

The Relationship between Standard-Induced Pollution Prevention Practices and Financial Performance:

Testing the Mediating Role of Green Growth Initiatives*

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Abstract: This study explores whether green growth (GG) initiatives can effectively complement standard-induced pollution prevention (P2) practices for long-term profitability in an attempt to combine a resource-based view (RBV) of firms and institutional theory. Using survey data collected from 299 manufacturing facilities in Korea, this article empirically examined the mediation effect of GG initiatives on the relationship between P2 practices and financial performance by structural equation models (SEM) with the LISREL technique. Results suggest that GG initiatives such as a new mechanism for environmental regulations in combination with P2 practices can enhance financial performance, which will, in turn, lead to economic recovery and new employment. This finding contributes to the strategic management literature. Theoretical and practical implications of the study's findings and directions for future research are discussed.

Key Words: Pollution Prevention Practices, Green Growth Initiatives, Financial Performance, Resource-Based Competence, Voluntary Regulation

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I. Introduction

Over the last three decades, institutional studies have centered on why firms adopt the standards and have examined the effects of regulatory pressures and isomorphic patterns of environmental management practices on common values such as pollution abatement, asset utility and profitability (e.g., Sharma and Vredenburg, 1998; Christmann, 2000; Majumdar and Marcus, 2001; Naveh and Marcus, 2005; Dowell and Muthulingam, 2017). Anecdotal evidences and case studies have suggested that “it pays to be green”, but empirical evidences remain elusive about whether voluntary institutional approach is more effective than coercive approach (King and Lenox, 2002; King, Lenox and Terlaak, 2005; Aragón-Correa, Marcus and Vogel, 2020).

As showed by Chen and Metcalf (1980), is a direct relationship between P2 practices and profitability spurious? This study agrees with Russo and Fouts (1997) that this inconclusiveness is mainly due to both conceptual and methodological flaws: for the former, notwithstanding the multidimensional nature, namely environmental, market and financial aspects of firm performance measures, a variety of measures of business performance were just collapsed to form a one-dimensional latent construct (e.g., Sharma and Vredenburg, 1998; Sung, 2002; Sroufe, 2003; Park, Kwon, Shin and Chung, 2004) that can lead to an *equivocal* latent variable (Hair, Black, Babin and Anderson, 2010) due to the sheer impossibility to *isolate* the market aspects of profitability performance.

The results of exploratory factor analysis (EFA) may be heuristic and suggestive and so need more confirmatory factor analysis (CFA) to examine the pattern of *a priori* latent constructs. In this respect, EFA is not a useful tool but even can become a hindrance (Jöreskog and

Sörbom, 1993). And because it is unreasonable to assume that the error variance of a single indicator is zero (Jöreskog and Sörbom, 1993) in management practices, to test the hypotheses this study does use not regression analysis but SEM to deal with the measurement problem.

For the latter, prior research has so much relied on archival data such as TRI (Toxics Release Inventory) or KEJI (Korea Economic Justice Institute) data (e.g., Hart and Ahuja, 1996; King and Lenox, 2002; Park et al, 2004; King, Lenox and Terlaak, 2005). TRI data has a disadvantage that can't appropriately reveal hidden the competitive competences embedded in facility by replacing P2 practices with "conceptually similar (i.e., surrogate) variables" (e.g., Berchicci, Dowell and King, 2012; Bergh et al., 2016, p.479). And omitting main predictors and potential multicollinearity problems in a regression model might lead to large standard error estimates and inconsistent parameter estimates (Grewal, Cote and Baumgartner, 2004). Thus, this study attempts to improve measures of P2 practices and profitability and also identify control variables omitted in prior studies.

On the one hand, especially as for mediation model if a proposed model is not compared with its nested model and also the relative strength of this mediation is not decomposed, then we can't figure out whether the property of mediation is partial or not (e.g., Judge and Douglas, 1998; Aragón-Correa, Hurtado-Torres, Sharma and García-Morales, 2008). In this article, these mediation concerns will simultaneously be addressed by SEM procedures.

As firms have committed to the standard GG initiatives, little is known about the effects of P2 practices on green growth outcome and financial performance. This article questions whether GG initiative adoption is complementary to P2 practices that in turn lead to firm performances.

Given these arguments, this study assumes that the direct and positive relationship between P2 practices and profitability might be *spurious* due to omitted predictors and explores *how* GG initiatives mediate the P2 practices-profitability link for deeper understanding of institutional theory and RBV.

II. Theory and Hypotheses

1. The Relationship between P2 Practices and Firm Performance

Many industries have attempted to avoid costly regulations to look for alternative instruments to deal with stakeholders, including government and have made a progress in competitive competence of P2 technologies (McEvily and Marcus, 2005). Through P2 practices, firms can increase cost-efficiency (Christmann, 2000) which lead to sustainable competitive advantage, i.e., first-mover advantage to deter entry to new market (Porter and van der Linde, 1995).

Anecdotal evidences have suggested that well-designed regulations could contribute to financial or stock-market performance. And case studies (e.g., Steelman and Rivera, 2006) have showed that flexible regulation program is a valuable policy tool to supplement the mandatory regulation approach. But despite a significant volume of research, empirical evidences are still equivocal about whether companies can profit from voluntary environmental management practices (King and Lenox, 2002; Darnall and Sides, 2008; Dowell and Muthulingam, 2017).

