

## Green Operations and Organizational Performance

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### Abstract

*This study investigates the influence of green operations on organizational performance for the top 500 publicly traded companies in the US. Based on metrics for environmental impact and green reputation, manufacturing companies scored lower on the environmental impact metric and higher on the green reputation metric than companies in services industries. Additionally, the overall impact of green operations was found to be different between the manufacturing and service firms studied. For manufacturing firms, environmental impact score and green policies and performance score were found to have an impact on organizational performance; while, green reputation plays a more important role in impacting the organizational performance of service firms.*

**Keywords:** Green operations, Environmental impact, Green policies and performance, Green reputation

### Introduction

Today, environmental protection and economic burden on industry is leading organizations toward reevaluation of their corporate strategies including operations and business performance. This is reflected in the literature by the growing number of recent papers that explore the relationship between environmental operations and business performance (Aragon-Correa 1998; Kleindorfer et al. 2005; McCrea 2010; Rothenberg et al. 2001). Some empirical evidence suggesting a positive relationship between “green” operations and business performance has been cited in the literature (Kassinis and Soteriou 2003); however, more empirical work is needed to clarify the nature of this relationship (King and Lenox 2001; Klassen and McLaughlin 1996).

For the most part, research on environmental operations has focused on the areas of green product and process development, lean and green operations management, and remanufacturing and closed-loop supply chains (Angell and Klassen 1999; Kleindorfer et al. 2005). Only a few studies have looked at the relationship between green operations and firm performance on a comparative basis between the manufacturing and service industries. Existing empirical evidence so far is limited to a few studies that focus on the manufacturing sector (Kassinis and Soteriou 2003; Klassen 1993; Klassen and Whybark 1999) and others on the service sector (Foster et al. 2000; Goodman 2000; Kassinis and Soteriou 2003). Very few of these studies found scientific evidence that green practices have important effect on firm performance. For instance, Enz and Siguaw (1999) and Schendler (2001) argue that environmental practices can improve customer loyalty and employee satisfaction, reduce costs, and enhance competitiveness. In their review of published studies exploring the relationship between green operations and firm performance in the service industry, Kassinis and Soteriou (2003) found that most studies were manufacturing based case studies that predominantly identified opportunities for future research.

Historically, numerous environmental frameworks, cases and concepts have evolved around the manufacturing industry. Today, we are in the midst of a service revolution that is rapidly transforming industries and changing some fundamental assumptions we have about business and economics. Increasingly, the size of the service economy’s contribution to gross domestic product is more than 70% in the U.S. and other developed countries, while the share of employment in services exceeds 80% in the U.S. and continue to rise (Fitzsimmons and Fitzsimmons 2000; Salzman 2000). These trends imply that further research and discovery is needed to gain an enhanced perspective and insight into these issues as they are becoming increasingly relevant to almost any organizational stakeholder.

Environmental issues and their implications for business performance therefore present tremendous research opportunities for traversing the growing and changing gap in how environment issues uniquely and collectively impact the value adding process in manufacturing firms and service firms (Sasser et al. 1978). This gap has been acknowledged by (Kassinis and Soteriou 2003). These authors conclude that “In practice, we know little about the environmental impacts of most service operations, how they can be managed, and what impact the environmental practices service firms adopt have on performance.” The identification of this gap prompts us to investigate the relationship between green operations and firm’s financial performance in both manufacturing and service industry simultaneously.

The paper herein identifies three key environmental operations that are important antecedents to a firm’s financial performance in the context of manufacturing and services industry and is organized as follows. In the next section, we review the literature about environmental operations and practices as well as firm-level performance. Next, we raise our research questions and put forward a theoretical framework to explain the relationship between green operations and firm’s performance. Empirical data for theory testing is collected from Compustat, a database of financial, statistical and market information on active and inactive global companies throughout the world, and Newsweek, an information gatekeeper that enables consumers to access a list of environmental friendly companies. Following the presentation of the methodology and the analysis used in our study we interpret our findings, present conclusions and outline implications and future research.

