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Abstract

Purpose – The purpose of this paper is to examine a multitude of motivators that facilitate the implementation of green practices (GP) in the context of Chinese manufacturing industry. Also, this study aims to explore the influence of GP on the environmental performance, operational performance, and financial performance of manufacturing firms.

Design/methodology/approach – This paper developed a conceptual model to investigate the stakeholder drivers and commensurate performance outcomes of GP. Statistical analysis was based on the data collected from 124 manufacturing firms across the Greater China. Finally, the hypotheses were empirically tested by partial least squares approach.

Findings – Of the ten proposed hypotheses, seven are considered valid. The statistic results reveal that pressures originate from employees, senior managers, and customers exert significant positive influence on firm's decision to adopt GP, while the drivers generated from government and competitors is non-significant. More specifically, this study indicates that environmental performance partially mediates the relationship between GP and operational/financial performance.

Originality/value – The originality of this research is that it proposes a novel conceptual model, ascertains the primary drivers in promoting GP in Chinese manufacturing industry. This research provides policy insights for professional organizations, regulators, and legislators to further promote GP.

Keywords Environmental performance, Financial performance, Stakeholder theory, Operational performance, Green practices, Chinese manufacturing industry

Paper type Research paper

1. Introduction

In recent years, increasing importance has been attached to environmental issues, it is expected that manufacturing firms from various countries and industries to implement initiatives to be green. Thus, green practices (GP) have gained in popularity for manufacturers in the hope of mitigating their environmental damages while achieving performance gains (Cronin *et al.*, 2011; Qi *et al.*, 2010). Previous studies posit that a variety of stakeholder pressures can act as motivating forces that push firms to pursue GP (Eltayeb *et al.*, 2004; Cai and Zhou, 2014). For example, environmental regulations have always been identified as a main driver due to their mandatory properties (Darnall *et al.*, 2009). Customers' increasing environmental awareness further pushes firms to alleviate their negative environmental impacts (Gonzalez-Benito and Gonzalez-Benito, 2006a; Kassinis and Vafeas, 2006). Additionally, pressures originate from successful

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competitors promote firms to develop products and services that are respectful to the environment (Cai and Zhou, 2014). Apart from the above mentioned external stakeholders, internal stakeholders such as employees and senior managers, also play significant roles in promoting GP.

While identification of the drivers of GP is a popular topic in the literature, many questions remain unanswered. First, most of the studies in this field are focusing on developed economies; their findings may not be applicable to the emerging countries such as China. Besides, it is unclear whether these stakeholder drivers solely or collectively motivated the implementation of GP. Therefore, the first objective of this paper is to identify the critical factors of GP adoption in China, with stakeholder theory as its underlying base.

Another purpose of this study is to empirically explore the impacts of GP on the firm's financial, operational, and environmental performance. Regarding the effect of environmental practices on firm performance, there exist opposing theoretical arguments (Mohindra, 2008). Porter and Linde (1995a, b) propose that environmental management behaviors can generate superior performance improvements. However, Walley and Whitehead (1994) argue that green activities are not always compatible with the profit-seeking behavior of the firm, which means the manufacturing enterprise must bears extra environmental investments and costs. Given that, this study tries to present a clearer picture of the relationship between GP and firm performance in the context of Chinese manufacturing industry.

There is a great deal of studies focusing on firm performance, including both anecdotal cases and large-scale researches. However, in-depth investigations of the relationship within its three dimensions are still lacking. To deepen our understanding of GP and consequent performance outcomes, we further identify if GP can contribute to financial and operational performance indirectly through improved environmental performance. To elaborate, this study attempts to address the following research questions:

RQ1. What the effects of different stakeholder motivators on firms' behavior of GP adoption?

RQ2. Would GP really bring firm performance improvement?

RQ3. Would the relationship between GP and financial/operational performance be mediated by environmental performance?

The remainder of this paper is organized as follows. The theoretical framework and research hypotheses are developed in Section 2. The research methodology and data analyses are presented in Section 3, followed by the results and discussions in Section 4. Concluding remarks and suggestions for future research are presented in Section 5.

2. Theoretical framework and research hypotheses

To explore mechanisms that potentially explain the drivers and performance outcomes of GP, a theoretical framework that simultaneously integrates the constructs of stakeholders, GP, and firm performance is proposed. As shown in Figure 1, this model explores the internal and external driving forces that trigger GP on the basis of stakeholder theory. Subsequently, we develop hypotheses to investigate the effects of GP on firms' environmental, operational, and financial performance. Finally, we determine the mediating role of environmental performance between GP and operational and financial performance.

2.1 Stakeholder theory and GP

Stakeholders are defined as any individual or group who can affect the decisions, practices, or goals of the organization (Henriques and Sadorsky, 1999). According to

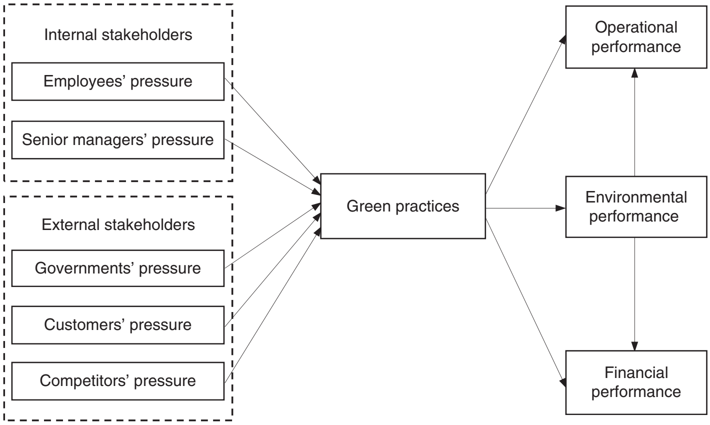

Figure 1. Conceptual model

organizational boundary, the stakeholders of a firm can be broadly classified into two types: internal and external stakeholders (Rasi *et al.*, 2014). Buysse and Verbeke (2003) argue that stakeholders can exert considerable and continuous pressures on firms to reduce negative impacts and enhance positive ones. According to previous literature, stakeholder theory (Hillman and Keim, 2001) is widely introduced as a theory to explain antecedents or contingencies for firms to adopt various environmental practices.