This study agrees with Russo and Fouts (1997) that this inconclusiveness is mainly due to conceptual and methodological flaws: for example, much reliance on secondary data (e.g., TRI and KEJI) and small, single-industry

samples. And previous studies have largely used “aggregate measures of environmental and financial performance” (Dowell and Muthulingam, 2017, p.1288) which parceled the different aspects of best practices and profitability (e.g., sales revenue, ROA, ROE, ROS, market share, ROS, ROA, ROE, corporate image and reputation, etc.) into a single composite measure using suggestive EFA method. These aggregate measures (e.g., Sharma and Vredenburg, 1998; Sung, 2002; Sroufe, 2003; Park et al., 2004) lack content validity and can “provide little information on the profits that a firm can realize from a given environmental initiative” (Dowell and Muthulingam, 2017) when we speculate on the origin of net profit.

The RBV argues that differences in firms’ resource endowments can cause performance differences (Berchicci et al., 2012, 2017). When a firm has resources that are rare and valuable, those distinctive resources can be a source of unique competitiveness that will improve its productivity and product quality. If a firm designs its management practices, again and changes them based on its heterogeneous resources which are unique, inimitable, scarce, and valuable (Barney, 1991), it can create new market opportunities leading to competitive advantage (Christmann, 2000) and ultimately enhance profitability (Naveh and Marcus, 2005).

Therefore, P2 competence relies on whether a firm continuously improves its management practices or not. The continuous improvements and innovation within a firm can generate basic competence in relation with P2 practices which could lead to reputation, social legitimacy, green market access, and ultimately increased financial performance. In this regard, nature-based idiosyncratic resources which are also difficult or costly to imitate can be a source of new competitive advantage for realizing social value as environmental

protection as well as profitability. This view assumes that firm-specific resources and competences could determine a firm's strategy and profitability (Berchicci et al., 2012; Kim and Kim, 2008, 2014; Kim, 2013). Shrivastava (1995) insisted that environmental performance may be associated with greater efficiency that may be derived from internal management practices.

Thus, "sustaining a firm's competitive advantage requires management to continuously adjust and renew the firm's unique bundle of limited resources as time and information that can destroy their mission and value" (Rumelt, 1984). Joshi, Khanna and Sidique (2005) found that stock markets penalize polluters and reward environmental excellence. Therefore, to investigate the effects of best practices and their competitive competences on profitability, it is inappropriate to use the cross-sectional data because of the necessary preparation period before P2 programs can be put into place (Naveh and Marcus, 2005). Notwithstanding long insights into the "best" practices in facilities (e.g., Hart and Ahuja, 1996; Russo and Fouts, 1997; Christmann, 2000; Dowell and Muthulingam, 2017), there has still been yet no consensus on whether P2 practices have a direct and positive impact on profitability.

To sum up, competitive green competence and skills make a firm deploy its resources to increase its green market standing and profitability. Thus, environmental technology could be supposed to be entry barriers for firms to get access to green markets. In this sense, this study assumes that institutional pressures have a strong influence on a firm's resource choice which affects, in turn, green market standing and ultimately profitability and would extend to integrate both regulation and resource-based view (e.g., Naveh and Marcus, 2005). A firm's sales of "green" products and profitability after P2 adoption are constrained

by a firm's resources and competence (Russo and Fouts, 1997; Majumdar and Marcus, 2001; King and Lenox, 2002). Unique management practices can facilitate P2 activities in facility by encouraging companies to eliminate some regulated processes and to substitute harmful inputs with more environmentally safe ones, together. Such actions can help firms improve environmental capabilities and ultimately enhance profitability such as market and financial performance. Given these arguments, this study can suggest the following hypotheses:

H1: P2 practices will have a direct and positive influence on financial performance.

H2: P2 practices will have a direct and positive impact on a firm's green growth performance, i.e., relative sales increase.

2. The Mediating Effect of Green Growth (GG) Initiatives

Since the recent global financial crisis, firms have been induced to undertake eco-friendly GG initiatives with environmental management practices. Institutional literatures have indicated that because it can take three to five years to implement an effective P2 practices (e.g., Naveh and Marcus, 2005), firms should “see the increased profitability in subsequent periods” (Vorhies, Morgan and Autry, 2009). In the previous studies (e.g., Lev, Petrovits and Radhakrishnan, 2010, p.187; Patel, Kohtamäki, Parida and Wincent, 2015, p.1743), a sales increase was used as the outcome indicator that firms efficiently exploit resources and capabilities (Yeoh and Roth, 1999). But resources alone cannot bestow competitive advantages until a firm has the *dynamic* ability to deploy the bundles of assets efficiently (Barney, 1991).

In green market, acquiring corporate reputation among customers

who are sensitive to such issues for leadership in environment, health and safety by improving “resource efficiency” will increase sales revenue (Kim and Kim, 2014) and concomitant profitability (Porter and van der Linde, 1995). In this respect, flexible regulatory pressure can trigger entrepreneurship and process innovation. Therefore, realizing revenue potential of these firm-specific resources requires alignment with other management practices. Thus, firms’ capabilities in congruence of firm-specific P2 practices and GG initiatives will improve profitability that will lead to economic growth and employment.

