Connecting the Environmental Activities of Firms with the Return on Carbon (ROC)

Mapping and Empirically Testing a Carbon Sustainability Balanced Scorecard (SBSC)

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Abstract

This study aims to explain why firms' environmental activities can lead to better financial performance. Most prior empirical research has shown that environmentally friendly firms enjoy higher stock returns and/or higher stock prices, relative to less environmentally friendly firms. However, the process for achieving better performance was not clear. We use the Sustainability Balanced Scorecard (SBSC), a tool to enhance financial performance through managing nonfinancial indicators, to show how "it pays to be green." Specifically, we map a Carbon SBSC strategy map, selecting environmental and financial indicators to include. We then conduct an empirical study to test the hypothesized relationships displayed on the Carbon SBSC. The empirical results support our hypotheses on causality. This study contributes to extant research by articulating logical relationships between firms' environmental activities and financial performance through a Carbon SBSC strategy map, and by testing the relationships using data for firms in Japan.

Keywords: Sustainability Balanced Scorecard (SBSC), carbon, nonfinancial indicators, environmental activities

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1. Introduction

Most extant research has shown "it pays to be green," finding that environmentally conscious firms enjoy higher financial performance and/or higher stock returns, relative to less environmentally conscious firms (e.g., Margolis and Walsh 2003; Orlitzky et al. 2003; Wu 2006; Beurden and Gössling 2008; Garcia-Castro et al. 2010). This may sound puzzling, as becoming an environmentally friendly firm entails costs, and thus reduces earnings and/or cash flows. Saka and Oshika (2011a, 9) empirically find that, on average, firms with higher CO_2 (carbon dioxide) emissions, which are harmful to the earth, have lower market capitalization. They also find that firms that reduced CO_2 emissions enjoy higher stock returns. In conjunction with popular valuation models (e.g., discounted cash flow models, residual income models), these results suggest that the stock markets estimate that environmentally friendly firms will earn higher earnings/cash flow in the future. In this

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sense, nonfinancial performance measures pertaining to the volume/reduction of CO_2 emissions could be leading indicators of future financial performance.

In terms of financial vs. nonfinancial performance, Johnson and Kaplan (1987) criticize reliance on traditional financial performance measures alone for management purposes, and point out the importance of nonfinancial indicators. Proponents of the Balanced Scorecard (BSC) have subsequently argued that the BSC is an evaluation system incorporating financial and nonfinancial indicators (Kaplan and Norton 1992; Kaplan and Norton 1996). In other words, the BSC concept, combined with the concept of the more recently proposed strategy map, can function as a strategic management system (Kaplan and Norton 2001, 2004). By using the BSC concept and strategy map, we can develop causal relationships to explain how nonfinancial indicators lead to financial performance. In this paper, we focus on firms' environmental activities as nonfinancial indicators.

We hypothesize the causality of "it pays to be green" using a Sustainable Balanced Scorecard (SBSC). Specifically, we first develop a SBSC strategy map that sets the return on carbon (ROC) as the highest-level indicator (or ultimate objective). We call this map a Carbon SBSC strategy map. In a Carbon SBSC strategy map, the ROC comprises environmental and economic strategies. Further, the Carbon SBSC shows lower-level components (the firm's environmental activities) and depicts the relationships between environmental activities and financial indicators.

We then undertake an empirical investigation of the causal chain that connects the firm's environmental activities and financial performance. All the hypothesized relationships among the internal and outside perspective variables of the SBSC are supported, except for variables using carbon emissions, due to data unavailability.

Our contributions to this body of research are as follows. First, ours is the first study to develop a Carbon SBSC strategy map. Given that traditional management systems are financially oriented, it may be difficult to evaluate properly the relationships between a firm's environmental activities and financial performance. Under the current business environment, which demands sustainable management, management systems need to incorporate nonfinancial indicators of firm performance. Our Carbon SBSC strategy map, connecting financial and nonfinancial indicators, is one model for carbon management. Second, given this is also the first study to investigate empirically the causal chain between SBSC indicators, our results provide useful feedback for companies seeking to refine their SBSC strategy map in that we provide support for positive associations for variables in our hypothesized causal chain.

The remainder of the paper is organized as follows. Section 2 introduces the SBSC and Section 3 discusses related research. Section 4 develops the Carbon SBSC strategy map and hypotheses. Section 5 describes our sample selection and data collection and Section 6 discusses the results in light of our hypotheses. Section 7 concludes.

2. Background of Sustainability Balanced Scorecard

With the growing worldwide attention to global environmental issues, the SBSC, an environmental or sustainability-conscious BSC, has been developed. In essence, the SBSC adds environmental and social concerns to the four traditional perspectives of a BSC (financial, customer, internal business process, and learning and growth) to evaluate more comprehensively the performance of sustainability (environmental, social, and economic) activities. By combining a strategy map, a SBSC can function as a management system that helps ensure efficient and effective development and execution of a firm's corporate sustainability vision and strategy.