### ***Theoretical Foundation and Hypotheses Development***

#### **Green Operations**

Traditionally, environmental issues have attracted the attention of researchers in various areas of operations management. The scope of research ranges from studying operational problems such as green product and process development, lean and green operations management, to remanufacturing and closed-loop supply chains (Bai and Sarkis 2010; Corbett and Klassen 2006; Kleindorfer et al. 2005). Environmental perspectives on operations lead to different terminologies with varying scope. One term emerging from the literature is “green operations.” It relates to all aspects related to product manufacturing, usage, handling, logistics and waste management once the design has been finalized (Srivastava 2007).

Research on green metrics is evolving and is playing an important role among practitioners. It provides managers with useful metrics that can be used to monitor their firms’ environmental efforts as well as to support decision making process related to business operations (Golicic et al. 2010). In the research community, MSCI ESG Research, a leading source of environmental, social, and governance ratings collaborated with NEWSWEEK to develop green metrics. Trucost, a firm that specializes in quantitative environmental performance measurement; and CorporateRegister.com, the world’s largest online directory of social responsibility, sustainability and environmental reporting also worked toward the same goal as the previous two firms. All these companies have adopted terms such as “environmental impact score”, “green policies and performance score”, and “reputation survey score” in their assessments of environmentally responsible (green) practices among 500 publicly traded U.S. companies.

From the above sources, a company’s environmental impact score that was obtained using more than 700 metrics is a key performance indicator comprising 90 percent of the overall environmental impact of a company’s global operations and 10 percent of disclosure of those impacts. To accommodate the fact that some companies operate in more than one industry, Trucost uses a benchmarking system for each of those sectors from publicly disclosed environmental data (e.g. the EPA Toxics Release Inventory). Trucost also scrutinized the quality of any outside data first before its usage.

The second metric, “Green policies and performance score”, are viewed as a set of rules and guidelines that regulate all operations of a company. The Green Policies Score, derived by MSCI ESG Research, was measured with more than 70 individual indicators in five categories. Among these categories, regulatory compliance, lawsuits, controversies, and community impacts, emphasize how well each company manages its carbon or non carbon emissions to air, water, and land. MSCI ESG Research also reports that life-cycle impacts each company’s products and services. It also impacts how well each company manages and uses its local resources; and the quality of each company’s track record of managing environmental risks. MSCI ESG Research drew data from a variety of sources such as company-disclosed information; dialogues with companies; media coverage; and government, NGO, and third-party research.

The last metric, the “Green reputation”, reflects the public image of the firm in relation to its attitude and actions toward environmental issues when managing its operations and product lines. It was obtained from an opinion survey of corporate social-responsibility professionals, academics, other environmental experts who subscribe to CorporateRegister.com and CEOs from all companies on the NEWSWEEK U.S. 500 publicly traded companies. Each respondent was asked to rate a random sample of 15 companies on a sliding scale (100 to one) from “leader” to “laggard” in three key green areas: environmental performance, commitment, and communications. Detailed procedure on how these variables were measured is available on newsweek.com.

A number of authors have proposed research frameworks to assess business performance of environmental responsible firms. Beamon (1999) described performance measures appropriate for the extended supply chain. Labuschagne and van Erck (2005) and Chinander (2000) also contributed frameworks and methods by which a firm can incorporate environmental objectives into their operations. Building on these environmental score and concepts from Trucost and CorporateRegister.com, we study the relationship between green operations (measured by environmental impacts, green policies and performance and reputation survey) and firm performance in manufacturing and service industry.

### ***Organizational Performance***

Historically, financial measures such as return on sales (ROS), return on assets (ROA), return on equity (ROE), and return on invested capital (ROIC) have been used in the literature to evaluate the interests of various stakeholders in the market place (Hart and Ahuja 1996; Hiroki and Keisuke 2010; Klingenberg and Geurts 2009; Sarkis and Cordeiro 2001). In modeling capital borrowed by stockholders from creditors and investors as well as their equity capital contribution, Konar and Cohen (2001), Russo and Fouts (1997), Elsayed and Paton (2005), Nakao et al. (2007), and King and Lenox (2002) have used ROA, Tobin's  $q-1$ , ROS, ROE, and return on capital employed (ROCE) to measure firm financial performance. Using the argument that managers are more open to offering their perceptions rather than offering precise quantitative data, other scholars use subjective perceptions of managers to assess firm financial performance (Correa et al. 2008; Judge and Douglas 1998; Sharma and Vredenburg 1998).

