

ABSTRACT

Title of dissertation: GREEN RIVALRY AND PERFORMANCE

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This study analyzes the competitive interactions between focal and rival firms in the domain of environmental management (EM) practices and the associated impacts on environmental performance and financial performance. Using competitive dynamics and institutional theory as a basis, the study contends that firm performance is impacted by behavior of both focal and rival firms, and perceptions of legitimacy. Our findings indicate that firms competing aggressively do benefit from their proactive approach, but significant dissimilarity of behavior from their rivals tends to negatively impact firm performance bringing issues of legitimacy to the forefront.

Subsequently, the study expands the work outlined above with a larger set of performance measures to look at the impact of rivalry on growth and long term shareholder value. Furthermore, this section also looks into the joint impact of environmental behavior and environmental performance on financial performance via a mediating model using various environmental performance measures. The findings indicate a partial mediation between EM behavior and financial performance from EM reputation and EM policy.

In the final part of the dissertation, the study presents exploratory work on two future research topics. The first topic expands the work from focal-rival dyads to include supplier networks as well. The second topic lays out a roadmap for future work in the area of credible EM signaling. This discussion dwells on issues surrounding *greenwashing* that has been reported in the popular media.

Given the visibility on sustainable activities across the entire spectrum, and the burden of *green* on firms, it is important to understand how firms are responding and if the returns justify their investments. This study contributes to this discourse by tying theory with behavior and adds additional clarity to firm behavior vis-à-vis *green*. From a methodological perspective, this study uses an original panel dataset using secondary data sources, which adds to the credibility of the results. The study has important managerial relevance at both the firm level and for policy making.

GREEN RIVALRY AND PERFORMANCE

by

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Chapter 1: Introduction

According to a report titled “*Green Manufacturing: An Inconvenient Reality*” in *IndustryWeek*, additional environmental regulations will continue to build pressure on manufacturers to adopt *green* manufacturing. As highlighted in this news piece “*In 2004 the business sector shouldered 65% of environmental regulatory costs, with manufacturers paying an average of \$4,850 per employee, according to a 2005 U.S. Small Business Administration report.*” The article creates a link between regulations, firm activities, environmental performance, additional costs, and the need for improved financial performance to offset added costs. In doing so, the above article raises several questions of interest. Are environmental management (EM) activities helpful or harmful to a firm’s performance? Given that firms and their rivals are vying for the same set of consumers, how is *green* competition impacting firm performance? How are firms competing? Do they have support from their suppliers and does that impact their performance? If firms are facing real competition then are the methods of competition transparent or are firms leveraging the information asymmetry to disseminate false information to seek unfair advantage? Given that firm operations primarily support its *green* agenda, this study takes a comprehensive look at the EM domain using signals as a proxy for operational activity and tries to explain firm behavior in the context of performance,

Several authors (Angell and Klassen, 1999; Kleindorfer et al., 2005) have advocated the need for integrating EM in the mainstream of operations management

research agenda. These studies acknowledge the action-outcome link while emphasizing the need for more integration with other disciplines including economics to better understand firm activity. Researchers have looked into sourcing, quality management, and other supply chain and operations management activities in the environmental context. King and Lenox (2001) look at the relationship between *lean* and *green*. Zhu and Sarkis (2004) look into the moderating effect of quality management and just-in-time between environmental practices and performance. Another area of interest in terms of *green* adoption by firms has been an emphasis on supplier selection. Researchers (Walton et al., 1998; Rao and Holt, 2005) have focused on the application of *green* criteria on supplier selection and integrating suppliers into the *green* objectives of the firm. Montabon et al., (2000) look at environmental and financial performance as a result of the adoption of ISO 14000. Klassen and McLaughlin (1996) look at financial performance in relationship to announcement of EM awards. The studies cited above have made important contributions to the field of environmental management research in the context of operations management. But, as noted by Montabon et al. (2007), much of the research looking at *green* behavior of firms has focused at a small subset of EM activities. Additionally, the impacts of EM on performance have been mixed and are further confounded by the fact that the studies undertaken are typically not supported by an underlying theory of firm behavior.

From a theoretical perspective, institutional viewpoints have often been used to explain the adoption of EM. As part of the institutional framework, policy and regulation driven research have been undertaken (Johnstone et al., 2010; Delmas and Montes-Sancho, 2011) by looking at patent filings or adoption of EM standards at the country

level, but this research does not provide insights into firm behavior at the operations level. In terms of regulations, as noted by Baylis et al. (1998), the type of regulation itself, for instance permit based as opposed to incident based, makes it difficult to apply any uniform criteria for assessing how firms internalize the impact of regulations into their operations. The institutional viewpoint has been partly successful in explaining the reason for EM adoption as a way to earn legitimacy, but it does not entirely explain the variance in EM adoption across firms. At the firm level, one needs to look into the quantum of a firm's environmental operations and the associated impact on a firm's environmental and financial performance to fully understand the EM choices being made by firms.

There is a growing evidence of voluntary adoption of EM practices by firms that aligns with Porter's (1991) "win-win" argument. In his exposition, the author challenged the traditional mindset that environmental regulations were harmful to firms; in fact he argued that the benefits could outweigh the costs if the regulations were properly structured. Porter (1991) advocated that benefits are achieved through innovation and by reduction and avoidance of pollution. In effect, Porter (1991) advocates a more competitive posture by going *green*. Several papers have extended Porter's argument from reactive adoption of environmental practices in response to regulations to proactive *greening* as a firm strategy (Hanna and Newman, 1995; Sanchez, 1997; Berry and Rondinelli, 1998). Hull and Rothenberg (2008) looked into the issue of corporate social responsibility (CSR) interactions with innovation and industry differentiation. They argue that corporate social performance (CSP) that includes being good stewards of the environment is a way for firms to differentiate and improve their financial performance,

especially in less innovative industries where competition through possibilities of innovation are lacking. Anecdotally, there is evidence that links firms in the same market to actions that could be construed as competition in the *green* domain. For example, Starbucks made the first move of replacing Styrofoam cups with paper cups, which was followed by McDonald's taking a similar step. More recently, Starbucks announced that it is introducing a one-dollar reusable cup for customers. The EM actions taken by Coca-Cola and PepsiCo to introduce bioplastics is well documented in the trade press as the "bottle wars."

In a first, Hofer et al. (2012) blend competitive dynamics viewpoint into operations management to look into the issue of competitive drivers of EM. By leveraging theory grounded in Schumpeterian economics and signaling, they find a positive association between rival and firm responses in terms of the scale of competitive environmental activities. Using competitive dynamics as a framework, this was the first study that explained firm behavior as an outcome of market based rivalry. Their study takes a comprehensive look at various possible EM activities, which would make up a firm's EM operations, as potential areas of competition to better understand firm behavior. In doing so, this work greatly augmented the observations made by others (Rao, 2002; Hull and Rothenberg, 2008) that firms do compete on the environmental dimension making moves and counter moves as they respond to each other to seek competitive advantage. Though Hofer et al. (2012) establish rivalry in the EM context, the study of EM rivalry in the framework of competitive dynamics is incomplete. Does EM rivalry impact performance? This question is central to this dissertation.

To seek answers to the question raised above, Chapter 2 looks at the impact of EM rivalry on firm performance, both environmental and financial. Chapter 3 extends the work done in the second chapter to look at a richer set of measures for additional insights into performance. More importantly, Chapter 3 also looks at a comprehensive model of EM behavior, EM performance, and financial performance to test out the various interactions. Chapter 4 brings more focus to the work done by Hofer et al. (2012) by expanding the set of rivals and developing additional measures to further our understanding of EM rivalry. Chapter 5 extends the work to boundary spanning activities to assess the impact of supplier EM behavior on focal firm performance. Finally, Chapter 6 builds out approaches for additional network level analysis, and the arguments for assessing credibility in the EM domain suggesting feasible approaches, to study these topics as part of future research beyond this dissertation.