In the European Union (EU) alone, many studies of SBSCs have been undertaken. Among these, the European Commission (EC), the United Kingdom (UK), and Germany have conducted the most important government-level research projects in helping build momentum for the introduction of SBSCs into everyday

business activities. To start with, over three years starting in 2001, the EC launched a combined international industry-government-academia research project known as the European Corporate Sustainability Framework. This sustainability framework is a management model to tackle complicated issues such as corporate sustainability and corporate responsibility, and to support business organization, through the development of a Responsive Business Scorecard (RBS) as a form of SBSC. The RBS system integrates stakeholder's requests into the program to improve and evaluates performance on the 3Ps of sustainability, that is, profit, people, and planet. Although the most important factor of the conventional BSC approach is profit, the RBS approach grants equal consideration to people and planet (Woerd and Brink 2004).

In the UK, the SIGMA Project, conducted mainly by the Department of Trade and Industry (DTI) starting in 1999, published *The SIGMA Guideline: Putting Sustainable Development into Practice—A Guide for Organizations* in 2003. The main objective of the SIGMA Project was to provide ideas and tools to contribute to sustainability management in business. One output was the development of the SIGMA Sustainability Scorecard as a form of SBSC. The SIGMA Sustainability Scorecard covers an expanded set of stakeholders by including corporate, environmental, and social aspects, such as customers, suppliers, governments, local communities, and nature. This is because the ultimate objective of the SIGMA Sustainability Scorecard is to improve performance from a sustainability perspective, whereas the ultimate objective of a traditional BSC is to improve performance from a financial perspective.

In Germany, the Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety (Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit: BMU) and Stefan Schaltegger of the Centre for Sustainability Management at Leuphana University of Lüeneburg conducted most of the German government's research on sustainability management. The resultant research report published in 2002, *Sustainability Management in Business Enterprises: Concepts and Instruments for Sustainable Organization Development*, recommends that business enterprises use the SBSC to help ensure that they (BMU 2002, 115):

(i) identify the environmental and social aspects relevant for success,
(ii) create a causal link between the environmental and social aspects and the company's economic results,
(iii) enable management of all environmental and social aspects in line with their strategic relevance,
(iv) develop appropriate indicators and measures, and thereby,
(v) result in the integration of environmental and social management in conventional economic management.

In this manner, a SBSC theoretically has not only economic aspects but also environmental and social aspects, and makes clear the process in accomplishing economic, environmental, and social objectives together. However, prior work research has not empirically investigated the relationships among the objectives.

3. Literature Review

3.1 Impact of Corporate Environmental Performance on Financial Performance

A company's environmental performance may affect its financial performance. Research that has examined the impact of corporate environmental performance on corporate financial performance includes the following, although they are not based on a SBSC approach. Cormier and Magnan (1997) use published corporate pollution information[1] to analyze the effects of pollution levels on stock market valuation. Their results suggest that in the pulp and paper, chemical, and oil refining industries, the level of pollution is negatively associated with market value. Hughes (2000) examines the relationship between sulfur dioxide (SO_2) emissions as reported under the US Clean Air

[1] Cormier and Magnan (1997) used water pollution data published annually by the Environment Ministries of the provinces of Quebec and Ontario (Canada).

Act and market value, finding a negative association between the SO_2 emission ratio of high-polluting electric utilities and firm market value. In other work, Konar and Cohen (2001) use data on chemical releases (Toxics Release Inventory) and environmental litigation incidents (Form 10-K disclosures) and find that bad environmental performance is negatively correlated with intangible asset value (Tobin's *q*). Konar and Cohen (2001) also demonstrate that chemical emissions have a significant negative impact on company market value.

With regard to the impact of soil pollution on market value, Barth and McNichols (1994) estimate corporate potential environmental liabilities from soil pollution (US EPA's Superfund[2]) and found the potential liabilities had a significant negative impact on firm value. Similarly, Garber and Hammitt (1998) indicate that additional environmental liability (Superfund exposure) appears to increase the costs of capital for larger chemical companies. Likewise, Bae and Sami (2005) indicate that the earnings response coefficients for companies with potential environmental liabilities are lower, that is, potential environmental liabilities create noise in corporate earnings. Finally, Graham et al. (2001) find that soil pollution and cleanup costs[3] are significant negative factors in explaining corporate bond ratings.

Together, these studies indicate that environmental performance data have an effect on corporate stock prices, capital costs, and bond ratings. However, these studies do not study the process of how corporate environmental performance affects corporate financial performance. We use a SBSC strategy map to display hypothesized relationships between environmental activities and financial performance, and then empirically examine the relationships.

3.2 Connecting Environmental Activities with Financial Performance by SBSC Strategy Map

To implement environmental management, companies need to decide on an environmental mission and then develop an environmental vision and strategy to accomplish this mission[4]. To achieve this environmental vision and strategy, companies must then establish a management system to implement the environmental strategy efficiently and effectively and comprehensively evaluate the performance of their environmental activities. For this kind of management system, the BSC (Kaplan and Norton 1992) can be useful in developing such a management system. The environmentally-oriented extension of the BSC is called the SBSC. In addition to the previously described research, there exist case studies and action research on SBSCs. These studies include Zingales and Hockerts (2003) (Novo Nordisk, Shell), Zingales et al. (2002) (Shell), Guerrero et al. (2002) (Flughafen Hamburg GmbH), Bieker et al. (2002) (Volkswagen AG), and Ito et al. (2001) (Ricoh and Takara).