This study defines GG initiatives as sales growth performance-driven sustainable business strategy in green market, consistent with PCGG (2009) and Gurría (2011, p.31). Thus, new empirical research addressing the question of whether GG initiatives can contribute to superior profitability in combination with P2 practices would be of value. Contradictory results in the previous articles “may be in part attributable to such ‘missing elements as measures of corporate strategy” (Surroca, Tribó and Waddock, 2010). And in mediation model, just as direct causal effects are estimated in a path analysis, so too are indirect causal effects (Kline, 2005, p.68). In this respect, given that sales increase will take some time to positively affect net profit, i.e., the bottom line (Naveh and Marcus, 2005), this study assumes that if a missing element, i.e., GG initiatives is specified in the model, there is no direct effect of P2 practices on financial performance. Thus, this paper explores *how* P2 practices could influence financial performance through green growth performance, i.e., market gains pathway which requires complementary assets and capabilities.

But the previous works (e.g., Hart and Ahuja, 1996; Majumdar and Marcus, 2001) showed that other variables, especially industry and firm

size could have a significant influence on the relationship of environmental management practices and business performance. Therefore, to avoid model misspecification, this study controlled for the effects of firm size and industry condition on the green growth and financial performance in each model (H1-H3). From the above arguments, this study can propose:

H3: Contrary to the expectation for H1 that there will be a direct and positive direct relationship between P2 practices and financial performance, when we control for an omitted variable, for example, sales growth outcome of profitability in the model, P2 practices will indirectly influence financial performance through the mediator GG initiatives.

III. Methods

1. Data Collection

This study used a systematic random sampling to obtain the company-level sample of 1,066 to show what is happening within multiple industries rather than being limited to single industry, using manufacturing firms listed in “2003 Annual Corporation Report” published by Maeil Business Newspaper in Korea. During the period from 1998 to 2003, Korean companies, along with competitors in Japan, U.S.A. and Europe, were among top ten countries across 117 countries for ISO 14001 certificates (ISO, 2003, p.7). But in the U.S. alone, by 2003 “many more had adopted non-certified EMSs” (Darnall and Edwards, 2006). In this regard, the lagged data during this period seems appropriate to explain why some firms much earlier adopt the best

practices than others do not.

The survey items adopted from the previous studies were modified based on the review of potential respondents and experts. Of the 1,066 survey, field-based data collection methods were used at 56 manufacturing facilities to “ensure that important indicators were captured during the interview to help develop an understanding of why new variables might be important” (Sroufe, 2003) and eliminate the threat of “common method bias” in relation with the measures of green growth and financial performance. And by mail and internet survey during April to May 2004, this study received a total of 332 responses from employees and supervisors in charge of environmental management practices in the facilities who can evaluate their P2 practices for a five-year implementation period 1999 through 2003 (Hendricks and Singhal, 2001) and profitability during the subsequent 3-year period 2001-2003, given that ISO 14001 certificates are valid for three years (ISO, 2003). But 9 responses were eliminated because of incomplete information, which left us with 323 usable questionnaires, yielding a response rate 30.3%, which meets the requirement of at least 200 or more cases being desirable to test structural equation models. Of these, 211 (73%) were small and medium sized enterprises (SMEs) under 300 employees and 78 (27%) were large firms. And to control for industry effect, this study categorized firms into eight industries: foods (5%), textiles and apparel (14%), lumber, papers, and printing (3%), chemicals (10%), basic and fabricated metals (17%), electronic and industrial machinery (12%), auto parts (21%) and others (18%).

2. Measures

This study examined the validation and reliability of observed

variables using the analysis of item-total correlations, traditional EFA and confirmatory factor analysis (CFA) to identify and eliminate the poor items for the reflective measures. Each purified scale item and reliability coefficient appears in Appendix 1.

Pollution prevention (P2) practices In relation with social legitimacy to protect nature and increase energy efficiency, P2 practices could become a new source of competitive advantage with growing enforcement of stringent environment regulation (Naveh and Marcus, 2005; Darnall and Edwards, 2006) which in turn could contribute to corporate revenue and net profit. To establish the mediation model, this study collected lagged data which observed variables are measured at more than one point in time (Hoyle and Smith, 1994) for management practices and long-term profitability. As suggested by Majumdar and Marcus (2001), Lenox and King (2004) and Berchicci et al. (2012), this study used P2 practices as a widely quoted proxy to measure the level of sustainable management practices in facilities that allows firms to generate competitive advantage (Christmann, 2000).

Thus, this study defines P2 practices as a degree that a firm perceives its resource-based capabilities that may emerge within its company as a consequence to institutionalize “best” management practices such as (1) source reduction, (2) existing process improvement, (3) ‘substitute less hazardous raw materials for more hazardous ones’ and (4) safe disposal of solid/hazardous wastes beyond (5) the end-of-pipe control technology that TRI contains. Based on these items, this study followed studies (McEvily and Marcus, 2005) in choosing this scale and added a comment to the modified questionnaire to indicate a degree of competitiveness because it can take at least three to five years to use P2 practices effectively as Hendricks and Singhal (2001) suggested (1: we do

this all of the time, 2: we do this most of the time, 3: we do this from time to time, about the same, 4: we know about this practice, but *not* to do it, and 5: we know little this practice).

A subscale aggregation approach is common in SEM procedure (Little, Cunningham, Shahar and Widaman, 2002) and so this study used the mean scores of each item that is consistent with the other P2 practices and performance studies (McEvily and Marcus, 2005). Cronbach's alpha (0.84) was high enough to combine items for exploratory study.