Research Contribution

This study proposes to extend the Hofer et al. (2012) study in several different ways, including: 1) by looking at a larger and richer set of firm interactions in the *green* domain; 2) by looking deeper at the competitive landscape for identification of rivals to refine our assessment of competitor activity; 3) by looking at the performance impacts, both environmental and financial, of EM behavior; 4) by looking at boundary spanning EM behavior to include a firm's supplier network and its impact on firm performance; and 5) by using secondary sources of data to add credibility to the results. In doing so the study makes the following key contributions:

1. Chapter 2 – makes a theoretical contribution via original hypothesis supported by existing theories. This chapter also provides the empirical evidence to support the hypothesized relationships between EM rivalry and firm performance, both environmental and financial.
2. Chapter 3 – makes an empirical contribution via additional insights into the impact of signaling on environmental impact vs. environmental reputation¹/policy putting signaling in the spotlight. This chapter also garners additional insights into the impact of EM rivalry on different financial performance measures. Furthermore, the empirical analysis in this chapter provides a comprehensive understanding of the different ways in which EM behavior affect financial performance via a mediating model of environmental performance.
3. Chapter 4 – makes an empirical contribution through continued emphasis on studying rivalry in the EM domain via additional competitive dynamic measures.
4. Chapter 5 – makes an empirical and theoretical contribution via expansion of the EM domain beyond firm boundaries answering the call for more research at the supply chain network level.
5. Chapter 6 – this chapter outlines future research topics. It discusses approaches for extending the supplier network analysis. Additionally, it lays the theoretical foundation and feasible approaches for empirical research into the issue of credibility of EM signals for a more meaningful analysis of firm performance.

¹ The terms environmental reputation and environmental image are used interchangeably throughout the dissertation.

Chapter 2: Competitive Dynamics and Performance

Introduction

Environmental management practices are an important topic in the supply chain literature (Klassen and McLaughlin, 1996; Gattiker and Carter, 2010; Sarkis et al., 2010; Hofer, Cantor, and Dai 2012). Environmental management practices include reduction in greenhouse gas emissions, reduction in water consumption, use of renewable energy, reduction in solid waste, and improved land use. Increasingly, customers, employees, suppliers, and the general public are paying close attention to corporations' sustainability and environmental management activities. Moreover, there is evidence that firms engage in competitive environmental moves and counter-moves as a means to enhance their environmental image. For example, Starbucks made the first move of replacing Styrofoam cups with paper cups, which was followed by McDonald's taking a similar step. More recently, Starbucks announced that it is encouraging customer owned tumblers as a further step to enhance its environmental image. (Wizness Community, 2012). The actions and counteractions taken by Coca-Cola and PepsiCo are also well documented in their race for introduction of bioplastics into their bottles (Bioplastic Innovations, 2012). Accordingly, it is important to consider how environmental practices of focal firms and rivals impact the environmental and financial performance of the firm. A stream of research has examined the impact of environmental management practices on environmental and financial performance. Using secondary data on stock market returns, Klassen and McLaughlin (1996) find a positive association between environmental

management announcements and financial performance. Montabon et al. (2000) do not find a conclusive link between adoption of ISO 14000 standards and overall performance in terms of reduced costs, reduced lead-times or improved quality, but acknowledge the possibility of improved competitiveness. Montabon et al. (2007) finds that environmental management practices are correlated with several forms of firm performance. Rao (2002) did not find a significant link between environmental management practices and financial performance. Sarkis et al. (2010) find that environmental training practices mediate the link between stakeholder pressure and firm performance. While these studies have made important contributions to the literature, prior research has not examined how rivalry in the environmental management practice domain affects both the focal firm's environmental image and firm financial performance. This study seeks to fill this gap in the literature.

The purpose of this study is to build and test theory regarding how rivalry in environmental management activity affects a focal firm's environmental and overall firm performance. Specifically, the research questions in this study are: Does a focal and rival firm's environmental management signals impact a focal firm's environmental and firm financial performance? Does the dissimilarity between a focal and rival firm's environmental management signals impact a focal firm's environmental and financial performance? In addressing these questions, this study contributes to previous environmental management literature discussed above, and also extends the work of Hofer et al. (2012) by assessing the impact of firm EM rivalry on firm performance. This study makes several contributions to the supply chain literature. Importantly, the study builds theory with regard to how signals of competitive environmental management

activity among a focal firm and its rivals affect environmental and financial performance. This study leverages competitive dynamics and institutional theory to explain how a focal firm is motivated to improve its environmental and overall financial performance. The theory is tested with an original, multi-year data set of 3,224 focal-rival dyad pairs. Measures of EM signals are developed from content analysis of corporate sustainability reports, which is responsive to the call for the use of innovative data sources in OM by Boyer and Swink (2008). An environmental performance measure, specifically environmental image, is drawn from the *Newsweek US 500 Green Rankings* data, with firm financial data drawn from *Compustat*. We next turn to the development of the theoretical model.

Theory background and hypotheses development

Competitive Dynamics Theoretical Perspective

Competitive dynamics is one of the theoretical frameworks for this study (Grimm and Smith, 1997; Grimm et al., 2006). Grounded in Schumpeterian economics (Schumpeter, 1934), competitive dynamics posits that firms operate in dynamic market environments where firms and their rivals constantly engage in competitive actions. Within the competitive dynamics perspective, a competitive action is defined as “a specific and observable competitive move, such as a new product introduction, advertising campaign, or price cut, initiated by a firm to improve or defend its relative competitive position.” (Grimm, et al., 2006, p. 87) A central premise of competitive dynamics is that the outcome of firm and rival competitive actions is the key to

competitive advantage. (Grimm and Smith, 1997; Young et al., 1996; Grimm et al., 2006). Beginning with Smith et al. (1991), the competitive dynamics perspective has relied on structured content analysis of business press to document actual competitive moves and countermoves and to assess their impact on firm performance. In recent years, the competitive dynamics perspective has continued to evolve within the strategy field.

In applying the competitive dynamics perspective here, we will focus on firm and rival competitive signals in lieu of competitive actions reported in the business press, this study measures firm signals as reported by the firm through corporate sustainability (CSR) reports. Prior research in competitive dynamics focusses on market actions as observed by a third party usually reported in the trade press. In our study, a competitive signal includes actions as well as announcement of intended actions. Furthermore, the competitive signaling is by the firm itself rather than observations made by an independent third party. This approach finds support in Porter's (1980) definition of market signals stating: 'A market signal is any action by a competitor that provides a direct or indirect indication of its intentions, motives, goals, or internal situation' (p.75). As noted by Heil and Robertson (1991), the definition includes both market actions themselves as well as preannouncements of market actions. This allows us to use the content published in CSR reports that record both accomplishments and intent in terms of potential actions by the firm in the EM domain. CSR reports record actions, such as, the establishment of a solar power generation facility (Agilent, 2009), as well as intent, for example, Michelin's commitment to reach a 100% recovery rate of used tires within a certain timeframe. In terms of third party observation as opposed to the firm itself sending out signals, we leverage the arguments around the signal sender (Heil and

Robertson, 1991; Stiglitz, 2000) to find support for this approach. As noted by Stiglitz (2000), firms employ various means to convey their capabilities and we accept CSR reports as a mechanism for firms to convey information on their *green* capabilities. The above argument is also supported by Heil and Robertson (1991) who anchor a competitive signal from a sender's perspective with the objective of conveying or gaining information from the signal. Together the above arguments support that competitive signaling can be achieved through firm disclosures in CSR reports.

Institutional Theory Perspective

The second overarching theory for our model is institutional theory. According to institutional theorists, a firm's strategy is affected by the social, political, and economic forces that exist in the organization's external environment (North, 1986). Because a variety of industries experience a constant flux of change relative to social values, technological advancements, and regulations, the firm is motivated to demonstrate how their products and services match the needs of the external environment. Thus firms are constantly attempting to demonstrate how their organization provides value to the key stakeholder in their respective industries. Stated differently, institutional theory helps to explain how firms have a desire to demonstrate legitimacy in their respective markets. Related to our study, Delmas and Toffel (2008) examine how firms attempt to demonstrate legitimacy concerning compliance with environmental regulations by adopting standards and environmental practices in the firm's manufacturing facilities. Thus Delmas and Toffel (2008) and Powell and DiMaggio (1991) highlight the

importance of the legitimacy of signals that are conveyed by the competitive actions of firms and their rivals in the environmental domain.