With regard to GP, the existing literature offer diverse definitions. Manaktola and Jauhari (2007) define GP as the commitment of various sound practices that minimize negative environmental impacts, such as saving energy, saving water, and reducing waste. Mohindra (2008) states that GP encompass three Rs: reduce, reuse, and recycle. GP mainly include: filter and control for emissions and discharges; systematic control of energy; recycling water; and use of ecological ingredients in the products. While opinions vary, the gist remains the same. In line with the above opinions, in this study, GP refer to practices that firms can employ to reduce the adverse environmental effects of their products and operations.

2.1.1 Internal stakeholders. Generally, internal stakeholders refer to employees and senior managers. In manufacturing firms, employees are perceived as one of the most important resources (Hall, 1992; Hanna *et al.*, 2000), especially for front-line operation and production workers, who are the closest to the sources of pollution and bear most of the waste and toxicants occurring along the manufacturing processes. Schaltegger and Synnestvedt (2002) have pointed out four types of pollution (i.e. air, noise, waste, and water) generated on production sites that exhibited serious negative impacts on workers. Nowadays, employees know more about the necessity of cleaner production and prefer to work for a firm with greener environment. When employees realize that their health and safety have been compromised by the poor working environment and toxic materials, they may refuse to work. Consequently, pressures from employees may underlie firms' motivation to implement GP.

Senior manager's pressure is another vital internal force driving firms to pursue GP. The opinions of senior managers have close association with business strategies. One of the main obligations of the majority of senior managers is to ensure the maximization of firm's profit through their visions, leaderships, and strategic intents (Hamel and Prahalad, 1989). Senior manager has the responsibility to assure the investments of banks and shareholders will not be at risk due to the loss of credibility of enterprises regarded by the public opinion as environmentally dangerous. Failing to create a good environmental image can provoke the public discontent and arouse protests. The rising expectation of environmental protection promotes senior managers to place more emphasis on GP. Their positive attitude toward environmental issues represents an important factor affecting the way firms make decisions and do business (Carter *et al.*, 1998; Clark *et al.*, 2014). More importantly, the desire of senior managers to implement GP is especially evident when green performance is related with their own career prospects and post promotion. Based on the above understandings, the following hypotheses can be introduced:

H1a. Employees' pressure positively affect firm's adoption of GP.

H1b. Senior managers' pressure positively affect firm's adoption of GP.

2.1.2 External stakeholders. The implementation of GP depends not only on internal drivers, but also on many external drivers. Drawn from the prior literature, three key elements of external stakeholders are identified, namely, governments, customers, and competitors (Sarkis *et al.*, 2010; Laosirihongthong *et al.*, 2013).

With increasing resources scarcity and environmental disruption, both central and local governments have established stricter environmental regulations to promote GP. Manufacturing firms, as the main polluters and resource consumers, have experienced tremendous pressures arisen from government regulations. Buysse and Verbeke (2003) believe that these command-and-control measures are effective to impose environmental practices. Likewise, Yalabik and Fairchild (2011) view government regulations as an important reason why manufacturing firms seek to implement GP, they suggest that firms are coerced into adopting GP or activities to avoid punishment and sanctions.

In addition, previous studies have observed that customers also play a significant role in pressurizing firms to adopt GP. Due to the burgeoning environmental crisis and growing environmental awareness, customers are now putting more emphasis on environmental issues (Follows and Jobber, 2000). In order to green their own supply chain, corporate customers may require upstream manufacturers to provide green products or services (Manaktola and Jauhari, 2007). Jabbour *et al.* (2015) posit that many firms are turning to be green due to their customers' green consumerism. An estimated 75 percent of customers made their purchasing decisions with the enterprises' environmental image in mind and 80 percent of customers are willing to pay more for green products (Carter and Jennings, 2002).

Stakeholder theory claims that a firm should take the actions of their competitors into consideration when they determine their organizational practices. With the increasing market competition, GP have been a principal differentiation tool to enhance efficiency, green reputation, and product quality to gain more competitive advantage (Bernauer *et al.*, 2007; Hwang and Min, 2015). Manaktola and Jauhari (2007) argue that organizations adopting GP are able to position themselves distinctively in the competitive market place and get potential competitive advantage over competitors. Lewis and Harvey (2001) also emphasize that firms should pay more attention to the changes in the rival firms' environmental strategies in green competition. Globalization has opened the gate for Chinese manufacturers to learn from their foreign competitors, especially for those operating in China (Christmann and Taylor, 2001). Thus, the influence of competitors on the pursuit of GP may be particularly salient in the manufacturing industry of China.

Therefore, the above discussion leads to the following hypotheses:

H2a. Governments' pressure positively affect firm's adoption of GP.

H2b. Customers' pressure positively affect firm's adoption of GP.

H2c. Competitors' pressure positively affect firm's adoption of GP.

2.2 GP and firm performance

Previous studies acknowledge various advantages to GP, such as business sustainability, cost savings, environment benefits, and better firm image. In combination, these advantages ultimately mean that GP can lead to better firm performance. Recently, the subject of firm performance is attracting more and more interest from both the managerial and academic aspects (Koufteros *et al.*, 2007; Panayides and Lun, 2009).

Firm performance can be divided into three dimensions: environmental, operational, and financial aspects. Environmental performance mainly relates to the ability of manufacturing plants to decrease consumption of toxic and hazardous materials, air emissions, and solid wastes (Zhu, 2007; Laosirihongthong *et al.*, 2013). Many studies indicate that the implementation of GP could reduce energy consumption, pollution generation, and hazardous materials usage, thus improve environmental performance (Zhu *et al.*, 2005).