The study herein is concerned with a firm's performance relative to the market and its competition. Debt ratio (DR), profit margin (PM), return on total assets (RTA), and market to book ratio (MBR) are recognized as important dimensions to firm's financial performance (Slywotzky et al. 2000). DR is defined as the total debt over total assets. PM, a primary variable most investors examine when analyzing a company's performance, measures the profitability of a company and represents the net income over the sales. The RTA represents the net income over the total assets, and the MBR represents the market price over the book value.

### ***Relationship between Environmental Practices and Organizational Performance***

A review of the literature on environmental issues indicates that a significant correlation exists between green practices and corporate profitability within any organization. Companies having higher scores on environmental criteria realize stronger financial returns than the overall market, whereas companies with poor scores have weaker returns (Correa et al. 2008; Estampe et al. 2010; McCrea 2010; Murphy 2002; Lee et al 2012 ; Zacharia et al. 2009 ; and Zu et al. 2010). The prevailing view is that incorporating environmental variables into firms' activities often impacts costs because additional requirements have to be met to this end. This in turn impacts firm-level financial performance (Porter and van der Linde 1995; Reinhardt 1999; Zu et al. 2008).

Empirical studies that have analyzed the relationship between environmental operations and practices and financial performance at the firm-level are fragmented across industries. Widely-cited research results relate environmental operations and practices to a firm's stock market performance, market valuation, and competitive advantage (Corbett and Klassen 2006; Hiroki and Keisuke 2010; Klingenberg and Geurts 2009). Most of these studies suggest that environmental performance is positively correlated with the intangible asset value of S&P 500 firms as well as firm market value (Dowell et al. 2000; Klassen and McLaughlin 1996; King and Lenox 2002; Konar and Cohen 2001). A study by Nakao et al. (2007) reveals that for the particular case of Japanese manufacturing sector, environmental performance improves ROA and Tobin's  $q - 1$ . From a competitive perspective, Porter and van der Linde (1995), Rao and Holt (2005), Dao et al. (2011), and Reinhardt (1999) suggest that environmental operations can improve firm-level financial performance and overall competitiveness through green products or services.

These authors also argue that poor environmental performance can reduce a firm’s market valuation. The literature also reveals “green” firms to be more efficient and innovative (King and Lenox 2001; Porter and van der Linde 1995).

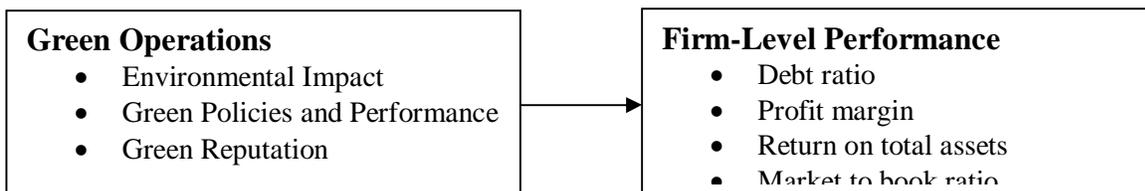
Although most studies find a positive correlation between environmental performance and firm-level performance, some results are conflicting and ambiguous (King and Lenox 2002). For example, Kiernan (2001) and Derwall et al. (2005) show that environmental performance and firm-financial performance is negatively correlated. A study by Min and Galle (1997) suggests that compared to liabilities and product disposal costs, competitive advantage plays a relatively minor role for managers considering green purchasing. In addition, Walley and Whitehead (Walley and Whitehead 1994) argue that corporate environmental initiatives generate unrecoverable costs, divert resources from other productive investments, and conclude that they are unsustainable. While previous approaches linking environmental operations and practices to firm-level performance seem to be fairly comprehensive and contribute significantly to our knowledge, existing empirical evidence so far has been limited to manufacturing sector (Klassen 1993; Klassen and Whybark 1999).

However, environmental operations and practices have been shown to be an important component of a service firm’s operations (Kassinis and Soteriou 2003). Despite this recognition, research on environmental issues in the context of services industry is limited. Kassinis and Soteriou (2003) argue that the results found in this literature is “limited by the case study or anecdotal nature of the evidence they are based on” and acknowledge the need for further empirical work to assess the relationship between environmental practices and firm-level performance in the service industry. The relative scarcity of research examining these two variables and the fact that prior approaches do not report consistent findings with regard to explaining how green operations impact firm-level performance both in manufacturing and service industry (Dowell et al. 2000; King and Lenox 2002; Klassen and McLaughlin 1996) motivates the need for the study conducted herein. It is our contention that by jointly examining the impact of environmental practices to firm-level performance in manufacturing and service industry, we can substantially contribute toward the findings of earlier studies.