Institutional theorists also point out that firms send signals of their competitive intentions and undertake competitive actions as a way to respond to the normative pressure that they experience. Firms seek to conform to several norms that are preferred and desirable, including fair and acceptable business practices. Firms are facing increased public scrutiny to engage in sustainable actions. In fact, Bansal and Clelland (2004) argue that firms face normative pressures to demonstrate that the firm is legitimately engaged in *green* behavior in order satisfy the desires of eco-friendly key stakeholders. As noted by Dixon-Fowler et al. (2013), media reports and by extension reports in the media help to send signals that the firm is attempting to comply with stakeholder desires which should help enhance the image of the firm and create a certain perception of the firm's legitimacy.

The resulting research model developed from the theoretical underpinnings of competitive dynamics and institutional theory are outlined in Figure 1. The hypothesized relationships are discussed in the following section.

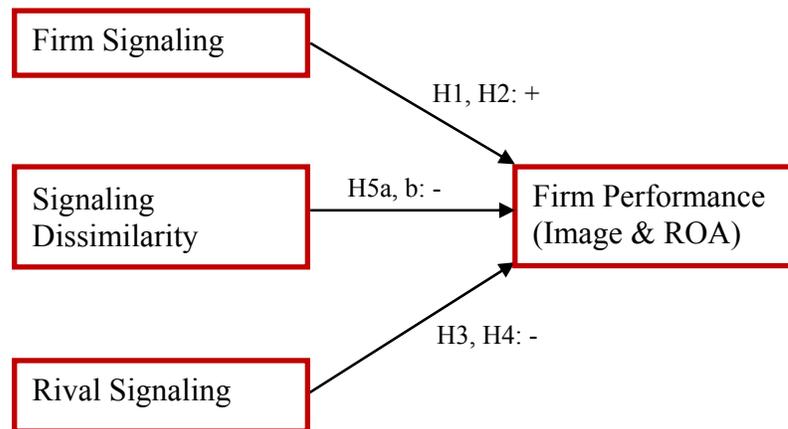


Figure 1 – Signaling – Performance model

Hypotheses

Our first hypothesis examines the link between environmental management signals from the focal firm and its environmental image. Drawing on Berg (1985), Gioia et al. (2000) define environmental image as “the public's perception or impression of an organization, usually associated with a given action or event.” These external perceptions are formed based on what is disclosed of and by the firm. Furthermore, as argued by Gioia et al. (2000), image is a representation of a firm’s adaptation to changing requirements to help reconcile the central and enduring identity of the organization with the changing environment. For example, the central identity of Apple could be a maker of innovative devices, but their attempts to adapt *green* practices would lend Apple to have a *green* image to go along with the identity of an innovative device maker. Given *green* is a new requirement that firms are trying to fulfill without changing their core business,

image as an external perception forms an appropriate measure of environmental performance to assess the impact of *green* signaling.

The competitive dynamics perspective provides a basis for the link between environmental signals and performance. Central to the competitive dynamics perspective is the need for firms to act for securing competitive advantages (Grimm et al, 2006). Continuous firm activity to improve market position draws from Schumpeter (1934) and is explained in terms of the need to recreate competitive advantage. As explained by Young et al. (1996) market actions by a firm (1) is an essential process in free markets, (2) helps break the competitive status quo to establish new performance relationships, and (3) can help firms discover new opportunities. All of the above is applicable to *green* initiatives in terms of establishing new product lines, or providing a new dimension for competition (Hull and Rothenburg, 2008).

To establish the competitive dynamics link with environmental image, we leverage Grunig's (1993) explanation of an image as something a firm tries to create, construct, or project to other people via a messages or signals by the firm. The explanation allows us to create the link between messages or signals by the firm using CSR reports and the resultant image. The competitive dynamics of the process of image creation has been elaborated in the context of a stakeholder's cognitive capabilities (Basdeo et al., 2006). Similar to the arguments presented by Basdeo et al, (2006), signals that include market actions and preannouncements are observable and convey information about the firm's strategy, intent, position, and capabilities. Furthermore, the firm's signals indicate the resources available to the firm to follow through on market actions. They also indicate the ability of the firm to create value for the stakeholders. By

conveying the unobservable information about the firm or intent of the firm via signals conveyed through multiple market actions, a firm competes to enhance its image for improved positioning in the market.

In our study, signals of environmental management activities through CSR reports fulfill a similar role as the communication of the firm's environmental efforts and is observable through publicly accessible corporate sustainability reports. These environmental reports convey the intent of the firm's environmental strategy, which is a central tenet of past competitive dynamics research (Smith and Grimm, 1991). Therefore, through the firm's environmental management signals reported via CSRs, a firm tries to construct or project a positive environmental image in the market place.

Given the aforementioned arguments, we contend that environmental signaling efforts should have a positive impact on the environmental image of the firm. Thus, this study merges observations from Heil and Robertson (1991), i.e., both actions and preannouncements act as signals from the sender, with the extant research in competitive dynamics that has found firm behavior, as observed via signals, to be a significant determinant of firm performance to formally propose:

H1: Higher levels of environmental signaling by a focal firm will have a positive effect on the environmental image of the focal firm.

Our second hypothesis examines the link between focal firm signals and financial performance. Drawing from Ferrier et al. (1999), the arguments for improved financial

performance as a result of firm actions is explained in the basis of those actions as undertaken to enhance firm profitability. Furthermore, aggressive actions by a firm results in greater exploitation of new opportunities by making them unavailable to rivals. Continuous actions also helps firm create unique assets in terms of knowhow, lowering the cost of future actions through increased efficiency from learning through past actions, greater attraction for more qualified employees, greater attraction for suppliers and partners, all of which would improve the firm's market position.

Prior competitive dynamics research has examined the extent to which a firm's competitive actions impact firm performance (Smith et al., 1991; Young et al., 1996; Ferrier et al., 1999; Grimm et al., 2006; Basdeo et al., 2006). This body of research has operationalized firm actions in different ways including scale of actions, scope of actions, actions similarity and speed of actions (Young et al., 1996; Basdeo et al., 2006; Derfus et al., 2008). While Young et al. (1996) find a positive association between competitive actions and performance, Derfus et al. (2008) find that market-leading firms need to engage in a constant flurry of actions in order stay ahead of rivals since the speed of actions is repeatedly being matched by rival firms. This stream of research has established that firms which engage in competitive moves and counter-moves achieve stronger market position and improved financial performance.

In the space of environmental management, the specific attributes of firm actions that lead to improved financial performance has been outlined by Porter (1991). He advocated that the adoption of environmental initiatives led to greater efficiencies and enhanced revenue streams. These arguments based on competitive dynamics have also been supported by others (Klassen and McLaughlin, 1996; King and Lenox, 2001) who

map out the ways in which environmental initiatives could positively impact the firm performance. Market share gains and higher product margins are often cited as outcomes of going *green* for increased revenues. Similarly, avoidance of penalties, reduced material consumption, reduced waste, increased attraction and hiring of better performers are often cited as mechanism for increased efficiency. Through environmental signaling, a firm is highlighting both its accomplishments as well as making its intentions known about the future course of *green* initiatives. As such, the signals link to both paths of improved financial performance by realizing efficiencies through accomplishments noted in the signals as well as higher revenue streams based on the ability to generate higher product margins, increase market share, establish new markets etc., with current or intended actions.

Given the aforementioned arguments, we contend that to establish a stronger positive link between environmental management signals and firm financial performance, the firm needs to send a constant flurry of environmental signals to the market. We present the following hypothesis.

