also opens additional research avenues for GSCM, corporate environmental management, and organizational theory, in general. For managerial implications, manufacturers are given some insights into how they can gain improved economic performance from implementing GSCM. For example, they need to understand the structural relationships between the internal and external aspects of implementing GSCM and ensure that coordination of their respective activities to arrive at better environmental and operational performance for economic gains to be achieved. Public policy makers and regulators can further understand how to motivate manufacturers to implement GSCM. In particular, mimetic and normative forces are influential antecedents affecting the implementation of GSCM in manufacturing. It is useful that government and related bodies promote GSCM by creating an awareness of the benefits and sharing successful experience. Such promotion can help to alleviate the doubts of the followers about adopting GSCM and reduce their risks association with the environmental innovation adoption.

6.2. Limitations and future research directions

As with any research, limitations in the study exist, but these limitations also provide opportunities and directions for further research.

First, it is found that the general hypotheses do not necessarily provide insight into all the specific and nuanced relationships that warrant additional investigation. For example one relationship is that coercive pressures relate to ECO, with ECO having negative direct relationships with economic performance. Questions for this relationship do arise. Are regulations not strict enough or not strictly enforced? Will government support in the form of subsidies encourage environmental management? Will using eco-designed products help manufacturers to improve economic performance, and thus further promote GSCM practices?

Second, normative and competitive pressures are instrumental for nurturing IEM which relates to external GSCM results. With globalization, Chinese manufacturers have experienced pressures from their foreign customers and competitors but at the same time they have the opportunities to learn from foreign companies to better implement environmental management practices. The diffusion mechanism of environmental experiences

from leading companies in developed countries to companies in developing countries such as China should receive additional investigation and attention. It is also worthwhile to investigate the diffusion covering the broader manufacturing supply chain in related sector as shipping and transport logistics (Wong et al., 2012a).

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APPENDIX. QUESTIONNAIRE ITEMS

1. **GSCM practices**

(1) Eco-design

- Design of products for reduced consumption of material/energy
- Design of products for reuse, recycle, recovery of material, component parts
- Design of products to avoid or reduce use of hazardous of products
- Design of processes for minimization of waste

(2) Internal environmental management

- Commitment of GSCM from senior managers
- Support for GSCM from mid-level managers
- Cross-functional cooperation for environmental improvements
- Special training for workers on environmental issues
- ISO 14000 certification
- Eco-labeling of products
- Existence of Pollution Prevention Programs
- The internal performance evaluation system incorporates environmental factors
- Generate environmental reports for internal evaluation

(3) Green purchasing

- Providing design specification to suppliers that include environmental requirements for purchased items
- Cooperation with suppliers for environmental objectives
- Environmental audit for suppliers' inner management
- Suppliers' ISO 14000 certification
- Second-tier supplier environmentally friendly practice evaluation
- Adopting just-in-time logistics system
- Suppliers are selected using environmental criteria
- Cooperating with supplier to reduce packaging
- Require suppliers to use environmental packaging (degradable and non-hazardous)

(4) Investment recovery

- Investment recovery (sale) of excess inventories/materials
- Sale of scrap and used materials
- Sale of excess capital equipment
- Collecting and recycling end-of-life products and materials
- Establishing a recycling system for used and defective products

(5) Cooperation with customers including environmental requirements

- Cooperation with customer for eco-design
- Cooperation with customers for cleaner production
- Cooperation with customers for green packaging
- Cooperation with customers for using less energy during product transportation
- Adopting third-party-logistics
- Cooperation with customers for product take back
- Cooperation with customers for reverse logistics relationships

2. **Institutional pressures**

(1) Coercive

- National environmental regulations (such as waste emission, cleaner production etc.)
- National resource saving and conservation regulations
- Regional environmental regulations (such as waste emissions, cleaner production etc.)
- Regional resource saving and conservation regulations
- Export countries' environmental regulations
- Products potentially conflict with laws (such as circular economy, EPR, EHS etc.)

(2) Normative

- Export
- Sales to foreign customers
- Environmental requirements from domestic customers
- Environmental awareness of Chinese consumers' (customers')
- Establishing company's green image
- The news media follows our industry closely
- Public environmental awareness (community, NGO etc.)

(3) Mimetic

- Green strategy of same product producers
- Green strategy of substitute product producers
- Industrial professional group activities

3. **Performance**

(1) Environmental performance

- Reduction of air emission
- Reduction of waste water
- Reduction of solid wastes
- Decrease of consumption for hazardous/harmful/toxic materials
- Decrease of frequency for environmental accidents
- Improve a company's environmental situation

(2) Operational performance

- Increase amount of goods delivered on time
- Decrease inventory levels

- Decrease scrap rate
- Promote products' quality
- Increased product line
- Improved capacity utilization

(3) Economic (cost avoidance/operational) performance

- Decrease of cost for materials purchasing
- Decrease of cost for energy consumption
- Decrease of fee for waste treatment
- Decrease of fee for waste discharge
- Decrease of fine for environmental accidents

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