**Research Framework**

The research framework guiding our investigation is illustrated in Figure 1. We draw on concepts from the interrelated literature streams of environmental operations, practices and corporate growth to propose a research model that assesses a direct effect between green operations and firm-level performance. Our framework suggests that firm-level performance is impacted by three green operation factors: environmental impact, green policies and performance, and green reputation. Other potential factors that may impact firm-level performance are not included in his study due to the limitation of the data.

**Figure 1: Research Framework**



**Research Methodology**

The focus of this research is on the top 500 publicly traded companies of 2010 as identified by their levels of revenue, market capitalization and number of employees. The score of green operations for each company was obtained from Newsweek (Oct 18, 2010). The financial performance of each company was obtained from Compustat. 19 companies were dropped because of missing data in Compustat and the sample size is reduced to 481. In addition, each company was classified into manufacturing or services industry based on its major business activities. There are 62% (298) manufacturing companies and the rest (183) belong to services industry.

**Data Analysis and Discussion**

In this section, regression analysis will be used to test if differences exist in the level of overall green operations between manufacturing and services firms found in the top 500 publically traded companies.

Six regression analyses will be conducted to identify how green indicators impact financial performance measures such as Debt Ratio, Profit Margin, Return on Total Assets, and Market to Book Ratio.

### ***Green Operations between Manufacturing and Services Industry***

A series of t-tests were conducted to see whether there is a difference in overall score and the score for each green operations measure (see Table 1). Examining Table 1, a significant difference in environmental impact and reputation survey score is found between manufacturing and services industry. The companies in manufacturing industry have a lower score in environmental impact and a higher score in reputation survey than those in the service industry. The lower environmental impact score for manufacturing companies may be explained by the nature of the industry which includes the activities of making physical products and therefore have a more direct impact on environment. Interestingly, a higher reputation score for manufacturing industry may in part come from the need for manufacturers to disclose their green operations in order to comply with governmental regulations and/or obtaining certain certification. In addition, no significant differences were found in term of green policies and performance score in both industries. These additional results represent important findings for both practice and research. They provide new insights to the practitioners in the manufacturing industry who are currently involved in green practices or who are planning their practices in this regard, toward enhancing their green operations for better performance outcomes.

### ***Green Operations and Financial Performance in Manufacturing Industry***

The results of green operations on each financial performance indicator for manufacturing industry are found in Table 2. Examining Table 2, green operations were found to have a significant impact on three of four financial indicators (Debt Ratio, Profit Margin and Market to Book Ratio). Specially, a higher environmental impact score is negatively associated with debt ratio and is positively associated with profit margin, indicating that a company's initiatives to reduce environmental impact of its operation does lead to a low debt ratio and a high profit margin. The findings also show that a higher score in green policies and performance leads to a higher market-to-book ratio, indicating positive stock market reaction to green initiative. In addition, the results show that reputation scores do not have a significant impact on any of the four financial indicators.

### ***Green Operations and Financial Performance in Services Industry***

The results of green operations on each financial performance indicator for the services industry are found in Table 3. The results show that green reputation score is associated positively with debt ratio and market to book ratio, indicating that a company with a good reputation in managing environmental impact has a higher debt ratio and a higher market-to book ratio.

In aggregate, the results of this study suggest that the impact of green operations differs among manufacturing and service firms found in the top 500 publically traded company. In the manufacturing industry, environmental impact score and green policies and performance score will have an impact on a firm's financial performance; while in service industry; green reputation plays a more important role in impacting its financial performance.

### ***Conclusion and Implication***

This study investigates the relationships between green operations and organizational performance for top 500 publicly traded companies in the US. Green operations were measured by three indicators (environmental impact, green policies and performance, and green reputation) while organizational performance were measured by debt ratio, profit margin, return on total assets and market to book ratio. Significant differences were found between companies in the manufacturing industry and service industry regarding green operations, organizational performance, and the impact of green operations on organizational performance.