H2: Higher levels of environmental signaling by focal firm will have a positive effect on the financial performance of the focal firm.

Our next set of hypotheses (H3 and H4) examines the extent to which a competitor's environmental signals will have an adverse impact on focal firm performance, both environmental image and financial performance. A central

characteristic of competitive dynamics looks at the interplay between competing firms. In a competitive market, firms are interdependent and actions taken by a firm impact their rivals who therefore make reactionary or counter moves either through mimicry or otherwise to erode the gains made by the firm initiating competitive actions (Grimm et al., 2006). This sequence of actions and reactions by firms and their rivals sets the competitive context and impacts performance. The increase in rival activity eroding focal firm advantages follows similar logic in terms of creation of unique assets, exploitation of new areas, attracting better talent, gaining consumers etc.

In the EM signaling context, CSRs include reporting on *green* products or processes to provide the stakeholders with insights into the firm's overall *green* posture and current state. We contend that the higher levels of EM signaling is to create a *greener* image vis-à-vis its rivals by seeking positive attention through the signaling effort. The impact on image as a result of higher levels of signaling can be explained by the substitutive effect (Basdeo et al., 2006). A substitutive effect is realized when a firm and its rivals compete for the same stakeholder attention. Rival signaling therefore garners attention at the expense of the focal firm thereby diminishing the importance of focal firm signals resulting in a loss of image. In addition to the substitutive effect, rival signaling might also provide greater insights into the viability of focal firm signals. Rival signaling could potentially highlight the competitive situation in the industry bringing into focus resources required by the focal firm to compete and thereby raising doubts about their strategy. In essence, the firm that is more successful in communicating its value proposition will end-up becoming the market leader. Through higher levels of EM

signaling, rival firms may become more successful compared to the focal firm in terms of successfully improving their environmental image.

Given the aforementioned arguments accounting for a substitutive effect, it is hypothesized that a firm improves its environmental image at the expense of its rival. Leveraging the competitive dynamics arguments, we present the following hypothesis:

H3: Higher levels of environmental signaling by rivals will have a negative impact on the environmental image of the focal firm.

The arguments for a negative impact of rival signaling on focal firm performance is grounded in Porter's (1980) viewpoint of competition. This argument is based on the notion that competition is a zero sum game (Porter 1980) and gains are made by a firm at the expense of their rival. The mechanism for eroding the financial gains of a rival have already been elaborated in earlier discussions. Prior research has leveraged the competitive context to study the types of competitive moves, the resultant counter moves, and overall impact on firm financial performance (Grimm and Smith 1997; Young et al., 1996; Grimm et al., 2006). As noted by Ferrier et al. (1999), competitive moves could include new promotional strategies, or cultivation of an upscale market segment to gain new customers. Given the interdependencies and the impact of focal firm actions such as loss of market share, rivals react with counter moves by the focal firm to prevent a focal firm from gaining a competitive advantage. Competitive dynamics studies have found

that competitive actions undertaken by rivals diminishes the competitive advantage accrued to a focal firm (Young et al., 1996; Ferrier et al., 1999; Basdeo et al., 2006).

Given the aforementioned arguments accounting for a zero-sum game, it is hypothesized that for financial performance a firm improves its performance at the expense of its rival. Leveraging the competitive dynamics arguments, we present the following hypothesis:

H4: Higher levels of environmental signaling by rivals will have a negative effect on the financial performance of the focal firm.

We now turn to describing how the dissimilarity between a firm's environmental signals and its competitors negatively affects a focal firm's performance, both environmental image and financial performance. In so doing, we draw-upon the legitimacy aspects of institutional theory. To gain or maintain the perception of legitimacy of its key stakeholders, the firm sends environmental signals to the market that its environmental activities are similar in nature to its rivals. Basdeo et al., (2006) find that similarity in the repertoire of actions (marketing, pricing, legal actions etc.) positively impacts focal firm reputation. Although firms try to differentiate themselves by distinguishing their actions from competitors, depending on the nature of the industry competition, some strategy scholars argue that firms should engage in competitive actions that conform to industry norms and beliefs (Suchman, 1995). Similarity of actions contributes to the institutionalization process and reaps positive benefits from doing so.

Conversely, dissimilar actions by focal or rival would in fact harm the dynamics of the industry when the firm departs from established norms and beliefs. For example, if firms within the industry place a strong value on ISO 14001 certification but the focal firm itself is more interested in creating *green* products with little regard to the certification process surrounding the manufacturing and distribution of products, the firm could be perceived as deviating from the industry's values and thus damages its own as well as the industry's standing. The importance of having firms that conform to industry norms and beliefs is further evident in industries that face higher levels of regulatory pressures. While non-conformity helps with performance in dynamic and less regulated markets, Norman et al. (2007) find that firms not conforming to key stakeholder requirements exhibit poorer performance when regulations exist. Therefore, we contend that the focal firm environmental reputation or image is harmed when there is a high level of dissimilarity in signals between focal and rival. While similarity in signals will have an overall positive effect on the focal firm's environmental image, a high level of environmental signal dissimilarity would lead to legitimacy concerns and thus negatively affect the focal firm's environmental image.

Similar to the impact on environmental image, the impact of environmental signal dissimilarity is hypothesized to have an adverse impact on focal firm financial performance. The argument for an adverse impact is also grounded in the institutional perspective of legitimacy. As argued by Bansal and Clelland (2004), legitimacy plays an important role in a firm's stock price performance as a reaction to an adverse event forms a stakeholder's perception of the firm. The legitimacy perspective is further qualified by Doh et al. (2010) who find that institutional intermediaries play an important legitimacy-

conferring function. Given the difficulty of separating environmental claims from actual actions, the authors argue that stakeholders rely on the institutional intermediaries to evaluate a firm's corporate social responsibility, which then impacts firm performance. This is especially true in the environmental management domain where the role of institutional intermediaries has resulted in the creation of various institutions such as Public Environmental Reporting Initiative (PERI), Coalition for Environmentally Responsible Economics (CERES), the ICC Business Charter for Sustainable Development (ICC), and the Global Reporting Initiative (GRI) with their respective set of evaluation standards. As noted by Jose and Lee (2006), with issues of sustainability becoming a prominent concern to stakeholders, firms have tried to institutionalize environmental management concerns through policies, procedures, and system, and these are now reflected in the use of reporting frameworks such as GRI. In essence, there is a push for conformity as witnessed by the proliferation of environmental management reporting frameworks and the creation of non-governmental organizations. This viewpoint is bolstered by Norman et al. (2007) in their advocacy of conformity in firm actions in regulation driven industries.

Given the above, we offer the following:

H5a: Higher levels of focal and rival signaling dissimilarity will have a negative impact on the environmental image of the focal firm.

H5b: Higher levels of focal and rival signaling dissimilarity will have a negative effect on the financial performance of the focal firm.

Sample, data, and variables

Sample

This study examines the relationship between environmental signaling and both the environmental image and financial performance of a focal firm. The empirical analysis focuses on US publicly traded companies that appeared in the *Newsweek US 500 Green Rankings* data, which was first published in 2009. A review of various environmental performance databases conducted by Rahman and Post (2012) indicates that the *Newsweek US 500 Green Rankings* data is a viable data source and has been used in prior empirical research (e.g., Aaron et al., 2012; Wilcox et al., 2014). Hence, the *Newsweek* dataset, comprising 2,000 firm-year level data points for 582 unique firms between 2009 and 2012, defines the sampling frame for the current study.

For each of the firms listed in the *Newsweek* rankings, a focal firm's rivals were identified using company profiles published in *Hoover's*, a Dunn and Bradstreet database, which profiles publicly traded companies and lists up to three of the key competitors for each firm. *Hoover's* has previously been used in academic research to identify competitors (Aktas et al., 2007). In an effort to verify the identification of rivals, spot checks were performed using *Compustat* to determine the largest firms by sales within the same six-digit NAICS industry. A high degree of overlap was found between

the sets of rivals identified via *Compustat* and *Hoover's*. This process yielded a set of 5,833 dyadic focal firm-rival observations.