Financial performance has been viewed as a top management priority for manufacturers. Much debate has occurred in the existing literature as to whether environmental management behaviors result in improved financial performance. There are two streams of the mechanism for explaining the linkage between GP and financial performance (King and Lenox, 2000; Moneva and Ortas, 2010; Lin and Ho, 2011). The traditional economic view suggests that GP transfers the cost previously borne by environment and society back to the firm, so there is a negative effect between GP and financial performance. Nevertheless, some researchers have argued that environmental management practices actually lead to higher profit margins through greener products and processes (Klassen and McLaughlin, 1996; Vachon and Klassen, 2006; Lee *et al.*, 2012). At the same time, GP can improve corporate reputation and customer satisfaction which can in turn bring better financial performance.

Apart from the aforementioned environmental and financial performance improvement, a third dimension of performance, i.e. operational performance, is hardly mentioned in extant literature. Operational performance mainly relates to the manufacturing plant's capabilities to optimize production process, improve product quality, and deliver products to customers in time (Chien and Shih, 2007; Zhu *et al.*, 2013). GP include many activities related to process improvement, such as recycling by-products, redesigning production processes, and innovating green manufacturing processes (Boiral, 2007). With that, incorporating green concept into manufacturing process can facilitate operation efficiency and enhance firm's ability to provide prompt delivery of products.

Thus, the following hypotheses are put forward:

H3a. GP positively affect environmental performance.

H3b. GP positively affect operational performance.

H3c. GP positively affect finance performance.

2.3 The mediating role of environmental performance

Positive relationship between GP and environmental performance is increasingly evidenced in the literature (Claver *et al.*, 2007; Jacobs *et al.*, 2010). However, the question whether GP can indirectly contribute to operational and financial performance through enhanced environmental performance seems to be untapped.

Successful implementation of GP is assumed to result in environmental performance enhancement (Albino *et al.*, 2009; Lee *et al.*, 2012). The available empirical evidence reveals that the most common direct environmental outcomes of GP are waste reduction and pollution prevention. And it seems that that producing environmental-friendly products will make final products to be less costly. More importantly, these green activities in turn lead to operational benefits such as on-time delivery, improvement of product quality and capacity utilization, decrease in inventory levels, and expansion of product line.

Several researches suggest that environmental performance will lead to higher financial performance (Hong *et al.*, 2009; Lee *et al.*, 2012). First, by offering differentiated products with green attribute can help firms to establish an environment responsible reputation, thus substantially enlarge their market share and achieve higher marginal profit. On the other side, environmental performance improvement can reduce costs associated with materials purchasing, waste discharge, energy consumption, and fines for environmental accidents.

Hence, the last two hypotheses are put forward:

H4a. GP indirectly affect operational performance in a positive manner through improved environmental performance.

H4b. GP indirectly affect financial performance in a positive manner through improved environmental performance.

2.4 Control variables

To avoid omitted variable bias in this study, we choose four control variables based on a systemic review of related literature. Considering the differences among organizations, firms with a longer history and larger scale may have more resources to launch environment management activities. Hence, company age and company size are selected as control variables in this study (González-Benito and González-Benito, 2005, 2006b). It needs to be mention that company size is measured by number of employees and sales volume, respectively. Consistent with similar researches, the number of employees and annual sales are transformed by taking the natural logarithm to alleviate univariate non-normalities and account for non-linear effects (Swamidass and Kotha, 1998; Vachon and Klassen, 2006). Furthermore, we include environmental investments as another control variable. It is an indicator to measure the willingness of the organization to invest in advanced green equipments and technologies. We measure environmental investment by asking respondents to indicate environment-related costs of past year.

3. Research methodology and data analysis

3.1 Sampling and data collection

To test the above hypotheses, we carried out a survey in Greater China on a database of manufacturing firms from various industries. Given that China is a country with economic development level varying across regions (Zhao *et al.*, 2008; Huo *et al.*, 2013, 2015), we strategically selected five cities taking geographic and economic diversity into consideration, namely, Tianjin, Chongqing, Shanghai, Guangzhou, and Hong Kong. Tianjin is a manufacturing center in Bohai Sea Economic area, representing the average stage of economic reform and marketization. Chongqing is a traditional industrial city in the southwest, indicating a relatively early stage of economic development and market formation. Shanghai and Guangzhou located in Yangtze River Delta and Pearl River Delta, respectively, which have China's highest GDP per capita. Hong Kong was chosen as being different from Mainland China, and exhibits a well-established business structure. Our target firms all come from high-pollution and high-energy consuming industrial sectors. Table I displays the profiles of respondent companies.

3.2 Survey questionnaire and measures

A survey facilitates the measurement of conceptual model by real-world data. In order to design a reliable and valid survey instrument, we undertook an intensive investigation of the extant literature to identify suitable measures for stakeholder pressures, GP, and firm performance (Rossiter, 2002). Whenever possible, we adapted the constructs that have been validated in previous studies. When the constructs have not been recognized in the literature, we developed new measurement items based on our own understanding and observations during firm visits and interviews with practitioners. In all these questions, a five-point Likert scale was used with "1" for

Characteristics of firms	Frequency	%
Firm age (year)		
< 5	6	4.84
5-9	25	20.16
10-19	57	45.97
20-49	24	19.35
Over 50	12	9.68
No. of employees		
< 100	14	11.29
100-199	26	20.97
200-499	23	18.55
500-999	30	24.19
1,000-4,999	24	19.35
Over 5,000	7	5.65
Sales (million RMB)		
< 5	41	33.07
5-9	2	1.61
10-19	9	7.26
20-49	8	6.45
50-99	13	10.48
Over 100	51	41.13
Environmental investment (sales %)		
< 0.5	29	23.39
0.5-1	61	49.19
1-4	23	18.55
Over 5	11	8.87

Note: $n = 124$

Table I. Attributes summary of the sampling firms "not at all" and "5" for "extensively". In addition, the questionnaire also included the demographic profile of the firm such as industry, location, and size.