Green growth (GG) initiatives and financial performance The composite firm performance scale which can't isolate market, financial and social aspects of business performance contains a problem of content and discriminant validity although it seems to appropriately meet the unidimensionality and convergent validity by EFA (e.g., Sharma and Vredenburg, 1998; Sroufe, 2003). Sales revenue reflects a firm's operational efficiency (Lev et al., 2010) that can be a source of the competitive advantage which might lead to increased profitability. Therefore, financial performance can be divided into two different performance aspects, i.e., sales revenue and net profit in the income statement. In this regard, sales revenue is a market performance indicator as the 'top line' on the income statement that green market opportunities are realized.

This study measured performance-based GG initiatives (PCGG, 2009) using two market performance indicators: sales revenue and relative market share of green products in the market served by a firm as used by Darnall (2006, p.369). And we measured overall financial performance by two profitability ratios such as return on sales (ROS) and return on asset (ROA) on a long-term basis as in Judge and Douglas (1998) and Naveh and Marcus (2005) and Vorhies et al., (2009, p.1316).

These firm performances were measured on a four-item, five-point Likert-type scale: how successfully your company has achieved these goals during the subsequent 3 years after P2 adoption (e.g., Naveh and Marcus, 2005; Darnall and Edwards, 2006) relative to key competitors (1: very superior, 2: superior, 3: about the same, 4: inferior, 5: very inferior). As Podsakoff, MacKenzie, Lee and Podsakoff (2003) recommended, in order to reduce the likelihood of common method bias, this study used a different scale anchors and format of P2 practices and performance while especially relative market share of items of green growth performance was differently scaled (percentage converted into 5-point scale as 1: 1-5%, 2: 6-10%, 3: 11-15%, 4: 16-20%, 5: >21%). Internal consistency of the items to measure two dimensions of financial performance was 0.76 high enough to be aggregated into a single measure.

Control variables Consistent with previous studies (e.g., King and Lenox, 2002; Darnall and Edwards, 2006), this study include firm size and industry as control variables in the model to isolate the possible confounding effects of firm size and industry conditions on profitability. Employees served as a proxy for firm size which was recorded as a dummy variable set equal to 1 if the number of employees is below 300 and to 0 otherwise. And each industry was transformed into a dummy variable set equal to 1 for food, textiles and apparel, lumber, papers and printing, chemicals, basic and fabricated metals, electronic and industrial machinery, and auto parts, respectively and coded as 0 otherwise for industries that were under 3% of the total sample size because of significant difference in sample size by industry.

3. Analytic Procedures

First, this study inspected the pattern of missing data, linearity,

normality and distribution of the data, multicollinearity, common method bias, and properties, namely validities and reliabilities of the measurement instruments to estimate the baseline model. Mediation analysis can help identify one or more mechanisms or structure through which a predictor could impact its outcome (Baron and Kenny, 1986). This study employed SEM approach to simultaneously investigate mediation model with latent constructs of multiple indicators because SEM method is a useful tool to *isolate* the direct and indirect effects in a model that include the third variables (Holmbeck, 1997; MacKinnon, Lockwood and Williams, 2004) and also address the problem of measurement errors that might result in “biased estimation of both mediation effects and confidence intervals” (Cheung and Lau, 2008).

This study obtained input data in the form of two matrices—the biserial correlation matrix and the corresponding asymptotic covariance matrix using PRELIS by LISREL 10.2 software and the weighted least squares (WLS) method (Kline, 2005, p.197) was employed to accurately estimate standard errors and χ^2 statistic (Bollen, 1989, p.443; Jöreskog and Sörbom, 1993). It reported the fit statistics, i.e., χ^2 statistic, degree of freedom, p -value, and standard error for assessing overall fit. And the good-of-fit of the model to the data was tested based on χ^2 values with an associated probability greater than 0.05. Due to some problems with relying solely on χ^2 statistic as a descriptive index of model fit, this study used value of RMSEA less than 0.05 to detect model misspecification with the p -value for test of close fit (RMSEA < 0.05) for non-normal condition and other fit indices above 0.90 of the goodness-of-fit test (GFI), adjusted goodness-of-fit test (AGFI), and the comparative fit index (CFI) as Jöreskog and Sörbom (1993) recommended.

IV. Analysis and Results

1. Preliminary Analyses

In the data set, percentage of missing data to valid data appeared to be not relatively noticeable, ranging 1.5% to 3.4% and there were no significant differences between the responding and nonresponding firms in P2 practices ($p > 0.10$). Thus, this study imputed the missing value of P2 practices by the maximum likelihood estimation (Schafer and Graham, 2002) based on pattern matching method in which the cases reduce from 323 to 299. And this study standardized firm performance measures by firm to deal with the potential multicollinearity between market and financial performance subscales. And it is unreasonable to assume that the measurement error in the observed variable 'sales of green product' as the only available measure of the GG initiatives is zero (Hair et al., 2010, p.717). Thus, to mitigate the problems of measurement errors and overestimation of mediation effects (Cheung and Lau, 2008), the variance of measurement error in 'sales of green product' was fixed to $(1-\alpha) \sigma^2$ of 0.2269 using its reliability of 0.77 as shown in Appendix 1 (Jöreskog and Sörbom, 1993).

This study applied the two-step SEM approach to evaluate the distinctiveness of measures and the mediation model because SEMs and latent constructs with multiple indicators can be simultaneously investigated (Holmbeck, 1997) and to deal with biased estimation problems of the mediation effect and its confidence intervals (Jöreskog and Sörbom, 1993; MacKinnon et al., 2004). This study first examined the pure structure of the latent variables in the study by EFA because a measure may be consistent (reliable) but not accurate (valid) and vice versa (Hair et al., 2010).