In a next step, corporate sustainability reports (CSR) were collected for each focal and rival firm for the 2008 to 2011 time period, reflecting a one-year lag relative to the available *Newsweek* environmental performance measures. A one-year lag was also employed in Hofer et al. (2012). CSR reports, available for download on company websites or aggregator sites such as *Responsibilityreports.com*, have been used in prior studies to examine firm-level environmental activity (Montabon et al., 2007; Tate et al., 2010; Hofer et al., 2012). CSR reporting is voluntary such that reports were not available for all firms in all years. Focal firm-rival observations were excluded from further analysis in those instances where neither company had published a CSR report. This sample selection process resulted in an unbalanced panel data set comprising 3,224 focal-rival dyad pairs spread over four years.

Measurement of variables

Dependent variables

There are two dependent variables of interest in this study: a focal firm's environmental image and its financial performance. The focal firm's environmental image measures are derived from the 2009 through 2012 *Newsweek US 500 Green Ranking* data which is based on a third party's external assessment of the firm's environmental performance. The focal firm's environmental image in 2009 and 2010 was operationalized as the firm's opinion based survey score, derived from the *Newsweek*

green database. In 2011 and 2012, a focal firm's environmental image was operationalized as a firm's environmental disclosure score. The environmental disclosure score is based on a third-party evaluation of the breadth and quality of focal firm's reporting of environmental material impact and accounts for a firm's participation in reporting initiatives such as the Global Reporting Initiative (GRI) and Carbon Disclosure Project (CDP). The environmental disclosure score is assessed by an independent third party, Trucost. Because *Newsweek* adjusted their green reporting methodology across the years of our sample, the scores are standardized. A positive and significant correlation value of 0.42 between 2010 and 2011 standardized scores for overlapping firms confirms the validity of this approach.

Because this study also examines the relationship between environmental signaling and a focal firm's financial performance, we now turn to defining how we operationalized firm financial performance. A focal firm's financial performance is operationalized as its return on assets (ROA), i.e., the ratio of net income and total assets. This measure is consistent with our argument that the impact of environmental signals can result in efficiency or revenue gains. The firm financial data was derived from the *Compustat* database across the years 2009 through 2012.

Independent variables

We now turn to describing our three key independent variables in this study, namely, focal firm environmental signaling, rival firm environmental signaling, and the dissimilarity in environmental signaling between focal and rival firms. These measures

are derived from the firm's corporate social responsibility (CSR) report. In so doing, we operationalized these measures using structured content analysis of the firm's CSR reports through the use of Crawdad software (Hofer et al. 2012; Tate et al. 2010). As described in Hofer et al. (2012), Crawdad software employs centering resonance analysis (CRA) to quantitatively assess the prevalence and relative importance of the most influential keywords from an archival document. To analyze the set of reports collected for creating the signaling measures, the following steps were undertaken.

First, in line with prior research (Tate et al., 2010; Hofer et al., 2012), the Crawdad software package was used to identify the 250 most influential keywords from the entire set of CSR reports. Corman and Dooley (2006) note that positive correlations between such keywords indicate that these terms tend to co-occur in an archival document and allow researchers to make inferences about the prevalence of a given theme. For example, the positive correlation between the keywords "waste" and "reduction" indicates that "waste reduction" is a relevant theme, and its prevalence in a given report can be assessed via the associated influence scores provided by the Crawdad software.

In the second step, relevant environmental management (EM) themes are identified using keyword combinations from the 250x250 keyword matrix generated in the first step. In this study, all positively correlated keyword combinations occurring in the 250x250 keywords matrix from step 1 are matched against the list of keyword combinations or themes that were classified as EM themes in the Hofer et al. (2012) study, which leveraged the Montabon et al. (2007) typology of EM activities. The net result from this step was the identification of 107 relevant EM themes in the entire set of

reports collected for the purposes of this study. The set of 107 themes establish the range of EM signals and ties back to Montabon et al (2007) EM typology. For example, some of the commonly occurring themes across the entire set of reports are “environmental management”, “environmental system”, “energy sustainability”, “energy waste”, “product waste” etc.

In the final step, relevant themes by individual report are used for creating a total signal count for a particular firm-year. Each of the 107 keyword combinations or themes are matched for that pair of keywords to identify the influence score provided via centering resonance analysis for each of the keywords in the combination. For each report, if the individual keyword influence scores in the pair exceeds the value of .01 (considered significant as per guidance for using Crowdad), the theme is included in the total count otherwise left out. The total count of themes for both focal and rivals are reported as the *Focal Signaling* and *Rival Signaling* measures respectively specific to the firm and year. Appendix A provides additional details on the methodology for quantifying EM signals.

For creating the *Signaling Dissimilarity* measure, we look at the category of membership for each of the 107 themes to assess the difference in the emphasis of the signals by category between a focal and its rival. Montabon et al. (2007) typology categorizes EM activities by operational, tactical, and strategic. Operational category is focused on internal operations such as the recycling processes. Strategic category lists activities around long term vision, corporate policies etc. Tactical deals with activities such as involvement of suppliers in product design, supplier auditing etc. Each of the environmental management themes are also mapped to one of these categories.

The measure of *Signaling Dissimilarity* between a focal firm's and its rival's environmental signaling was generated following the approach defined by Nodofor et al. (2012). Specifically, *Signaling Dissimilarity* = $\sum_i [(P_i - C_i)]^2$, where P_i is the proportion of signals in category i for the focal firm and C_i is proportion of signals in category i for the rival firm.

Control variables

We now describe several control variables that are included in the model. All control variables are derived from the *Compustat* database unless otherwise noted for the time period of 2009 to 2012. First, we control for the size of the firm. Firm size is measured as the sales of focal firm. The argument is supported from a competitive dynamics viewpoint, as in, larger firms have more flexibility to undertake competitive actions (Young et al, 1996). Next, we also measure the focal firm's profitability as measured by return on assets (ROA). The selection of profitability as a control variable finds support in more profitable firms have the slack resources to make investments into competitive actions (Hofer et al., 2012). Lastly, consistent with prior competitive dynamics research, we control for market concentration. Firm signals are likely to be more effective in concentrated industries as compared to less concentrated industries. In more concentrated industries, there is less competition among firms that are sending the signals thus the signals are more likely to be attended to among key stakeholders (Basdeo et al. 2006). Our market concentration is measure is derived from the Hoberg and Phillips (2014) dataset. The authors use text based parsing of product descriptions in 10-K annual

filings to determine firm similarity by products. Concentration measures are then calculated from sales data using the Herfindahl-Hirschmann sum of squared market shares formulation by including firms that exceed a certain threshold of similarity in their product descriptions. Due to skewness and kurtosis issues, both firm size and market concentration are logged in the model. Descriptive statistics for the different variables is provided in Table 1.

Table 1 – Descriptive statistics for the performance data set

Descriptive Statistics (N=3224)				
Variable	Mean	Std. Deviation	Min.	Max.
Firm Profitability (ROA)	0.05	0.06	-0.44	0.34
Firm Image	46.20	22.20	0.40	100.00
Firm Signaling lagged	4.34	5.80	0.00	30.00
Rival Signaling lagged	4.80	5.55	0.00	34.00
Signaling Dissimilarity lagged	0.54	0.34	0.00	2.00
Firm Size (sales, million \$)	26900.00	45500.00	1520.00	467000.00
Market Concentration	1530.00	1800.00	151.00	10000.00

As shown in Table 1, the average firm in our sample had \$26,900 million in annual sales and operates in a fairly competitive market (mean market concentration = 1530).

Transformed variables are used for generating the correlations as reported in Table 2. As noted earlier, we take the logarithm of sales and market concentration, and use a standardized score for environmental image. There are no serious multicollinearity concerns based on reported correlations in Table 2.