The English version of the survey questionnaire was first suggested and then translated into Chinese. Then the Chinese version was translated back to avoid any potential cultural bias. We checked the back-translated English version against the original English version to ensure that the translation is accurate, and some questions were reworded to reflect the original meaning in English. The Chinese version was used in the survey. The questionnaire was pilot tested by employing a sample of ten randomly selected firms. After receiving their completed questionnaires, we visited these ten sampling firms and discussed the questions with them. According to their feedback, some revision and refinement of the questionnaire was made so that it is more understandable and accurate. The list of research variables and their respective measurement items are provided in Table AI.

Subsequently, questionnaires were sent out to the respondents who agreed to participate in this study. In order to obtain a higher response rate, we gave a call to each target firm in advance to introduce the objectives of our research and to identify a main informant. We promised the participants a free report that indicated its performance relative to other plants in the same industry as a participation incentive. Self-addressed and stamped envelopes were sent out together with the survey questionnaire to facilitate the returning of the completed surveys. Follow-up calls were also made to improve the response rate (Frohlich, 2002). Out of 300 firms, a total of 171 survey questionnaires were received, and 124 surveys were at least 90 percent complete, yielding a usable response rate of 41.33 percent. Referring to several similar studies (e.g. Hajmohammad *et al.*, 2013; Jabbour *et al.*, 2015), we concluded that the response rate is considered satisfactory.

The possible non-response bias was measured by *t*-test method (Armstrong and Overton, 1977). No significant differences were found for all the items and factors, indicating that non-response bias is not a problem in this research. In addition, the data derived from single informants can lead to potential common method bias, which may artificially inflate observed relationships between variables. Harman's single factor test was employed to evaluate common method bias (Harman, 1967). The results ascertained that common method variance do not seem to be problematic in our study.

3.3 Data analysis

The model parameters were estimated by consistent partial least squares (PLS) (Dijkstra and Henseler, 2015a, b; Henseler *et al.*, 2016). This allowed for the assessment of the structural as well as the component measurement simultaneously. Path modeling with PLS does not require multivariate normal data, is more suitable for smaller samples, and places relatively lower requirements on the measurement levels (Fornell and Larcker, 1981; Ringle *et al.*, 2012; Götz *et al.*, 2010; Henseler *et al.*, 2014).

3.3.1 Constructs assessment. Before testing the hypotheses from the research model, an assessment of the constructs' psychometric properties (reliability, convergent validity, and discriminant validity) was performed.

As presented in Table II, the results of reliability test showed that all the scales were reliable, with Dijkstra-Henseler's ρ_A ranging from 0.789 to 0.927 (Henseler *et al.*, 2016), Cronbach's α values ranging from 0.750 to 0.925, and composite reliability ranging from 0.753 to 0.925 (Nunally, 1978). Content validity was established through extensive literature review, iterative construct review by researchers, and feedback from executives.

Construct	Item code	Dijkstra-Henseler's ρ_A	Cronbach's α	CR	Standardized factor loading	AVE
Employees' pressure	EMP1	0.901	0.896	0.897	0.861	0.685
	EMP2				0.861	
	EMP3				0.802	
	EMP4				0.784	
Senior managers' pressure	MAN1	0.883	0.882	0.879	0.794	0.647
	MAN2				0.697	
	MAN3				0.812	
	MAN4				0.901	
Governments' pressure	GOV1	0.843	0.829	0.831	0.645	0.555
	GOV2				0.779	
	GOV3				0.659	
	GOV4				0.874	
Customers' pressure	CUS1	0.927	0.925	0.925	0.885	0.754
	CUS2				0.879	
	CUS3				0.881	
	CUS4				0.829	
Competitors' pressure	COM1	0.828	0.811	0.813	0.612	0.524
	COM2				0.684	
	COM3				0.778	
	COM4				0.805	
Green practices	GP1	0.921	0.902	0.906	0.537	0.620
	GP2				0.756	
	GP3				0.914	
	GP4				0.867	
	GP5				0.803	
	GP6				0.793	
Environmental performance	EP1	0.887	0.870	0.866	0.811	0.529
	EP2				0.845	
	EP3				0.822	
	EP4				0.503	
	EP5				0.525	
	EP6				0.772	
Operational performance	OP1	0.862	0.853	0.855	0.800	0.597
	OP2				0.859	
	OP3				0.696	
	OP4				0.725	
Financial performance	FP1	0.789	0.750	0.753	0.802	0.506
	FP2				0.673	
	FP3				0.650	

Notes: CR, composite reliability; AVE, average variance extracted

Table II. Construct measures assessment: reliability and validity

Every item displayed a standardized factor loading higher than 0.5, which indicates an adequate convergent validity (Fornell and Larcker, 1981; Anderson and Gerbing, 1988). Another indicator of convergent validity is average variance extracted (AVE), which ranged from 0.506 to 0.754 indicating that the items share at least half of their variance with the construct (on average) (Chin, 1998). Furthermore, two approaches were applied to evaluate the discriminate validity of the measurement model. First, the Fornell-Larcker criterion was employed to compare the square roots of AVE value of each construct with the correlations between the focal and other constructs. As shown in Table III, the square root of AVE value of each construct is greater than the correlation between that construct

Table III.
Discriminant validity: Fornell-Larcker criterion and heterotrait-monotrait ratio (HTMT)