First, the results show that companies in the manufacturing industry have a lower score in environmental impact and a higher score in green reputation than those in the services industry. The findings indicate that manufacturing companies have a stronger negative impact on environment because of all production activities involved. In addition, higher green reputation score in the manufacturing industry also shows companies in this sector are more likely to publicize their environmental related initiatives and thus have a better reputation.

Second, it we found that in the manufacturing industry, environmental impact score and green policies performance score have an impact on organizational performance. This result indicates positive impact of green operations on organizational performance in manufacturing industry. This finding is consistent with some of previous studies.

Third, the results also show that in the service industry, green reputation has a significant impact on the market performance of a firm (measured by debt ratio and market to book value). The firms with a higher green reputation score have a higher debt ratio and a higher market to book value. The results may indicate that higher reputation score is helpful in obtaining a loan and boosting stock price for service companies. Interestingly, environmental impact score and green policies and performance score (that represent the direct measurement of green operations) do not have a significant impact on organizational performance. This may indicate that the impact of green operations on organizational performance is indirect and the companies with a better public image regarding its environmental initiatives will have a better market performance in service industry.

To further explore the impact of green operation on organizational performance, future studies may investigate the impact of green operations by section in each industry. For example, in the manufacturing industry, one study could examine the impacts of green operation in each industry sector (Basic Materials, Consumers Products, Food and Beverage, General Industrials, Industrial Goods, Oil and Gas, Pharmaceuticals, Technology, Transport, and Aerospace and Utilities); while in the service industry, another study could examine how the impact of green operations differ in sectors such as in Banking and Insurance; Financial Services; Health Care; Media, Travel, Leisure; and retail. In addition, further studies may explore the impact of green operations on organizational performance on a longer period by collecting a firm’s financial performance on multiple years. For example, it will be of interest to see how green operation impacts the financial performance of an organization in the current year, a year after and two years ahead. Other future studies may incorporate other contextual variables, such as firm size, organizational culture, environmental pressure, etc.

**Table 1: t-tests on Green Operations between Manufacturing and Service Industry**

Green Operations Indicator	Industry Sector	N	Mean	t	Significance
Environmental Impact Score	1 (Manufacturing)	298	.42	-8.14	0.00
	2 (Services)	183	.63		
Green Policies and Performance Score	1 (Manufacturing)	298	.43	1.32	0.19
	2 (Services)	183	.41		
Reputation Survey Score	1 (Manufacturing)	298	.50	4.35	0.00
	2 (Services)	183	.44		

**Table 2: Regression Analysis (Manufacturing Industry)**

Independent Variables	Dependent Variables							
	Debt Ratio		Profit Margin		Return on Total Assets		Market to Book Ratio	
	Standardized Coefficient	Sig.	Standardized Coefficient	Sig.	Standardized Coefficient	Sig.	Standardized Coefficient	Sig.
Environment Impact Score	-.290	<b>.000</b>	-.115	<b>.056</b>	-.062	.305	.008	.892
Green Policies and Performance Score	.104	.111	.104	.120	.112	.096	.168	<b>.012</b>
Reputation Score	.020	.756	.085	.202	.060	.367	.019	.771
R	.28		.17		.15		.18	
R <sup>2</sup>	.08		.03		.02		.03	
F-statistics	8.42		2.94		2.12		3.32	
Significance	<b>.00</b>		<b>.03</b>		.09		<b>.02</b>	

**Table 3: Regression Analysis (Service Industry)**

Independent Variables	Dependent Variables							
	Debt Ratio		Profit Margin		Return on Total Assets		Market to Book Ratio	
	Standardized Coefficient	Sig.	Standardized Coefficients	Sig.	Standardized Coefficient	Sig.	Standardized Coefficient	Sig.
Environment Impact Score	-.125	.091	.018	.817	-.103	.165	-.138	.062
Green Policies and Performance Score	-.120	.129	-.007	.934	-.040	.615	.035	.653
Reputation Score	.168	<b>.033</b>	-.065	.420	-.135	.087	.175	<b>.026</b>
R	.22		.07		.19		.23	
R <sup>2</sup>	.05		.01		.04		.05	
F-statistics	2.98		.29		2.22		3.37	
Significance	<b>.03</b>		.34		.09		<b>.02</b>	

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