To categorize how studies connect corporate environmental activities and financial performance, Oka (2010) classifies SBSCs in previous work into the following three types (Figge et al. 2002):

(i) Subsumption SBSC: the subsumption of environmental and social aspects into the traditional four BSC perspectives,

(ii) Addition SBSC: the addition of a fifth environmental and social perspective to the four traditional BSC perspectives, and

(iii) Integration SBSC: the setting of four or five new perspectives that completely differ from

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[2] The two relevant laws are the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 and the Superfund Amendments and Reauthorization Act (SARA). Together, these laws determine who bears the cost of and responsibility for soil and groundwater contamination cleanup with strict liability, no-fault liability, joint liability, and retroactive responsibility as features. Under this legislation, many companies have accrued considerable decontamination costs along with legal costs and damages.

[3] Graham et al. (2001) employ the following four data items in their analysis: (1) the number of letters of notice from the EPA, (2) the sum of capital costs of cleanup and operation and monitoring costs for all sites in which the company has been identified as a PRP, (3) costs allocated for particular Superfund site evenly among PRPs associated with the site, and (4) costs allocated on an equal basis only to those companies listed on Compustat.

[4] The mission of the organization provides the starting point; it defines why the organization exists or how a business unit fits within a broader corporate architecture. And the organization's vision paints a picture of the future that clarifies the direction of the organization and helps individuals to understand why and how they should support the organization. The vision creates the picture of the destination. The strategy defines the logic of how this vision will be achieved. Vision and strategy are essential complements (Kaplan and Norton 2001).

the four traditional BSC perspectives.

For organizations that want to incorporate environmental and social aspects into their existing BSC, the subsumption SBSC is the easiest SBSC to implement. The next type, the addition SBSC, can clearly demonstrate top management's emphasis on sustainability as the new (fifth) perspective communicates additional objectives and measures to employees. However, inclusion of the fifth perspective in the addition SBSC complicates the causal relationships with the existing four perspectives. Lastly, the integration SBSC sets completely new perspectives, which thereby can incorporate the concept of the triple bottom line[5] more deeply into the BSC, but requires development of a whole new BSC. Table 1 details the three types of SBSCs discussed in previous work.

Table 1- Three Types of SBSC from Previous Research

Type	Previous research	Perspectives				
Traditional BSC	Kaplan and Norton 1992, 1996	Financial	Customer	Internal Business Process	Learning and Growth	
Subsumption SBSC	Kaplan and Norton 2001, 2004	Financial	Customer	Internal Business Process	Learning and Growth	
	Novo Nordisk (Case)	Financial	Customer and Society	Business Process	Human and Organization	
	Shell (Case)	Financial Results	Customer	Human	Sustainable development	
Addition SBSC	Germany BMU	Financial	Customer	Internal Business Process	Learning and Growth	Non-market
	Ricoh (Case)	Financial	Customer	Internal Business Process	Learning and Growth	Environmental Protection
	Takara (Case)	Financial	Customer and Products	Process	Corporate Culture and Human Resource	Social and Environmental Activities
Integration SBSC	EU EC	Financiers and Owners	Customer and Suppliers	Internal Process	Employees and Learning	Society and Planet
	UK DTI	Sustainability	External Stakeholders	Internal	Knowledge and Skills	

In this study, we develop our carbon SBSC strategy map using the subsumption SBSC because it is the

[5] The concept of the triple bottom line was first coined by John Elkington, cofounder of the business consultancy SustainAbility, and states that companies should prepare three different bottom lines: a traditional bottom line (or "profit"), an environmental bottom line (or "planet"), and a social bottom line (or "people").

easiest modification of a traditional BSC that already includes the usual four perspectives. Moreover, environmentally friendly and socially responsible firms must also achieve financial success, consistent with the representation of a traditional BSC.

BSC advocates Kaplan and Norton (2001, 2004) integrate environmental and other social indicators into the four traditional perspectives of the BSC, thereby providing the subsumption SBSC. In their earlier study, Kaplan and Norton (2001) emphasize the importance of being a good corporate citizen and introduce "regulation and environmental processes" in the internal business process perspective. Kaplan and Norton (2004) use "regulation and social processes" as a substitute for "regulation and environmental processes" with four factors—not only "environment", but also "health and safety", "employment practices", and "investment in the local community". The cases of Novo Nordisk and Shell represent the subsumption SBSC.

BMU in Germany adds a fifth perspective, "Non-Market Perspective", to the four traditional BSC perspectives to create the addition SBSC. The purpose of including the "Non-Market Perspective" is to integrate any strategy-related environmental and social aspects, such as an activity's flexibility, legitimacy, and legality (Figge et al. 2002, 279–280). The cases of Ricoh and Takara represent the addition SBSC.