Based on item analyses (Bagozzi and Heatherton, 1994), two items, i.e., 'safe disposal of solid/hazardous wastes' and the 'relative market share' turned out to be less reliable than other measures included in the analysis. Thus, since 'sales of green product' was a sole indicator for the GG initiatives, EFA was performed to assess the unidimensionality of the latent constructs P2 practices and financial performance with varimax rotation to "maximize a variable's loading on a single factor" (Hair et al., 2010). We examined the threat of common methods variance via the Harmon one-factor test (Podsakoff et al., 2003). Because neither a single factor emerged in the initial solution from the analysis nor accounted for a significant amount of variance, common method bias did not influence the responses in this study.

As expected, two factors, i.e., P2 practices and financial performance with eigenvalues greater than one were extracted, which accounted for 72.78 percent of the variance of the variables in which the first factor accounted for 46.95 percent of the variances while the second factor accounted for 25.83, respectively. Respective rotated factor loadings of the underlying items for two theoretical constructs fell substantially above 0.81 with communalities of 0.58 or above, the measures of Bartlett's test of sphericity of 658.101, $d.f. = 15$ and of sampling adequacy (MSA) of 0.733 ($p < 0.001$), indicating "the presence of correlations among the variables and the pure structure of factor analysis" (Hair et al., 2010) that did meet the critical assumptions in factor analysis.

And in Appendix 1, reliability coefficients for two proposed constructs were all 0.77 or higher than the recommended 0.70 level for exploratory study (Nunnally, 1978). These results indicate sufficient convergent, discriminant validity and reliability of the measures for each latent construct. Before the items constituting two latent variables were

parceled, to generalize *a priori* information about estimates of parameters from the early EFA, this study also assessed the appropriateness of measurement model using CFA with maximum likelihood which also included the single item indicator of GG initiatives.

Convergent validity and reliability analyses Measurement model appeared to be a satisfactory fit to the data as a whole: the chi-square was not significant ($\chi^2 = 10.12$, *d.f.* = 12, *p*-value = 0.61, which meets the critical value of 0.05. And RMSEA was a very acceptable 0.00 less than 0.05 with the 90% confidence interval for RMSEA ranging from 0 to 0.05 and the *p*-value for the test of close fit (RMSEA < 0.05) equal to 0.95. In addition, both GFI and AGFI was 0.99 and 0.98, well above the recommended value of 0.90 (Hair et al., 2010). Observed variables included in each latent construct are detailed in Appendix 1. The estimates of standardized factor loadings in the λ_x matrix linking the latent constructs with their indicator variables ($\lambda_{x\ 2\ 1} = 0.64$, $\lambda_{x\ 3\ 1} = 0.84$, $\lambda_{x\ 4\ 1} = 0.82$, $\lambda_{x\ 7\ 3} = 0.79$) were statistically significant ($t = 14.35$, $t = 18.91$, $t = 18.61$, $t = 11.55$), respectively. All factor loadings of 0.64 or higher are significant ($p < 0.001$) and any items within each set did not cross-load on a non-hypothesized construct and further, the standardized loadings were large in magnitude that are reflective of the corresponding latent variables, providing evidences that multiple indicators represent a single-dimensional latent construct, i.e., convergent validity (Little et al., 2002).

Next, the squared multiple correlation (R^2) for the indicator of GG initiatives was 0.77, suggesting that 'sales of good product' is a reliable 'good' measure of the latent variable (Bollen, 1989; Jöreskog and Sörbom, 1993). And composite reliability values of two proposed constructs ranged from 0.80 to 0.85, exceeding the recommended level of 0.70 for exploratory research (Hair et al., 2010) and also two AVEs

ranged from 0.58 to 0.66, exceeding the 0.50 guideline, respectively (Fornell and Larker, 1981). These reliability tests reflect the high internal consistency of the measures in this study. This indicates that P2 practices and profitability performance measures should be aggregated into a composite indicator (Little et al., 2002), respectively.

Discriminant validity analysis In <Table 1>, correlations(ϕ s) between three latent constructs are reported for subsequent SEM analyses. But since a correlation ($r = 0.71$) between GG initiatives and financial performance is as significant as expected ($p < 0.001$), this study tested the discriminant validity of latent constructs by comparing the AVEs for each latent variable with the squared correlation between these latent variables (Hair et al., 2010). Two AVEs are the diagonal elements in bold and the bivariate correlations between two latent constructs are the

<Table 1> ϕ s and descriptive statistics

	1	2	3	4	5	6	7	8	9	10	11
1 P2	.58										
2 GGI	.13 [†]	1.00									
3 FP	.17**	.71***	.66								
4 Size	.33***	.04	.21***	1.00							
5 IND1	-.08	-.01	.02	.02	1.00						
6 IND2	.06	.01	.10*	.25***	-.08 [†]	1.00					
7 IND3	-.08 [†]	-.01	.08	-.08 [†]	-.04	-.08 [†]	1.00				
8 IND4	-.14**	-.02	-.10 [†]	-.02	-.08 [†]	-.14**	-.07	1.00			
9 IND5	.05	.01	.17**	.04	-.12*	-.15**	-.09 [†]	-.15**	1.00		
10 IND6	.01	.00	-.05	-.03	-.12*	-.13 [†]	-.07	-.15**	-.21***	1.00	
11 IND7	-.04	-.01	-.16**	-.17**	-.11*	-.24***	-.08 [†]	-.15**	-.23***	-.16**	1.00
Mean	2.56	3.09	2.87	0.73	0.05	0.14	0.04	0.10	0.17	0.12	0.21
SD	0.83	0.78	0.78	0.45	0.23	0.35	0.19	0.30	0.37	0.33	0.41