	EMP	MAN	GOV	CUS	COM	GP	EP	OP	FP	FA	NE	FS	EI
EMP	*0.828*	0.636	0.666	0.723	0.584	0.707	0.446	0.571	0.347	0.052	0.213	0.248	0.038
MAN	0.639	*0.804*	0.734	0.731	0.379	0.752	0.443	0.435	0.256	0.143	0.160	0.091	0.110
GOV	0.659	0.730	*0.745*	0.733	0.272	0.711	0.391	0.396	0.315	0.166	0.228	0.115	0.128
CUS	0.723	0.735	0.734	*0.869*	0.356	0.773	0.460	0.500	0.272	0.024	0.184	0.124	0.091
COM	0.568	0.373	0.285	0.352	*0.724*	0.429	0.280	0.381	0.538	0.205	0.196	0.370	−0.065
GP	0.713	0.754	0.729	0.777	0.419	*0.788*	0.515	0.493	0.226	0.102	0.267	0.159	0.134
EP	0.459	0.460	0.415	0.472	0.272	0.513	*0.727*	0.658	0.404	0.230	0.261	0.197	−0.046
OP	0.573	0.439	0.396	0.497	0.382	0.495	0.652	*0.773*	0.179	0.008	0.195	0.109	−0.019
FP	0.324	0.251	0.290	0.264	0.526	0.215	0.394	0.168	*0.711*	0.016	0.196	0.177	0.028
FA	0.049	0.146	0.168	0.023	0.201	0.092	0.227	0.009	0.010	–	0.356	0.170	0.192
NE	0.216	0.166	0.225	0.184	0.183	0.245	0.264	0.197	0.199	0.358	–	0.513	0.143
FS	0.250	0.096	0.119	0.124	0.372	0.149	0.188	0.118	0.175	0.170	0.514	–	0.064
EI	0.039	0.102	0.122	0.084	−0.049	0.132	−0.047	−0.020	0.021	0.183	0.141	0.064	–

Notes: Numbers in italics on the diagonal indicate the square root of AVE; numbers in the upper triangle of the matrix indicate the HTMT and numbers in the lower triangle represent the Fornell-Larcker criterion

and the other constructs, suggesting acceptable discriminant validity (Fornell and Larcker, 1981; Anderson and Gerbing, 1988). Second, we adopted the heterotrait-monotrait ratio (HTMT) as another criterion and compared it to the predefined threshold (Henseler *et al.*, 2015, 2016). Table III showed that no HTMT value violate the 0.85 threshold (Kline, 2011), providing further evidence of discriminant validity.

3.3.2 The structural model estimation. The PLS structural model was assessed by examining the path coefficients and their statistical significance. Bootstrapping method (5,000 sub-samples) was used to test the significance level of path coefficients in this study (Hair *et al.*, 2011). Instead of just calculating the *t*-values, 95 percent bootstrap confidence intervals were conducted to provide additional information on the stability of a coefficient estimate (Efron and Tibshirani, 1986; Chin, 2010; Hair *et al.*, 2013a, b). Table IV summarized the path coefficients, *t*-values, significance levels, confidence intervals, and the explained construct variances.

Each dependent variable depending on one or more independent variables has a R^2 value, representing the percentage of explained variance by the independent latent variables. For example, in the full model, GP with a $R^2 = 0.776$ indicating that 77.6 percent of variance for this variable is explained by internal and external stakeholders variables, and it is the highest value in R^2. Similar interpretations can be applied to the other dependent variables. Besides, the goodness of fit of the model is tested with the help of ADANCO 2.0, a new variance-based SEM software (Henseler and Dijkstra, 2015). The values of standardized root mean square residual, the geodesic discrepancy (d_G) and the unweighted least squares discrepancy (d_{ULS}) are all less than 95 percent bootstrap quantile (H195) for both the saturated model and estimated model, show evidence of a good fit (Dijkstra and Henseler, 2015b; Henseler *et al.*, 2015, 2016; Hu and Bentler, 1999).

In order to test the possible mediating effect, the procedure proposed by Baron and Kenny (1986) was adopted in this study (Zhao *et al.*, 2010). First, an assessment of the path between GP and the mediating variable (environmental performance) is needed that path is positive and significant ($\beta = 0.529$; $p < 0.001$, Model 1). Then, we examined the path between environmental performance and operational performance ($\beta = 0.654$;

Table IV. PLS structural model results

	Model 1			Model 2			Model 3			Model 4		
	β	*t*-value	Confidence intervals	β	*t*-value	Confidence intervals	β	*t*-value	Confidence intervals	β	*t*-value	Confidence intervals
EMP → GP										0.130	1.970*	(0.001, 0.259)
MAN → GP										0.317	2.865**	(0.118, 0.516)
GOV → GP										0.058	1.247	(−0.101, 0.217)
CUS → GP										0.443	4.759***	(0.264, 0.622)
COM → GP										0.051	1.028	(−0.055, 0.157)
FA → GP	0.007	0.071	(−0.087, 0.101)				−0.003	0.162	(−0.102, 0.096)	−0.024	0.677	(−0.095, 0.047)
NE → GP	0.222	2.116*	(0.020, 0.424)				0.210	1.984*	(0.002, 0.418)	0.053	1.101	(−0.037, 0.143)
FS → GP	0.116	1.260	(−0.053, 0.285)				0.103	1.059	(−0.058, 0.264)	0.022	0.384	(−0.047, 0.091)
EI → GP	0.093	1.208	(−0.054, 0.240)				0.102	1.282	(−0.045, 0.249)	0.056	1.233	(−0.025, 0.137)
GP → EP	0.529	6.543***	(0.395, 0.663)							0.512	5.554***	(0.359, 0.665)
EP → OP				0.654	8.674***	(0.536, 0.772)				0.538	6.204***	(0.399, 0.677)
EP → FP				0.375	5.022***	(0.230, 0.520)				0.169	2.157*	(0.061, 0.278)
GP → OP							0.479	6.820***	(0.350, 0.608)	0.219	2.982**	(0.082, 0.356)
GP → FP							0.233	3.157**	(0.108, 0.358)	0.100	1.240	(−0.040, 0.239)
OP → FP										0.439	4.623***	(0.308, 0.570)
FA → EP	0.027	0.291	(−0.077, 0.131)	0.068	0.735	(−0.038, 0.174)				0.031	0.384	(−0.071, 0.133)
NE → EP	0.141	1.565	(−0.039, 0.321)	0.164	1.718	(−0.022, 0.350)				0.141	1.576	(−0.037, 0.319)
FS → EP	0.102	1.080	(−0.072, 0.276)	0.111	1.230	(−0.056, 0.278)				0.101	1.103	(−0.071, 0.273)
EI → EP	0.105	1.172	(−0.048, 0.258)	0.109	1.182	(−0.030, 0.248)				0.100	1.065	(−0.057, 0.257)
FA → OP				0.052	0.607	(−0.099, 0.203)	0.065	0.768	(−0.082, 0.212)	0.044	0.571	(−0.103, 0.191)
NE → OP				0.116	1.262	(−0.021, 0.253)	0.120	1.313	(−0.039, 0.279)	0.116	1.278	(−0.023, 0.255)

(*continued*)

Table IV.