Representative examples of the integration SBSC include the RBS developed by the EC and the SIGMA Sustainability Scorecard developed by the UK DTI. The RBS consists of five different perspectives: (1) financier and owner, (2) customer and supplier, (3) internal business process, (4) employee and learning, and (5) society and planet. The SIGMA Sustainability Scorecard consists of four perspectives: (1) sustainability, (2) external stakeholder, (3) internal, and (4) knowledge and skills. These models emphasize a nonfinancial or sustainability perspective, although the financial perspective is the most important perspective in a for-profit firm's traditional BSC.

The extant SBSC research mainly employs normative, case, and action research methods (Figge et al. 2002; Schaltegger and Dyllick 2002; Dias-Sardinha and Reijnders 2005; Möller and Schaltegger 2005; Schaltegger and Wagner 2005; Wagner and Schaltegger 2006; Dias-Sardinha et al. 2007; Hansen et al. 2010; Kawai and Otomasa 2011; Hubbard 2009; Schaltegger 2011). Many BSC studies investigate the relationships between customer and financial indicators (e.g., Ittner and Larcker 1998; Malina et al. 2007), quality and financial indicators (e.g., Nagar and Rajan 2001), and employee and financial indicators (e.g., Wiersma 2008). They also include analyses of the relationships among the four BSC perspectives (e.g., Bryant et al. 2004) and the environmental perspectives (e.g., Hsu and Liu 2010; Elijido-Ten 2011). However, there is no research examining relationships between environmental activities and financial performance in conjunction with a SBSC. In the next section, we develop a SBSC model to connect environmental activities and financial performance and to investigate empirically the relationships.

4. Developing the Carbon SBSC Strategy Map And Hypotheses

We develop a Carbon SBSC strategy map in this section. Given that global warming has become an important topic discussed by the G20 Summit and the UN General Assembly and is increasingly recognized as a high-priority issue around the world, carbon management is critical. Carbon management ideally simultaneously achieves a reduction in CO_2 emissions and an improvement in economic return, in order to realize sustainable growth of corporate value. The Carbon SBSC strategy map is a tool for carbon management.

The development of the SBSC comprises a horizontal causal chain, including objectives, measures, targets, and initiatives within each perspective, and a vertical causal chain linking the perspectives. In this paper, we develop a strategy map for the Carbon SBSC by focusing on the vertical causal chain and adopting the integration SBSC. That is, we integrate economic and environmental aspects in each perspective, given that the objective is to achieve economic and environmental performance simultaneously.

In developing the Carbon SBSC, and before establishing visions and strategies, we need to identify the mission the company undertakes with regard to carbon management. For example, the mission might be to achieve CO_2 emission reductions to fulfill social responsibilities such as the Kyoto Protocol, and to improve economic results to realize the sustainable growth of corporate value. Therefore, one possible vision is to balance CO_2 emission reductions with improvements in economic return. A corresponding strategy is then to improve the ROC, i.e., operating income divided by the volume of CO_2 emissions (in tons). This is a key eco-efficiency indicator.

Some integration SBSCs, like the Responsive Business Scorecard developed by the EC, have five perspectives. Adding a fifth perspective to an existing BSC increases the number of performance indicators that must be managed, and makes it incrementally more difficult to construct a vertical causal chain between perspectives. Accordingly, we develop a Carbon SBSC with just four perspectives: sustainability, external stakeholder, internal business process, and learning and growth. For each of these perspectives, we select performance indicators from the corporate social responsibility (CSR) database compiled by Toyo-keizai Publishers and other available data sources, and place them into their corresponding perspective, as shown in Figure 1.

For the sustainability perspective at the top of the strategy map, to achieve the ultimate objective of improving ROC, we first set two performance indicators, namely, "operating margin growth" as an economic strategy, and "CO_2 emission reduction" as an environmental strategy. Consequently, to increase operating income, we require sales growth and reductions in energy costs.

For the external stakeholder perspective, we include "acceptance in Social Responsibility Investment (SRI) (investor relations)", "ISO 14001 certification (supplier relations)", "eco label (consumer relations)", and "environmental law violation (government and local community relations)" as leading indicators, and "environmental brand ranking" as a lagging indicator. In addition, "energy input reduction" affects "energy cost reduction" in monetary units and "CO_2 emission reduction" in physical units. Both the sustainability perspective and external stakeholder perspective are outside perspectives.

Next, we develop the internal business process perspective and the learning and growth perspective to evaluate the firm's internal activities. For the internal business process perspective, we include "green supplies purchase", "green raw materials purchase", "eco design", "biodiversity conservation", "establishment of environmental management system (EMS)", "eco audit", "environmental accounting system", and "medium-term plan for CO_2 emission reduction" as leading indicators, and "recycle", "waste reduction", "environmental burden reduction", "environmental conservation cost", and "economic benefit associated with environmental conservation activities" as lagging indicators.