Listwise N = 299

[†]: $p < 0.10$, *: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.01$

Note: AVEs (average variance extracted), including 0.58 and 0.66 are shown as diagonal elements in bold. The correlations between constructs are shown as off-diagonal elements

P2 (pollution prevention practices), GGI (green growth initiatives), FP (financial performance), Size (firm size), IND1(foods), IND2(textiles and apparel), IND3(lumber, papers and printing), IND4(chemicals), IND5(basic and fabricated metals), IND6(electronic and industrial machinery), IND7(Auto parts)

off-diagonal elements. The correlation between GG initiatives and financial performance is 0.71 and its squared value is 0.504. In Table 1, the AVEs of two latent variables are substantially greater than the squared correlations across each latent construct. These results support the discriminant validity of the latent constructs.

2. Model Testing

⟨Table 1⟩ shows Φ s and descriptive statistics for all the latent variables. P2 practices are significantly associated with the three-year average green growth performance (0.13, $p < 0.05$) and subsequent financial performance (0.17, $p < 0.01$), respectively and GG initiatives have a positive association with financial performance (0.71, $p < 0.001$), indicating each correlation is non-zero. Generally, the zero-order-correlations between the hypothesized latent variables are in the expected direction that also met the preconditions for the mediation model (Baron and Kenny, 1986). In addition, when this study examined the correlation of P2 practices and financial performance, controlling for GG initiatives by a partial correlation analysis, the value of this correlation coefficient ($r = 0.13$, $p < 0.05$) is close to zero ($r = 0.09$, $p < 0.10$). This result indicates that the direct association between P2 practices and financial performance may be *spurious* (Kline, 2005, p. 69).

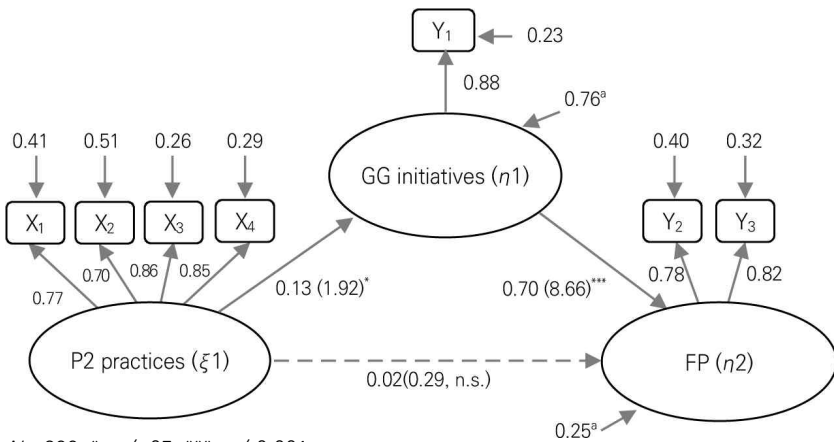
Baseline versus nested model. Prior to testing structural relationships, this study compared a baseline model with its nested model. The fit indices for the base line model show reasonably good fit to the data: $\chi^2_{(52)} = 59.34$; p -value = 0.22568; RMSEA = 0.022 with a 90% CI of 0 to 0.0443) and p -value for test of close fit (RMSEA < 0.05) = 0.985; SRMR = 0.037; GFI = 0.993; AGFI = 0.983; CFI = 0.998. On the one hand, fit indices of the nested model are as good as those of the baseline model: χ

$\chi^2_{(53)} = 59.42$; p -value = 0.25317; RMSEA = 0.020 with a 90% CI of 0 to 0.0432) and p -value for test of close fit (RMSEA < 0.05) = 0.988; SRMR = 0.037; GFI = 0.993; AGFI = 0.983; CFI = 0.998.

But there was no significant chi-square difference ($\Delta\chi^2 = 0.08$, $\Delta df = 1$) between the baseline and its nested model while other fit measures are almost same. Therefore, based on the previous win-win hypothesis (Hair et al., 2010, p.720) that “it pays to be green”, the baseline model was used to test the hypotheses in this study. Baseline model offers consistent and equal information regarding the variability of the mediation effect as compared with its bivariate model.

<Figure 1> depicts the parameter estimates: standardized estimates and factor loadings, t -value, variances of measurement errors in the observed exogenous and endogenous variables and three latent constructs for the baseline model. But the control effects are not shown for clarity. As expected, when the GG initiatives as a mediator, firm size

<Figure 1> Results of baseline model analysis



$N = 299$, *, $p < .05$, ***, $p < 0.001$

Notes: Model statistics: $\chi^2(52) = 59.34$, p -value = 0.23, RMSEA = 0.02 SRMR = 0.04 GFI = 0.99, AGFI = 0.98 CFI = 0.998

^a Errors of latent endogenous variables are unstandardized estimates. For parsimony, controls are not shown

and industry dummies were included in the SEM analysis, the first hypothesis proposing P2 practices have a direct and positive influence on a company's 'bottom line' was *not significant* although have the same direction ($\gamma_{2,1} = 0.02$, $t = 0.29$, $p > 0.10$). Because the direct effect approaches zero, the mediator GG initiatives can be said to *fully* account for the relationship between P2 practices and financial performance. Therefore, Hypothesis 1 was not supported.