Table 2 – Correlation table for the performance data set

Bivariate Correlations (N=3224)		1	2	3	4	5	6
1	Firm Profitability (ROA)						
2	Firm Image	0.02					
3	Firm Signaling lagged	0.04	0.18				
4	Rival Signaling lagged	0.06	-0.08	-0.19			
5	Signaling Dissimilarity lagged	-0.03	-0.07	-0.17	-0.17		
6	Firm Size (sales, million \$)	0.01	0.32	0.07	-0.08	-0.07	
7	Market Concentration	0.11	0.05	0.11	0.08	0.03	-0.12

Correlation coefficients significant at $p < 5\%$ are printed in bold.

Empirical analysis and results

Estimation methodology

A generalized estimating equation (GEE) methodology is employed to estimate the parameters of the regression model. The GEE technique is particularly suitable for the analysis of panel data with serially and cross-sectionally correlated observations (Liang and Zeger, 1986; Ballinger, 2004). In our data set, the temporal dimension is modeled as a first-order autoregressive process, where the value of a dependent variable in a given year is a function of its value in the immediately preceding year. The cross-sectional dimension of the data is defined by focal firm-rival pairs. It is noteworthy that the GEE method produces consistent estimates even when the covariance structure is misspecified due to potentially unknown correlation between outcomes (Liang and Zeger, 1986).

Empirical results

The results from the GEE analysis for the environmental performance model as well as the financial performance model are summarized in Table 3.

Environmental performance - Image

Hypothesis 1 states that greater firm signaling results in better environmental image. The positive and statistically significant coefficient of *Focal Signaling lagged* variable ($\beta = 0.006, p \leq 0.05$) provides evidence in support of this hypothesis. Hypothesis 3, which states that the rival's signaling will negatively impact the focal firm environmental image is also supported. The coefficient estimate of *Rival Signaling* is negative ($\beta = -0.010$) and significant at $p \leq 0.05$ as reported in Table 3. Hypothesis 5a states that dissimilarity in signaling between focal and rival would result in a negative impact on focal firm's image. The negative and statistically significant coefficient of *Signaling Dissimilarity* ($\beta = -0.076, p \leq 0.05$) supports this hypothesis. Thus, there is evidence that firm signaling helps establish a firm's image as long as there is an aspect of legitimacy to the signals, which can be disturbed by either focal or rival depending how far apart they are in their signaling strategies.

²Table 3 – Results for *Image* and *ROA* model

GEE (AR1) regression results (N=2776)		
	Image	Return on Assets
	Coef.	Coef.
Constant	-3.240 (0.334)	-1.412 (1.976)
Firm Signaling	0.006* (0.003)	0.057** (0.020)
Rival Signaling	-0.010** (0.003)	0.064** (0.022)
Signaling Dissimilarity	-0.076* (0.043)	-0.021 (0.299)
Firm Size	0.310*** (0.026)	0.304* (0.153)
Market Concentration	0.098*** (0.029)	0.466** (0.168)
Firm Profitability	-0.005 (0.003)	
Wald χ^2	174.36	27.66

Standard errors are shown in parentheses below the parameter estimates.

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Two-tailed tests for controls, one-tailed tests for hypothesized variables.

Financial performance – ROA

Hypothesis 2 states that higher levels of environmental signaling will have a positive impact on a firm's financial performance. The positive and statistically significant coefficient of the *Focal Signaling* ($\beta = 0.057, p \leq 0.05$) provides evidence in support of this hypothesis. Hypothesis 4 states that a higher level of rival signaling will

² These results have been generated with help from Dr. Christian Hofer and Dr. David Cantor. While the results in all other chapters were generated in R, these results were generated in STATA due to a higher comfort level with STATA on the team.

have a negative impact on focal firm performance as argued from the basis of competitive dynamics. The positive and statistically significant coefficient of the *Rival Signaling* ($\beta = 0.064, p \leq 0.05$) provides contrary support to the hypothesis. Finally, Hypothesis 5b states that signaling dissimilarity should adversely impact focal firm financial performance, but the lack of evidence of *Signaling Dissimilarity* as reported in Table 3 does not support this hypothesis.

As a robustness check, a feasible generalized least squares (FGLS) model is also run to test the hypothesized relationships. If the model is only accounting for individual effects, the general FGLS framework allows the error covariance structure within a group to be fully unrestricted (Wooldridge, 2002). This allows for robustness against any type of intragroup heteroskedasticity and serial correlation. While only the GEE results are presented and discussed, it is to be noted that the FGLS estimation results are similar in terms of signs and overall significance of variables in both the environmental performance and financial performance model.

Discussion

Theoretical implications

The purpose of this study is to investigate the impact on performance of environmental signaling undertaken by a firm and its rivals. The study further embeds the research agenda in the theoretical context of competitive dynamics with further grounding from the institutional viewpoint. It advances the Hofer et al. (2012) study by extending the findings of firm-rival interactions to assess its impact on performance. In doing so, the study furthers EM research in a natural market setting.

Prior survey based approaches to studying the impact of EM initiatives on performance, though insightful, lacks the appropriate theoretical basis for explaining firm behavior. While theoretical approaches from institutional and stakeholder perspectives have been leveraged, they do not completely explain the variances in firm reactions to external pressures. Coupled with the prior Hofer et al. (2012) study, this research provides a comprehensive explanation of firm behavior in the EM domain and its impact on performance. Furthermore, panel data estimation using archival data sources adds credibility to the findings.

In line with prior research outcomes in competitive dynamics, the study finds a positive and significant impact of focal firm signaling on focal firm performance, both environmental image and financial performance. While the effect of rival signaling on image supports the competitive dynamics viewpoint, the positive impact of rival signaling on focal firm financial performance is surprising. The impact of dissimilarity supports the institutional viewpoint, which differentiates the research in the environmental domain from a traditional competitive dynamics setting.

The positive impact of competitor signaling on focal firm financial performance though surprising could be due to the nature of the *green* market and the institution of *green*. First, environmental management activities present new market opportunities for the focal firm and its competitors. In so doing, pursuit of environmental management activities might lead to increasing the size of the environmental product and service market (e.g., creation of new revenue streams). As such, investment into environmental management activities is analogous to a “Blue Ocean” strategy (Kim and Mauborgne, 2005). Assuming environmental behavior increases overall environmental demand, then

as noted by Derfus et al. (2008), competitor actions will not affect a firm as it continues to increase its own revenue with an expanding market.

A related argument is that environmental management activity by focal and rival firms increases the environmental legitimacy of multiple industry participants. In so doing, environmental signals are an enactment of a new set of social rules for acceptance that result in orderly, stable, socially integrated practices as advocated from an institutional perspective (Handelman and Arnold, 1999). Within such socially constructed norms, such as environmental management behavior, organizational theorists have argued that legitimation is achieved by others via actions that mimic these norms (Handelman and Arnold, 1999) resulting in a strengthening of the institution. The institutional benefits are examined by Dixon-Fowler et al. (2013). The authors look at the increased perceived legitimacy of female CEOs through positive stock market reactions as new female CEO's are appointed at another firm enhancing the legitimacy of the institution of female CEOs. A similar argument can be extended to the institution of environmental management and the actions undertaken by firms and competitors in the legitimation process. Stated otherwise, competitive actions might actually add legitimacy to a firm's actions and thus in this case environmental management pursuits by rivals creates an "uplift" to the focal firm's performance.

To gain further insights into the impact of rival signaling on focal firm financial performance, we conduct additional analysis for the three separate signaling categories namely: operational, tactical, and strategic. Table 4 summarizes results from GEE analysis with operational signaling. Table 5 summarizes results from GEE analysis with tactical signaling. Table 6 summarizes results from GEE analysis with strategic signaling.