Lastly, for the learning and growth perspective at the bottom of the SBSC, we focus on members inside the organization in much the same manner as the traditional BSC and include the "number of R&D staff", "environmental education", "environmental director", "environmental department", and "environmental policy".

Although Figure 1 presents our model of a possible Carbon SBSC strategy map, data for several of the indicators in Figure 1 are not currently available. Therefore, we simplified the Carbon SBSC strategy map to empirically investigate the causal chain from corporate environmental activities to the ultimate objective, namely, the improvement in ROC. As shown, the theoretical Carbon SBSC in Figure 1 has four perspectives, but we amend this to only two perspectives: an Outside Perspective (comprising the sustainability perspective and the external stakeholder perspective) and an Internal Perspective (including the internal business process perspective and the learning and growth perspective). Given the limits imposed by data availability, we remove the employee- and education-related indicators from the learning and growth perspective; some indicators related to investors, suppliers, government, and the local community from the external stakeholder perspective; and a number of other indicators. Figure 2 depicts our simplified Carbon SBSC strategy map that we will use for our empirical analysis. Thus, our hypotheses are very simple; whether the hypothesized

relationships in Figure 2 can be supported.

Figure 1- Carbon SBSC Strategy Map

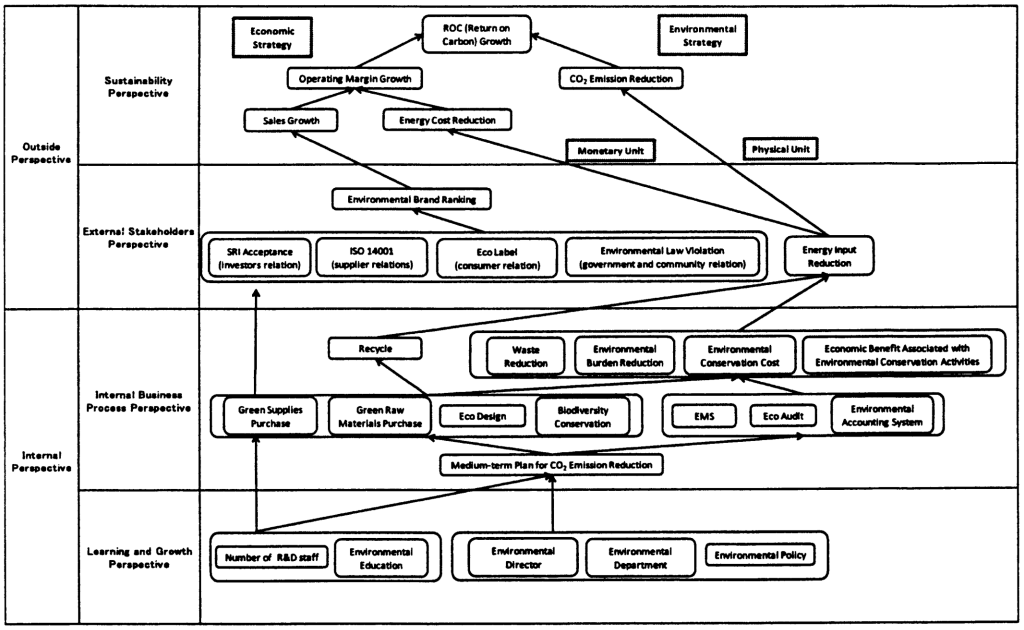
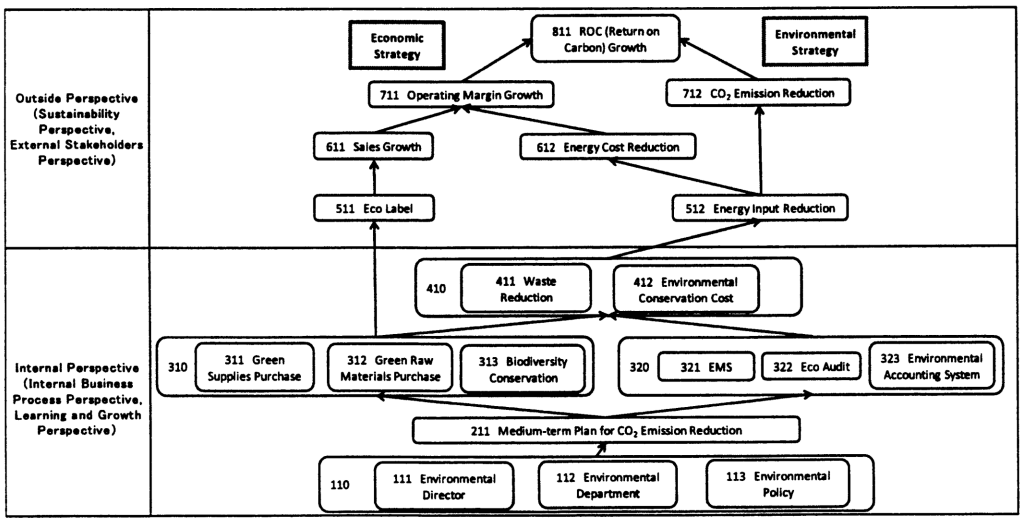


Figure 2- Simplified Carbon SBSC Strategy Map for Empirical Analysis



5. Sample Selection and Data Collection

We now conduct an empirical analysis to see whether our hypothesized relationships depicted in Figure 2 are

supported. We limited our sample to companies with a March fiscal year end, representing about 80 percent of listed companies. We believe our sample is representative of all listed Japanese companies, as the sample characteristics (e.g., firm size, industrial distribution) are similar to those of the population.