This result is contrary to the 'win-win' statement that can "it pays to be green". It suggests that omitting GG initiatives from the model may lead to overstatements about the effects of P2 practices on financial performance. On the one hand, the path from P2 practices and GG initiatives was as much significant at the 0.05 level ($\gamma_{1,1} = 0.13$, $t = 1.92$) and the path from GG initiatives to financial performance was significant at the .001 level ($\beta_{2,1} = 0.70$, $t = 8.66$), supporting Hypothesis 2 and Hypothesis 3, respectively. This result indicates that P2 practices significantly exert an *indirect* and positive impact on financial performance through GG initiatives.

Additional analyses for mediation effects If that's the case, how much is indirect effect in the baseline model? <Table 2> shows that the direct relationship was *not* significant. But the indirect effect was significant (0.092, $p < 0.05$) and substantially added to the total effects (i.e., direct effects plus indirect effects, 0.11, $t = 1.559$, $p < 0.10$). The variance accounted for (VAF) the indirect effect through GG initiatives was 83.6% (0.092/0.110 = 0.836), suggesting a significant indirect effect of P2 practices on financial performance. This meets the condition of *complete (full) mediation* as suggested by Hair, Hult, Ringle and Sarstedt (2014).

<Table 2> Direct and indirect effects of P2 practices on financial performance

	Indirect effect through GG initiatives	Direct effect	Total effect
P2 practices	0.092 ($t = 1.863$)*	0.018 ($t = 0.290$)	0.110 ($t = 1.559$)†

†: $p < 0.10$, *: $p < 0.05$

Robustness checks Following Zhao, Lynch and Chen (2010), in order to evaluate the *accuracy* of the baseline model, this study employed the bootstrapping option (5,000 repetitions) to obtain confidence intervals to test the indirect effect. These results provided reasonable SEM fit indices for indirect mediation of the baseline model: $\chi^2_{(52)} = 73.17$; p -value = 0.028; RMSEA = 0.036 with the 90% CI for RMSEA of 0.009 to 0.054; p -value for test of close fit (RMSEA < 0.05) = 0.889; SRMR = 0.0300; GF I= 0.991; AGFI = 0.978; CFI = 0.979). And 90% bootstrap confidence intervals for the indirect effect in the baseline model *did not* include zero (0.009 to 0.054), indicating that coefficient estimates for baseline model are *still stable* (MacKinnon et al., 2004; Cheung and Lau, 2008; Hair et al., 2014). This bootstrapped result for the indirect effect also *does* confirm Hypothesis 3. Thus, this concludes that P2 practices have an *indirect* positive effect on financial performance through GG initiatives.

Effects of control variables For SMEs, there was a statistically significant difference in financial performance by firm size ($\gamma_{2,2} = 0.14$, $t = 2.37$, $p < 0.05$). And lumber, paper and print ($\gamma_{2,5} = 0.10$, $t = 1.85$, $p < 0.05$) and basic and fabricated metals ($\gamma_{2,7} = 0.14$, $t = 2.08$, $p < 0.05$) realized higher performance than referent industries, respectively. And other sectors such as food ($\gamma_{2,3} = 0.04$, $t = 0.60$), textiles and apparel ($\gamma_{2,4} = 0.06$, $t = 0.90$), chemicals ($\gamma_{2,6} = -0.06$, $t = -0.96$), electronic and industrial machinery ($\gamma_{2,8} = -0.03$, $t = -0.39$), and auto parts ($\gamma_{2,9} = -0.09$, $t = -1.30$) was similar to that of the referent industries, respectively.

These results suggest that SMEs are more aware of the financial returns from adopting P2 practices and green growth policies than large corporations, but some industries (e.g., lumber, wood and paper and basic and fabricated metals) is likely to realize higher profitability than the referent industries.

V. Discussion

Prior studies on the effects of best practices on profitability have been inconclusive due to key conceptual and methodological shortcomings as stated by Russo and Fouts (1997). In this regard, after assessing the validity and reliability of observed variables, based on the asymptotic covariance matrix, this study investigated the combined effect of P2 practices and GG initiatives on financial performance. More specifically, by exploring the direct and indirect effects of P2 practices on profitability, controlling for the confounding effects of third variables such as GG initiatives, firm size and industry, this article demonstrated *how* P2 practices enhance firms' profitability. Figure 1 summarizes the LISREL estimates for baseline model and Table 2 demonstrates that P2 practices have not direct effect on financial performance but have an indirect and positive impact on financial performance via green growth performance. These results are consistent with prior findings (Chen and Metcalf, 1980) that pollution reduction practices do not directly improve profitability and similarly support Darnall (2006) that environmental management practices might generate unique competitiveness and sales revenue.

And here, it is important to note that these results are contrary to

previous studies (e.g., Hart and Ahuja, 1996; Russo and Fouts, 1997; King and Lenox, 2002; Naveh and Marcus, 2005) that there is positive and *direct* relationship between best practices and profitability and also isomorphic patterns of best practices striving for social legitimacy are *not or negatively* associated with firms' profitability (e.g., Wiseman, 1982; Sung, 2002). They reveal that the direct relationship between P2 activities and profitability may be spurious (e.g., Chen and Metcalf, 1980; Kim and Kim, 2008) and support Sharma and Vredenburg (1998) that 'win-win argument' is "overly simplistic and sometimes erroneous".