	Model 1			Model 2			Model 3			Model 4		
	β	t-value	Confidence intervals	β	t-value	Confidence intervals	β	t-value	Confidence intervals	β	t-value	Confidence intervals
FS → OP				0.086	0.955	(−0.086, 0.258)	0.039	0.499	(−0.139, 0.217)	0.080	0.943	(−0.085, 0.245)
EI → OP				0.050	0.601	(−0.062, 0.162)	0.011	0.153	(−0.162, 0.184)	0.048	0.596	(−0.064, 0.160)
FA → FP				0.001	0.011	(−0.197, 0.199)	−0.006	0.076	(−0.214, 0.202)	−0.002	0.022	(−0.192, 0.188)
NE → FP				0.181	1.934	(−0.005, 0.367)	0.174	1.857	(−0.012, 0.360)	0.155	1.681	(−0.023, 0.333)
FS → FP				0.165	1.725	(−0.019, 0.349)	0.149	1.628	(−0.029, 0.327)	0.138	1.525	(−0.038, 0.314)
EI → FP				−0.003	0.024	(−0.223, 0.217)	−0.005	0.069	(−0.226, 0.216)	−0.002	0.016	(−0.218,0.214)
R^2												
GP	0.095						0.078			0.776		
EP	0.302			0.067						0.294		
OP				0.444			0.251			0.464		
FP				0.161			0.158			0.596		

Notes: FA, firm age; NE, no. of employees; FS, firm sales; EI, environmental investment; β, standardized path coefficient. $^*p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$ (two-tailed test)

$p < 0.001$, Model 2). The third step is to assess the direct path from GP to operational performance when there is no path between GP and operational performance in the model. Results showed that the path is also positive and significant ($\beta = 0.479$; $p < 0.001$, Model 3). As shown in Table IV, the path between GP and operational performance in the full model (with all the paths) is significant ($\beta = 0.219$; $p < 0.01$, Model 4). When combined with the result of the steps above, it can be concluded that environmental performance is partially mediating the impact of GP on operational performance. A Sobel test was conducted to confirm the mediating effect (Sobel, 1982). The Sobel test was significant ($z = 4.960$), corroborating the mediating effect and supporting the hypothesis *H4a*. Finally, we need to determine the strength of this mediation by using the variance accounted for (VAF), which determines the size of the indirect effect in relation to the total effect (i.e. direct effect + indirect effect) (Hair *et al.*, 2013b; Sarstedt *et al.*, 2014a, b). The results of this final analysis step yield a VAF value of 0.557, which suggests that 55.7 percent of GP' effect on operational performance is explained via the environmental performance mediator. This implies that the environmental performance partially mediates the relationship between GP and operational performance.

Similarly, repeated procedures were applied to investigate financial performance. The path between environmental performance and financial performance is positive and significant ($\beta = 0.375$; $p < 0.001$, Model 2). When the direct path between GP and financial performance was assessed without any path to environmental performance, it is also positive and significant ($\beta = 0.233$; $p < 0.01$, Model 3). However, the direct path was non-significant after introducing environmental performance in the model ($\beta = 0.100$; $p > 0.05$, Model 4). The Sobel test was significant ($z = 2.771$), indicating that there exists a mediating effect. In the final step, the VAF value is 0.464, consequently, 46.4 percent of GP' effect on financial performance is explained via the environmental performance mediator. Since the VAF value is larger than 20 percent and less than 80 percent, this situation can be characterized as partial mediation.

To get a comprehensive understanding of the theoretical model, the relationship between operational performance and financial performance was also discussed. The results revealed that operational performance has significant positive effects on financial performance ($\beta = 0.439$; $p < 0.001$, Model 4). Additionally, it is also noteworthy that in Models 1 and 3, only the number of employees shown a significant correlation with GP adoption ($\beta = 0.222$; $p < 0.05$, Model 1; $\beta = 0.210$; $p < 0.05$, Model 3). Whereas in Model 4, all the control variables were not verified to have a significant influence on GP adoption. Moreover, the potential effects from the control variables to the three performance variables were also modeled. The results showed that none of the control variables has a significant influence on performance outcomes.

To assess whether a predictor variable has a substantive influence on the dependent variable, Cohen's (1988) f^2 was applied. The independent construct with a higher f^2 will has a greater impact and value of 0.02, 0.15, and 0.35, respectively, can be regarded as small, medium, or large. The results are presented in Table V and three f^2 values were considered as small. However, Chin *et al.* (2003) stressed that even the minutest value of f^2 should be considered as it can stimulate the endogenous variable in its certain ways.

In order to estimate the predictive performance of our structural model, we performed a blindfolding procedure (omission distance of 7) (Hair *et al.*, 2011, 2013a, b). This procedure is a sample reuse technique that omits each *d*th data point in the

Independent variable	f^2	Rating
Dependent variable GP		
EMP	0.034	Small
MAN	0.165	Middle
GOV	nc	
CUS	0.255	Middle
COM	nc	
Q^2	0.446	
Dependent variable EP		
GP	0.353	Large
Q^2	0.127	
Dependent variable OP		
EP	0.403	Large
GP	0.068	Small
Q^2	0.251	
Dependent variable FP		
EP	0.050	Small
OP	0.289	Middle
GP	nc	
Q^2	0.188	

Table V. Results of f^2 and Q^2 values

endogenous construct's indicators and assesses the parameters with the remaining data points (Chin, 1998; Tenenhaus *et al.*, 2005; Henseler *et al.*, 2009; Hair *et al.*, 2013a, b). By repeating this procedure for several times, multiple samples are obtained, where each sample omits different data points. Then, the results from the different samples are used to acquire cross-validated communality and redundancy statistics for the constructs that are used to calculate Stone-Geisser Q^2 values. Table V indicates that the hypothesized model has a good prediction, since all corresponding Stone-Geisser Q^2 values are positive.