To undertake the empirical analysis, we gathered the data from various sources. For Items 1*xx* to 5*xx* (see Figure 2), we used the 2011 CSR database published by Toyo-keizai Publishers. This database is compiled from responses to questionnaires sent to all listed companies and some large unlisted companies in Japan. For 2011, the most recent year of the database, 1,132 companies are included in the database. For the financial performance data (i.e., Items 6*xx* to 8*xx*), we use the Nikkei NEEDS-Financial Quest database. Finally, we attempted to obtain data for Item 712 and Item 811 from the greenhouse gas (GHG) emissions database released by the Ministry of Environment under the Act concerning the Promotion of Global Warming Countermeasures[6]. However, the GHG emissions data corresponding to the 2011 CSR data were not available at the time of our empirical analysis. Even though we could not analyze the relationships between the firms' ultimate goal (i.e., improving ROC) and firms' activities and financial performance, our empirical analysis makes a contribution to the literature, as this is the first paper to see whether the relations within the firms' internal activities, and the relationships between internal activities and financial performance is empirically supported.

6. Results of the Analysis

6.1 Relationships among Variables within Internal Perspective

Table 2 provides an explanation of the variables included in the Internal Perspective (i.e., Items 1*xx* to 4*xx*). We treat Items 411 and 412 as dummy variables for several reasons, even though numerical measures are available. First, the reported numbers lack reliability. They are not audited, and the calculation method is up to the companies and thus the reporting is not uniform. In this sense, the numbers contain noise. Second, not all companies that answered the 2011 CSR answered these questions. For example, the response rate of Item 411 is 41.4%. Thus, we assume that the companies that did not answer these items are the companies that do not manage the amount, relying on the notion of "You can't manage what you can't measure." For Item 411, companies may fail to reduce waste in that they do not measure the current amount of waste. Similarly, companies cannot facilitate investment in environmental conservation (for Item 412) if they do not know the current monetary investment. For these reasons, we treat Item 411 and 412 as dummy variables. This treatment, of course, reduces the information content of these variables, but we place priority on the reliability.

Following this treatment, all variables in the Internal Perspective are now dummy variables. Therefore, we employed a chi-squared test on the relationships between the items. We hypothesize that companies with a value of 'Yes' for a lower-level variable item are more likely to have a value of 'Yes' for a higher-level variable item.

Table 3 summarizes the results. As shown, all the hypothesized relationships in Figure 2 are supported at statistically significant level. For example, firms with a director, a department, and/or a policy concerning environmental issues (i.e., Item 110 is 'Yes') are likely to have a medium-term plan to reduce GHG emissions (i.e., Item 211 is 'Yes'). Also, firms with a medium-term plan to reduce GHG emissions are likely to take care of the earth by actually buying green supplies, green materials, and/or conserving biodiversity (i.e., Item 310 is 'Yes'), and to have a scheme to support the plan by developing an EMS, eco audit system, and/or environmental accounting system (i.e., Item 320 is 'Yes'). The relationships between all sub-items (e.g., Item 111 and 211 have a positive correlation) are also statistically supported; to avoid undue complexity, we do not tabulate this information.

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[6] This act introduced a scheme requiring the calculation, reporting and public disclosure by businesses of their greenhouse gas emissions. This scheme aimed to encourage businesses to recognize their own emissions status and promote voluntary corporate actions to reduce emissions, while making emissions information more transparent to the public. Under this act, businesses with 21 or more employees and generating more than 3,000 metric ton equivalents of CO_2 of greenhouse gases must calculate and report their greenhouse gas emissions from financial year (FY) 2006 to the Ministry of Economy, Trade and Industry and the Ministry of the Environment, which then aggregates and publishes the data. This was the world's first publicly available CO_2 emissions data obtained from businesses.