Ans also they would imply that flexible regulations (Majumdar and Marcus, 2001) could be useful mechanisms to effectively complement RBV perspective and standard-induced P2 practices could increase their competitiveness and profitability. Therefore, P2 practices can be beneficial not only for sales revenue and net profit but also for favorable corporate reputation and image.

VI. Conclusion and Implications

This study examined whether P2 practices have a direct and positive impact on financial performance by analyzing the role of GG initiatives. Results demonstrate that GG initiatives as a new government regulation could be a possible supplement to P2 practices for long-term profitability. This enriches the RBV and regulation literatures by explaining the complementarity of GG initiatives to P2 practices to enhance the long-term profitability and suggests theoretical and practical implications.

Implications for theory Previous studies have paid much attention to

the contexts in which environmental management practices will be *directly* related to profitability. However, empirical findings of this study imply that there is a need to reconsider the traditional “win-win” hypothesis that it can pay to be green. In particular, this study suggests that firms can achieve a green growth performance based on P2 capabilities that in turn enhance profitability. And also it enhances the literature on regulation and RBV perspective by investigating the catalysis of GG initiatives on the relation of firm-specific P2 capabilities embedded in best practices and profitability.

Secondary data such as TRI emissions and KEJI index cannot reflect firm-specific internal capabilities caused by changes in corporate perceptions of environmental issues. And so this study used the survey data on the competence for P2 activities accumulated inside a firm by learning through eco-friendly management practices. The results reveal that the congruence between P2 practices and GG initiatives can *positively* affect a firm’s long-term profitability such as ROS and ROA, opposed to the inconclusive prior studies which the isomorphic patterns of behavior have either a negative or not any effect on profitability. They support Florida and Davison (2001) that an alternative institutional pressure such as GG initiatives could be a good complement to P2 practices using the SEM approach. In these regards, this research contributes to strategic literature in relation with analytic methods and theory development.

Implications for regulation and business For government regulations, this study demonstrates the role for GG initiatives as an alternative mechanism. First, government can establish flexible institutional settings to encourage innovation within firms beyond stringent regulation. Therefore, if GG initiatives are to be successful, institutional support is

essential for facility improvement, including manufacturing process, product redesign, technical assistance and certification system. In addition, as the US EPA has sought, institutional environments in which P2 adopters can be protected and rewarded in the green market need to be established: reducing the frequency of environmental inspections and the fines against firms who voluntarily adopt the P2 practices beyond the regulatory actions, tariff and subsidies for improving facilities, certification for green packing and labeling, building carbon market.

For business, now GG initiatives are not a choice but an existential issue that each firm must positively respond to. Firms lacking the fit between P2 practices and GG initiatives, i.e., sales revenue performance could face serious difficulties and lose the market opportunity to enter to the emerging green market. Therefore, internalizing beliefs to protect natural environment for our future generations become a precondition for a firm to increase sales revenue in the short term and to achieve social legitimacy, survival, reputation and profitability in the long run.

In this respect, symbolic adapters who would only seek certification for social legitimacy are likely to be faced with government and market pressure that would not permit to enter to target market: losing the market opportunity and closing down a facility. Thus, in order for flexible regulations to be complement to best practices, a firm should comply with new standards, not installing standards but continuously improve management practices through TQM and CRM to customize the need of target market who like to buy 'green' product, emphasizing on health and safety of product. These efforts could lead to sales revenue and long-term profitability that in turn could promote the employment and could ultimately be offered a road to escape from the recent financial crisis.

But this study contains a limitation to be lack of external validity. Thus, it should have been paid careful attention to generalize the results relying on cases of specific country despite a strong statistical analytic method used. Therefore, on data from the third countries, e.g., U.S.A. and Japan, future study can extend to test the mediation model to compare the environmental strategy and internal competence of early adopters and laggards, including other predictors such as EMS and early timing and also is able to do comparative studies by countries because environmental regulation approach can vary across countries.

And as for the latent variable GG initiatives, this study was obliged to use a single measure for green growth performance due to low reliability of market share measure using a different anchor from other measures to avoid common method bias. Therefore, an alternative anchoring system can be taken into consideration to measure multiple items for sales growth performance.

〈Appendix 1〉 The CFA results

Construct	Parameter	Loadings(<i>t</i> -value)	α	CR	AVE
Pollution prevention(P2) practices	$\lambda_{1,1}$ (Substitute less hazardous raw materials for more hazardous ones)	0.726 ^a	0.84	0.85	0.58
	$\lambda_{2,1}$ (End-of-pipe control Technology)	0.644 (14.35) ^{***}			
	$\lambda_{3,1}$ (Source reduction)	0.840 (18.91) ^{***}			
	$\lambda_{4,1}$ (Existing process improvement)	0.823(18.61) ^{***}			
Green growth (GG) initiatives	$\lambda_{5,2}$ (Sales of green product)	0.879 ^a	0.77	NA	NA
Financial performance	$\lambda_{6,3}$ (ROA)	0.776 ^a	0.76	0.80	0.66
	$\lambda_{7,3}$ (ROA)	0.792(11.55) ^{***}			

N=299

***: $p < 0.001$

Notes: Loadings = standardized estimates, CR= composite reliability, AVE = average variance extracted

a: *t*-values were not calculated because loading was set to 1.00 to fix construct variance (fixed parameter)

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