4. Results and discussions

This study presents empirical results for a conceptual framework that ascertains the primary drivers in promoting GP and explores the influence of said practices on the financial, operational, and environmental performance of firms. Moreover, we check the mediating role of environmental performance.

Of the ten proposed hypotheses, seven are considered valid. A summary of the conclusions according to the initial hypotheses can be observed in Table VI. The primary results of the study are as follows:

- pressures from employees, senior managers, and customers have significant positive impact on GP adoption, while the hypotheses regarding governments and competitors are not validated;
- GP exert positive influence on environmental performance and operational performance, while the hypothesis regarding financial performance is not supported; and
- environmental performance partially mediates the relationship between GP and operational/financial performance.

Hypotheses	IV	DV	MV	Decision
H1a	Employees' pressure	Green practices		Accepted
H1b	Senior managers' pressure	Green practices		Accepted
H2a	Governments' pressure	Green practices		Rejected
H2b	Customers' pressure	Green practices		Accepted
H2c	Competitors' pressure	Green practices		Rejected
H3a	Green practices	Environmental performance		Accepted
H3b	Green practices	Operational performance		Accepted
H3c	Green practices	Financial performance		Rejected
H4a	Green practices	Operational performance	Environmental performance	Accepted
H4b	Green practices	Financial performance	Environmental performance	Accepted

Notes: IV, the independent variable; DV, the dependent variable; MV, the mediating variable

Table VI. Conclusions summary of the hypotheses

4.1 Stakeholder drivers and GP

The empirical results show that the firm's decision to implement GP is influenced by a combination of stakeholder factors. As shown in Table IV, drivers arising from customers were the most influential. This showed that customers with a green purchasing initiative will pressure their upstream manufacturers to alleviate environmental burdens and provide green products. Especially for those manufacturers operated in China, a majority of their customers are from oversea markets. These customers possess a higher environmental awareness and green requirements. If Chinese firms do not cater to customer's green consumption by implementing GP, their products may encounter with trade barriers. Besides, from the perspective of green supply chain, customers are willing to provide implicit and explicit assistance to help focal firms to implement GP.

Interestingly, the obtained results demonstrated that Chinese manufacturing firms place a high consideration on pressures generated from employees. This finding is consistent with the real life of Chinese manufacturing industry nowadays. Labor shortage is getting more and more prominent; employees pay more attention to their working environment. Faced with continuous pressures from front-line employees, the adoption of GP indicates a positive response to their demand. It is expected that employees would be more satisfied when unsafe toxic materials are removed from the production process. Hence, the implementation of GP in some firms could be a bottom-up process. Another key factor that triggers firms to adopt GP is pressures form senior manager. Such results are consistent with findings of previous studies. This can be attributed to the managers who are responsible for the firm strategy have a clear understanding of the importance of environmental issues. To ensure environmental excellence, they must be fully committed and supportive to GP.

Unexpectedly, the hypothesis that government pressure has positive influence on GP is not statistically sufficient, which is contrary with some prior studies (Murphy and Gouldson, 2000; Sarkis *et al.*, 2010). One possible explanation could be that Chinese manufacturing firms are operating in an environment of low-environmental legislation. In developed countries, regulatory pressure is effective in enforcing firms to adopt environmental practices. The situation in China is more complicated. There exists extensive governmental rent-seeking activities and firm's illegal environmental behavior would be immune from punishment, thus substantially damage the government authority and cause regulation ineffective enforcement. Moreover, the economic incentive instrument is not well established and the implementation of incentive policies remains weak, thus did not provide enough temptation to attract firms to adopt GP. Against this background, government pressure does not constitute the true motivator in the current study.

The construct of competitor pressure is not perceived as a main criterion by manufacturers in deciding whether to adopt GP or not. It is somewhat surprising but consistent with some previous studies that environmental concerns exhibit a relatively lower weight percentage in overall competitive goal. Although being green has become an important area where firms can differentiate themselves and get potential competitive advantage, the fierce market competition is more focusing on other consideration, such as cost, design, and delivery timeliness. Furthermore, manufacturing firms also perceive that the cost spent to change current technology and search for new green alternatives is uncontrollable.

4.2 GP and firm performance

We find significant positive impact of GP on environmental and operational performance. Obviously, the implementation of GP can help to reduce air emission, waste water, solid wastes, decrease frequency for environmental accidents, and improve environmental image, leading to better environmental performance. Meanwhile, the generation of waste and pollution during manufacturing process is a sign of operational inefficiency; GP can minimize the pollution and improve the product quality, thus contribute to operational performance improvement. By contrast, we do not find positive impact of GP on financial performance. The explanatory power that environmental performance and GP perform on the financial performance of the firms is not high, being the relationship between GP and financial performance non-significant. This may be due to the implementation of GP need relative high-initial capital investment. To some extent, GP may have some lag effect on financial performance.

4.3 The mediating role of environmental performance

Our empirical results show support for a partial mediating effect of environmental performance on the relationship between GP and operational/financial performance. In other words, GP not only promote operational performance and financial performance directly, but also improve them indirectly by enhanced environmental performance. The waste reduction and resources conservation nature of environmental performance will contribute to operation efficiency enhancement. By improving environmental performance, firms can enhance the ability to reduce costs associated with waste treatment, pollution discharge, energy consumption, and fines for environmental accidents. Moreover, a better environmental performance is expected to promote customer satisfaction and loyalty, brand value, employee satisfaction, enhanced publicity and marketing opportunities, and better acceptance by local communities. The implementation of GP represents greener products, which will facilitate firms to expand new markets and attract new customers. Thus, firms that are interested to improve financial performance can begin by valuing their environmental performance. All in all, understanding the important role of environmental performance should cause Chinese manufacturers to rethink their environmental activities.

5. Conclusions and implications

This study investigates the drivers and performance outcomes of GP by empirically examining data collected from 124 Chinese manufacturing firms. We add to the literature a more complete framework that simultaneously integrates the constructs of stakeholders, GP, and firm performance. To the best of our knowledge, it is one of the first models to integrate these variables in this way. This study provides practical implications for both manufacturers and policy makers.