Table 2- Explanation on Variables in Internal Perspective

Item		Explanation	Corresponding item in 2011 CSR database
110			Yes if at least one of Item 111, 112, and 113 is Yes; No otherwise
	111	Environmental director	Presence or absence of director in charge of environment (Yes if the answer is either "Presence of full-time director" or "Presence of interlocking director"; No if the answer is either "Absence", "Other" or not answered)
	112	Environmental department	Presence or absence of department in charge of environment (Yes if the answer is either "Presence of environment department" or "Presence of department engaging environment and other"; No if the answer is either "Absence", "Other" or not answered)
	113	Environmental policy	Development of environmental policy (Yes if the answer is either "Developed" or "Under development"; No if the answer is either "Absence" or not answered)
211		Medium-term plan for CO_2 emission reduction	Specific description of mid-term plan to reduce GHG emissions (Yes if answered; No otherwise)
310			Yes if at least one of Item 311, 312 and 313 is Yes; No otherwise
	311	Green supplies purchase	Implementation of green supplies purchase (Yes if the answer is either "Implementation by Green Purchase Network Guideline" or "Implementation by company's own green purchase policy"; No if the answer is either "Non implementation", "Other" or not answered)
	312	Green raw materials purchase	Implementation of green raw materials purchase (Yes if the answer is either "Implementation by comprehensive guideline" or "Implementation by partial guideline"; No if the answer is either "No implementation", "No need to purchase raw materials for business" or "Other")
	313	Biodiversity conservation	Specific description of effort in biodiversity conservation activity (Yes if answered; No otherwise)
320			Yes if at least one of Item 321, 322, and 323 is Yes; No otherwise
	321	EMS (Environmental Management System)	Development of EMS (Yes if the answer is either "ISO14001certification", "ISO14001to be certificated", or "Company's own EMS"; No if the answer is either "No development", "Other" or not answered)
	322	Eco audit	Implementation status of eco audit (Yes if the answer is either "Implementation of regular eco audit" or "Implementation of non-regular eco audit"; No if the answer is either "No implementation", "Other" or not answered)
	323	Environmental accounting system	Development of environmental accounting system (Yes if the answer is either "Developed" or "Plant to develop"; No if the answer is either "No development" or not answered)
410			Yes if at least one of Item 411 and 412 is Yes; No otherwise
	411	Waste reduction	Description of waste volumes (Yes if answered; No otherwise)
	412	Environtental conservation cost	Description of the amount of environmental conservation investments and expenses (Yes if at least one is answered; No otherwise)

These results are straightforward. It is natural to see firms' positive attitude toward the environment in various ways if the firms are environmentally friendly. Even so, these results are important, as this is the first research to show that the relationships are empirically supported. In addition, this paper will help to reduce the complexity of future research when they need to decide which eco-friendly indicators to select. By observing high correlations among all variables, future research can pick items in the Internal Perspective section (i.e., Item 1*xx* through Item 4*xx*) as proxies of firms' activities toward environmental friendliness.

Table 3- Chi-squared Test Results for Internal Perspective

		Item 211		
		No	Yes	
Item 110	No	249	5	254
	Yes	315	507	822
		564	512	1076

χ^2= 277.4 ***

		Item 310		
		No	Yes	
Item 211	No	332	232	564
	Yes	54	458	512
		386	690	1076

χ^2= 272.4 ***

		Item 320		
		No	Yes	
Item 211	No	287	277	564
	Yes	26	486	512
		313	763	1076

χ^2= 273.0 ***

		Item 410		
		No	Yes	
Item 310	No	345	41	386
	Yes	274	416	690
		619	457	1076

χ^2= 249.9 ***

		Item 410		
		No	Yes	
Item 320	No	303	10	313
	Yes	316	447	763
		619	457	1076

χ^2= 278.7 ***

		Item 511		
		No	Yes	
Item 310	No	371	15	386
	Yes	479	211	690
		850	226	1076

χ^2= 106.3 ***

		Item 512		
		No	Yes	
Item 410	No	595	24	619
	Yes	85	372	457
		680	396	1076

χ^2= 679.3 ***

***Significant at the 0.1% level.

6.2 Relationships among Variables within Outside Perspective

Table 4 provides explanations of the variables employed in the Outside Perspective (i.e., Items 5xx to 8xx). We treat Item 512 as a dummy variable for similar reasons as described for Items 411 and 412.

We were unable to analyze Items 712 and 811 because the most recent GHG emissions data available are for FY2008, while our 2011 CSR data are for FY2010. As a result, our empirical analysis of the Outside Perspective is limited to that concerning the relationships between Items 511 and 611, 511 and 711[7], and 512 and 711. We employ the nonparametric Wilcoxon Rank-Sum test given that we cannot estimate the distribution of each item beforehand.

Table 5 provides the results. We observed a statistically positive association between Items 511, 611, and 711. The companies with eco labels on their products tend to achieve higher simultaneous sales growth and higher operating margin growth, when compared to the companies without eco labels. Similarly, the companies that try to reduce their energy input achieve higher operating margin growth. These results suggest that environmentally friendly firms can achieve better financial performance. Thus, if the performance superiority of eco-friendly firms persists, it is natural to see their higher market capitalization.