Table 4 – Impact of Operational Signaling

GEE (AR1) regression results (N=2776)

	Image Coef.	Return on Assets Coef.
Constant	-3.251 (0.320)	-1.825 (1.849)
Firm Operational Signaling	0.015*** (0.004)	0.065* (0.033)
Rival Operational Signaling	-0.007~ (0.005)	0.053* (0.031)
Signaling Dissimilarity	-0.067~ (0.041)	-0.247 (0.205)
Firm Size	0.307*** (0.026)	0.273~ (0.148)
Market Concentration	0.087*** (0.026)	0.634*** (0.160)
Firm Profitability	-0.004~ (0.002)	
Wald χ^2	177.1	27.59

Standard errors are shown in parentheses below the parameter estimates.

~ $p < 0.10$

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Two-tailed tests for controls, one-tailed tests for hypothesized variables.

Table 5 – Impact of Tactical Signaling

GEE (AR1) regression results (N=2776)

	Image Coef.	Return on Assets Coef.
Constant	-3.226 (0.322)	-1.818 (1.849)
Firm Tactical Signaling	0.005 (0.006)	0.126* (0.063)
Rival Tactical Signaling	-0.018** (0.006)	0.073* (0.039)
Signaling Dissimilarity	-0.080* (0.043)	-0.072 (0.222)
Firm Size	0.305*** (0.026)	0.227~ (0.146)
Market Concentration	0.094*** (0.026)	0.632*** (0.161)
Firm Profitability	-0.004~ (0.002)	
Wald χ^2	169.91	25.72

Standard errors are shown in parentheses below the parameter estimates.

~ $p < 0.10$

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Two-tailed tests for controls, one-tailed tests for hypothesized variables.

Table 6 – Impact of Strategic Signaling

GEE (AR1) regression results (N=2776)		
	Image	Return on Assets
	Coef.	Coef.
Constant	-3.241 (0.319)	-1.632 (1.861)
Firm Strategic Signaling	0.064*** (0.019)	-0.097 (0.173)
Rival Strategic Signaling	-0.042* (0.019)	-0.199* (0.119)
Signaling Dissimilarity	-0.064~ (0.042)	-0.411* (0.207)
Firm Size	0.304*** (0.025)	0.266~ (0.149)
Market Concentration	0.092*** (0.025)	0.677*** (0.160)
Firm Profitability	-0.004~ (0.002)	
Wald χ^2	177.96	28.27

Standard errors are shown in parentheses below the parameter estimates.

~ $p < 0.10$

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Two-tailed tests for controls, one-tailed tests for hypothesized variables.

While operational and tactical signaling by rivals continue to have a positive and significant relationship with focal firm financial performance, strategic level rival signaling has a negative and significant impact on focal financial performance. These results suggest that the institutional effect is dominant with *green* initiatives possibly improving the performance of the institution. In so doing, both focal and rival firms benefit from such improvements. For example, a common *green* supplier base might positively impact both focal and rival firms. Whereas the operational and tactical

signaling supports the institutional viewpoint, the impact of strategic signaling continues to provide support for the competitive dynamics viewpoint. At the strategic level, initiatives such as integration with suppliers result in competitive advantages, which are then challenged by rival moves to change the status quo.

Focusing on the operational aspects of EM signaling to increase the tie with sustainable research in operations management, we do obtain identical results in terms of direction and significance by solely focusing on operational signals. As classified by Montabon et al. (2007), operational initiatives are limited to initiatives within firm boundaries such as waste management, recycling etc. While the impact of focal and rival signaling in this category support the competitive dynamic viewpoint for image, the impact of rival operational signaling on focal financial performance supports the institutional viewpoint as explained earlier.

While this study builds significantly on the earlier study by Hofer et al. (2012) by laying down competitive dynamics as the theoretical framework for studying EM behavior and performance, there are some areas of concern that can be addressed in future efforts. Though the study does not suffer from common method bias, it does rely on CSR reports that is based on voluntary reporting and might lead to missing data issues. Furthermore, the methodology ignores any relative importance of signals and by proxy, activities. For example, a significant theme of recycling-policy is accorded the same weightage as an environmental-award or an ISO 14000-certification. More work is needed to parse out these signals to assess their credibility for studying issues such as *greenwashing* commonly reported in the EM literature. Finally, even with the current extension, the research stream leveraging competitive dynamics is restricted to looking at

firm behavior and rivalry within the boundaries of the firms. Though the firm's actions is an important contributor to its performance, large firms rely extensively on suppliers. As such, it is not just the individual firm, but suppliers as well who contribute to performance. As stated by Rice and Hoppe (2001):

“The conventional wisdom is that competition in the future will not be company vs. company but supply chain vs. supply chain. But the reality is that instances of head-to-head supply chain competition will be limited. The more likely scenario will find companies competing—and winning—based on the capabilities they can assemble across their supply networks.”

Therefore, it is important to assess the *green* behavior of a firm and its suppliers in assessing rivalry and its impact on performance.

Managerial implications

From a managerial perspective, the study sheds light on how to react to rival moves in the EM domain. It is important to note that firms need to respond to rival moves to keep their image intact in the market. But the reactionary moves need to be nuanced. As evidenced in the analysis, radical moves hurt rather than help a firm. Given the sensitivity of *green*, radically different moves tend to be less believable and seem to lack legitimacy thereby hurting the firm's image. Furthermore, it seems that *green* is a growth market and competitor moves does not seem to hurt a firm financially. This provides additional flexibility for a firm to plan its reactions to competitor moves. The “uplift” from competitor moves suggest a common good arising out of activities in the EM domain allowing firms to incrementally build their EM base within the industry.

This study also has relevance from a policy perspective. As opposed to approaching the issues of *greening* from a regulatory framework, this study looks at how firms are adopting *green* initiatives in a natural market setting. The chances of success of environmentally responsible or sustainable behavior is probably higher when the market rewards this behavior.

Conclusion

This study looks at the effect of environmental signaling on firm performance in the context of competitive dynamics with additional support from the institutional viewpoint. Prior research into environmental performance as a consequence of environmental initiatives (Montabon et al., 2000; Sroufe, 2003; Zhu and Sarkis, 2004) have been largely restricted to survey based studies without sufficient theoretical grounding. While the studies do establish improvements in operational performance as a consequence of environmental initiatives, common method bias remains a concern given the methodology employed in these studies. In looking at performance, both environmental and financial, using secondary data, this study largely eliminates some of the methodological issues of concern associated with prior studies. Furthermore, the theoretical grounding adds clarity to the empirical observations of the effect of focal signaling, competitor signaling, and signaling dissimilarity and their effect on performance.

Chapter 3: Further Examination of EM Signaling/EM Performance/Firm Performance Relationships

Introduction

This chapter explores relationships between EM signaling and additional performance measures for both environmental and financial performance. While primary performance measures defined for this study and reported in the previous chapter are EM image or reputation for environmental performance, *Newsweek* data also contains two additional environmental performance measures, i.e., *Impact* and *Policy*. *Impact* measure comes closest to grading a firm's environmental footprint while the *Policy* measure is an assessment of the overall EM posture to include environmental stewardship and management of environmental issues. Analysis on the impact from rivalry on reputation is replicated with these two additional environmental performance measures.

For financial performance, besides ROA, data was also collected on a measure of earnings per share, and year-to-year growth was calculated as the increase in sales over the previous year. The impact from EM rivalry is assessed using these two additional financial performance measures.

Finally, an analysis of the impact of environmental performance as a mediator between EM signaling and financial performance is also conducted to gain a comprehensive understanding of the drivers of financial performance in the EM domain.

Additional environmental performance measures

Besides environmental reputation of focal firms, the *Newsweek* data set also reports an environmental impact score and a green policies score. From the description of the measure, *Impact* score is based on quantitative performance measures that take into account several key variables such as greenhouse gas emissions, water use, carbon footprint, solid waste etc. A final derived score is reported as an environmental impact score based on proprietary models used by the firms partnering to produce the *Newsweek* rankings. The impact score offers a quantitative opportunity to test if words are being put to action. *Policy* score is reported to be based on an analytical assessment of the firm's policies. The policy score also captures regulatory infractions and lawsuits. The measure generates interest as a possible assessment of how environmental signaling impacts a firm's policy posture and limits damages from infractions. The tests used for assessing the impact of EM signaling on EM reputation in the prior chapter are replicated with *Impact* and *Policy* scores as dependent variables in order to garner additional insights. The same data set is used for testing the relationships by replacing the dependent variables as applicable. The results of the replication using the generalized estimating equations (GEE) technique are reported in Table 7.