First, it enhances our understanding of the factors that initiate and boost GP. The results provide policy insights for professional organizations, regulators, and legislators to further promote GP. For example, we find that government does not constitute the true driver for firms' implementation of GP in Chinese context. This finding shows that the government agencies at national and local levels should strengthen environment regulations enforcement and forbidden the rent-seeking activities.

Second, based on a sample of Chinese manufacturing plants, this study provides the first empirical evidence that environmental performance mediates the relationship between GP and financial performance. For managerial implications, manufacturers can obtain some insights into how they can seek financial outcomes from implementing GP. The adoption of GP is conducive to enhance organization environmental performance, and then improve financial performance and operational performance indirectly. These findings indicate that the practitioners should change their mindset, recognize that the efforts on GP mean economic and competitive opportunities, rather than additional costs on their operations. Manufacturers can hopefully improve financial performance in the longer term by implementing GP.

While this study makes significant contributions to both literature and practice, there are several limitations which open up directions for future researches. The main limitation of our study is that we extracted five factors or determinants as possible drivers of GP. It is possible that ongoing studies could include more drivers in this regard. This would contribute to a more detailed and accurate portrayal. In addition, although the research included firms of various sizes and sectors, the sample was taken only from China. Therefore, for a wider analysis, it would be better to conduct similar or comparative research on a sample of firms from more countries. Also, the generalization of conclusions to other countries could be an attractive subject of further research. Finally, the framework of sustainability in this study is mainly focused on the traditional perspective (eco-efficiency, linearity). Contemporary changes on sustainable approaches (e.g. circularity and eco-effectiveness) are not addressed.

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Further reading

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Appendix

Constructs	Measurement items	Mean	SD
Employees' pressure (Eiadat *et al.*, 2008; Zhu *et al.*, 2013)	EMP1: employees have a strong desire to improve their working environment and reduce potential health threats	3.552	0.888
	EMP2: employees know well about the pollution and toxic materials generate in the production process	3.509	0.909
	EMP3: employees will suggest bottom-up proposal concerning green practices and cleaner production	3.543	0.898
	EMP4: employees have the autonomy to make environmental decisions (green empowerment)	3.603	0.822
Senior managers' pressure (Eiadat *et al.*, 2008; Qi *et al.*, 2010)	MAN1: our firm assess senior manager's contribution to the advancement of environmental performance	3.904	0.794
	MAN2: senior managers in our firm have a higher environmental commitment and awareness	4.069	0.754
	MAN3: senior managers have a positive attitude toward green practices	3.836	0.864
	MAN4: environmental initiatives will receive support from senior managers	4.138	0.768
Governments' pressure (Qi *et al.*, 2010; Zhu *et al.*, 2013; Rasi *et al.*, 2014)	GOV1: national and local environmental regulations (such as cleaner production) implemented well in our firm	4.276	0.764
	GOV2: products and materials potentially conflict with environmental laws will be forbidden by governments	4.017	0.772
	GOV3: governments provide preferential subsidy and tax policy on green practices	4.112	0.842
	GOV4: governments will provide training and guidance about green practices	4.164	0.791
Customers' pressure (Rasi *et al.*, 2014; Singh *et al.*, 2015)	CUS1: our customers have established an effective environmental management system	3.922	0.836
	CUS2: customers pay great attention to search for suppliers with environmental responsibility and green awareness	3.819	1.001
	CUS3: customers require our products meet their green requirements and eager to pay more for green products	3.845	0.929
	CUS4: customers will monitor our manufacturing process and visit our firm regularly	3.810	0.913
Competitors' pressure (Qi *et al.*, 2010; Rasi *et al.*, 2014; Singh *et al.*, 2015)	COM1: competitors can achieve competitive advantage through higher environmental awareness	3.864	1.121
	COM2: competitors employed green strategy to enter and occupy new high-profit markets	3.228	1.022
	COM3: competitors try to enlarge their market share by green practices adoption	3.661	0.982
	COM4: competitors can establish a better environmental image through green practices	3.241	0.998
Green practices (Lin and Ho, 2011; Zhu *et al.*, 2013; Jabbour *et al.*, 2015)	GP1: avoidance of the discharge of hazardous/harmful/toxic substances	4.138	1.285
	GP2: design of products for reuse, recovery, recycle of material and component parts	3.948	1.141
	GP3: reduced consumption of material/energy during the manufacturing process	3.966	0.969

(*continued*)

Table AI. Construct measurement

Constructs	Measurement items	Mean	SD
	GP4: green purchasing	3.914	0.983
	GP5: green auditing	3.793	0.956
	GP6: establish an GP management system (such as ISO14000 certification)	3.948	0.931
Environmental performance (Zhu *et al.*, 2013; Li, 2014; Jabbour *et al.*, 2015)	EP1: there has been an improvement in the company's environmental reputation and image in the market	4.290	0.784
	EP2: there is a significant decrease of environmental accidents occurrence	4.139	0.771
	EP3: reduction of toxic gas emission	4.174	0.717
	EP4: reduction of solid wastes	4.304	0.691
	EP5: reduction of waste water	4.217	0.735
	EP6: decrease of consumption for hazardous and harmful materials	4.236	0.750
Operational performance (Zhu *et al.,* 2013; Jabbour *et al.*, 2015)	OP1: there has been a reduction in costs	3.447	1.114
	OP2: there has been an increase in the quality of the firm's products	3.948	0.724
	OP3: there has been an increase in delivery	3.826	0.871
	OP4: there has been an increase in flexibility	4.045	0.787
Financial performance	FP1: our firm has a better profitability improvement relative to competitors	3.628	1.011
(Zhu *et al.*, 2013 and Jabbour *et al.*, 2015)	FP2: our firm has a higher return on investment (ROI) relative to competitors	3.491	0.986
	FP3: our firm achieves greater success and acquire a higher market share	4.448	0.650

Table AI.

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