In summary, these empirical results support our hypotheses derived from our Carbon SBSC strategy map. Saka and Oshika (2011a) empirically suggest a positive relationship between eco-friendliness and market capitalization. This means the stock market expects that eco-friendly companies will achieve and maintain better performance (e.g., higher sales growth, operating margins, sustainability of sales, etc.), and our results show one possible process. Our empirical

[7] We also can see the relation between Items 611 and 711. As both items are numerical, it is not feasible to test the relationship using chi-squared analysis or Wilcoxon Rank-Sum test. Thus, we employed the Wilcoxon Rank-Sum test between Item 511 and 711. As a robustness check, we also examined the correlation coefficient between Items 611 and 711 and found it to be significantly positive.

results suggest that environmentally friendly firms tend to act in various ways (i.e., positive correlation among variables within the Internal Perspective). We also showed empirically that those firms achieve better financial performance simultaneously (i.e., positive correlations between variables in the Internal Perspective and the Outside Perspective, and positive correlations among variables within the Outside Perspective).

Some issues remain unclear. The issue of persistence (i.e., whether eco-friendly companies can maintain better performance) should be empirically tested in the future. In addition, differences across industries, and relationships between ROC and other variables remain to be examined.

Table 4- Explanation of Variables in Outside Perspective

Item	Explanation	Corresponding Item in 2011 CSR and other database
511	Eco label	Introduction of eco labels on products; "ISO14020 Type I", "Type II", and "Type III" (Yes if at least one is answered "Introduced"; No otherwise)
512	Energy input reduction	Description of energy input volumes (Yes if answered; No otherwise)
611	Sales growth	Sales in a given year divided by sales in the previous year
711	Operating margin growth	Operating margin (operating income divided by sales) in a given year minus operating margin in the previous year
712	CO_2 Emission Reduction	CO_2 emissions volume in a given year divided by CO_2 emissions volume in the previous year
811	ROC (Return on Carbon) growth	Item711 divided by Item712 in a given year minus those in the previous year

Table 5- Rank-sum Results for Outside Perspective

		Item 611							
		Average	Std. dev	Min	1Q	Median	3Q	Max	Wilcoxon (one-sided)
Item 511	0	1.115	0.913	0.011	0.967	1.035	1.121	17.727	1.798 *
	1	1.092	0.242	0.228	0.989	1.053	1.137	3.523	

		Item 711							
		Average	Std. dev	Min	1Q	Median	3Q	Max	Wilcoxon (one-sided)
Item 511	0	-0.875	20.403	-440.008	0.000	0.001	0.003	1.247	1.824 *
	1	0.023	0.061	-1.882	0.000	0.001	0.004	0.052	

		Item 711							
		Average	Std. dev	Min	1Q	Median	3Q	Max	Wilcoxon (one-sided)
Item 512	0	-0.713	18.431	-440.008	0.000	0.001	0.003	1.247	1.814 *
	1	0.032	0.087	-0.211	0.000	0.001	0.004	0.052	

*Significant at the 5% level.

7. Summary and Conclusion

Many studies have examined the impact of corporate environmental activities on corporate financial performance. However, none of these illustrates the process through which corporate environmental activities affect financial performance and thereby we aimed to show a possible process. Although the SBSC is useful to evaluate corporate environmental activities and financial performance, and to investigate the improvement process, there is no prior research concerning the analysis of the causal chains among SBSC indicators.

In this paper, to examine the connections between environmental activities and financial performance, we first develop a Carbon SBSC strategy map (Figure 1), in which we show how firms' environmental activities can lead to financial performance. We then conduct an empirical analysis of the relationships in the Carbon SBSC strategy map using Figure 2, a simplified version of Figure 1. Our empirical results support positive associations that are consistent with the hypotheses derived from Figure 2. For the Internal Perspective variables, all of our hypothesized relationships in Figure 2 are statistically supported. For example, firms with a director, a department, or a policy concerning environmental issues (i.e., Item 110 is 'Yes') are likely to have a medium-term plan to reduce GHG emissions (i.e., Item 211 is 'Yes'). Our empirical results also suggested positive relationships between the Internal Perspective variables and the Outside Perspective variables. For example, the companies with eco labels on their products tend to achieve higher simultaneous sales growth and higher operating margin growth, when compared with the companies without eco labels. Similarly, the companies that try to reduce their energy input achieve higher operating margin growth. These results suggest that environmentally friendly firms can achieve better financial performance than firms that are less environmentally friendly.

Our study makes the following contributions. First, this is the first study to develop a Carbon SBSC strategy map. Given that traditional management systems are financially oriented, it may be difficult to evaluate properly the relationships between a firm's environmental activities and financial performance. Our Carbon SBSC strategy map is one model for carbon management connecting financial and nonfinancial indicators. Second, given that this is the first study to investigate empirically the causal chain between Carbon SBSC indicators, our results may be useful for refining the Carbon SBSC strategy map.

Some issues are left unaddressed. First and foremost, we could not confirm if the eco-friendly firms achieve their final objectives (i.e., ROC improvement), due to data unavailability. Expected forthcoming carbon emission data will provide further analysis potential to conduct empirical research on the relationships. Second, our empirical research was too simple to derive comprehensive conclusions. More detailed and precise analysis (e.g., multiple regressions using control variables) will yield more persuasive implications. Nonetheless, we consider our research as an incremental step in the ongoing investigation of sustainable management in firms.

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