Table 7 - Results for additional environmental performance measures

GEE (AR1) regression results (N=3224)		
	Impact	Policy
	Coef.	Coef.
Constant	-0.715 (0.334)	-2.879 (0.293)
Focal Signaling	0.000 (0.002)	0.013*** (0.002)
Rival Signaling	-0.006** (0.002)	0.001 (0.002)
Signaling Dissimilarity	-0.050* (0.030)	-0.068** (0.023)
Firm Size	0.099*** (0.024)	0.250*** (0.025)
Market Concentration	-0.046 (0.030)	0.084*** (0.023)
Firm Profitability	0.353* (0.174)	-0.211 (0.203)
Wald χ^2	35.88	154.72

Standard errors are shown in parentheses below the parameter estimates.

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Two-tailed tests for controls, one-tailed tests for hypothesized variables.

It is interesting to note the lack of significance of the *Focal Signaling* on the *Impact* score. One would have expected that higher levels of environmental signals, acting as a proxy for EM activity at a firm, would lead to a better *Impact* score. In line with competitive dynamics outcomes, we notice a negative and significant impact of *Rival Signaling* and *Signaling Dissimilarity* on *Impact*. A possible explanation for this result lies in the fact that the focal firm is lagging in its industry thereby getting a lower *Impact*

score. The results for *Signaling Dissimilarity* on *Impact* score follow the prior discussions around legitimacy with a negative and significant effect raising questions around the legitimacy of firm's signals. For the *Policy* results, the significance of *Focal Signaling* ($\beta = 0.013, p \leq 0.05$) is not surprising. Higher level of EM signals should expectedly articulate a sustainable policy and posture of the firm. One would have expected a significant negative effect of *Rival Signaling* if higher levels of rival signaling could be construed as the focal firm playing catch-up, but that cannot be established from the above set of results. The significance of *Signaling Dissimilarity* ($\beta = -0.068, p \leq 0.05$) follows prior arguments around legitimacy of actions. An extreme dissimilarity would likely accrue negative points toward a final policy score.

Additional financial performance measures

As discussed earlier, Porter (1991) emphasizes that the impact of environmental activity is felt either through cost savings or increased revenue. Recurring savings should result in sustained long term shareholder value. In the prior chapter, *ROA*, which is a short run financial measure lends credence to arguments around cost savings from going *green*. To test the long term improvement in shareholder value, a measure of earnings per share is used as the dependent variable assessing the impact of EM signaling. *EPSPI* data from *Compustat* is used as a measure for earning per share.

The arguments around increased revenue are further augmented by the discussion around uncontested markets by Kim and Mauborgne (2005). They present a “blue ocean strategy” for creating new uncontested markets. The authors argue that instead of

competing head to head in the “red ocean”, where the competitors currently exist, it is better to look at uncontested markets for expansion. Based on Porter’s (1991) comments, *green* could present one such uncontested market space for firms to expand. To test the possibility of increased revenue from EM, a measure for year-to-year growth (*YTYG*) is developed as the increase in sales over the previous year. The results of replicating the *ROA* model with *YTYG*, and *EPSPI* are presented in Table 8.

Table 8 – Results for additional financial performance measures

GEE (AR1) regression results (N=3224)		
	YTYG	EPSPI
	Coef.	Coef.
Constant	-0.262 (0.061)	-3.309 (1.176)
Focal Signaling	-0.001 (0.001)	0.035* (0.018)
Rival Signaling	0.001 (0.001)	0.018* (0.010)
Signaling Dissimilarity	0.009 (0.016)	-0.063 (0.146)
Firm Size	0.029*** (0.009)	0.629*** (0.113)
Market Concentration	0.004 (0.006)	-0.050 (0.077)
Wald χ^2	16.46	37.72

Standard errors are shown in parentheses below the parameter estimates.

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Two-tailed tests for controls, one-tailed tests for hypothesized variables.

While we get similar results in terms of significance of variables on *EPSPI* as on *ROA*, we do not get similar significance with *YTYG*. The results seem to validate our earlier findings with *ROA* and lends credence to Porter's (1991) contention of better performance through cost savings. The results also seem to suggest a long term of positive effect of EM initiatives undertaken by firms. There is a lack of support for the year-to-year growth in the dataset used for the above analysis.

Environmental performance as a mediator

In this section, we extend the findings of Chapter 2 to assess the impact of environmental performance on financial performance. The findings in the previous chapter establish significant relationships between EM signaling and both environmental and financial performance. For a comprehensive understanding of the interactions between EM signaling, environmental performance, and financial performance we look at a mediated model to test out the various relationships with environmental performance mediating the impact of EM signaling on financial performance.

Based on prior work (Shane and Cable, 2002) with non-financial performance measure, a mediating model with environmental performance mediating the relationship between EM signaling and financial performance is considered suitable. Shane and Cable (2002) look at the entrepreneur's reputation as a mediating variable that investors use to overcome the information asymmetry of the quality of an entrepreneur. The authors argue that reputation will mediate the impact of any direct social ties or "private information" between investor and entrepreneur since the social tie will generate little additional

information about the entrepreneur. I take a similar logic for positing environmental performance variables as a mediator between environmental signaling and financial performance. *EM Reputation, Policy, and Impact* should act as the mechanisms for overcoming information asymmetry mitigating the relevance of the firm signal. The framework for this study is depicted in Figure 2.

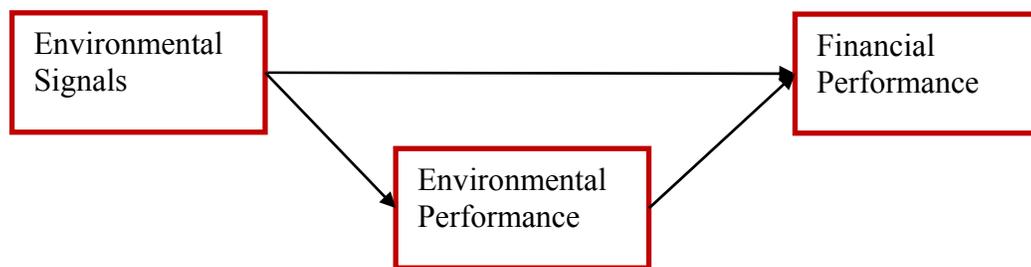


Figure 2 – Mediation model for assessing the impact of environmental performance

In accordance with the mediation model depicted in Figure 2, it is expected that the environmental performance variables will provide the indirect path for the impact of EM signaling on financial performance.

Sample, data and variables

Newsweek data for the period of 2009-2012 is used to identify firms with associated environmental performance measures. Financial data for the firms in the dataset is collected from *Compustat*. This dataset is subsequently matched with the EM signaling dataset to filter for records where we have either focal or competitive activity.

Finally, environmental performance and EM signaling data is lagged by a year to the financial performance data resulting in a dataset of 2433 records. Table 9 provides the descriptive statistics on this dataset.

Table 9 – Descriptive statistics for the mediation model

Descriptive Statistics (N=2633)		
Variable	Mean	Std. Deviation
ROA	5.33	6.01
Reputation (Lagged)	42.03	21.13
Impact (Lagged)	49.06	26.33
Policy (Lagged)	48.77	18.15
Focal Signaling (Lagged)	4.53	5.89
Firm Size (Lagged) (sales, million \$)	26551.00	44282.70
Firm Profitability (Lagged) (ROA)	5.33	5.84
Market Concentration (Lagged)	1516.78	1797.30

We notice that the average firm had \$25,800 million in annual sales and operates in a moderately concentrated market (mean market concentration = 1530). Both *Firm Size* and *Market Concentration* are logged in the model. The aggregate reputation score, impact score, and policy scores are standardized. Table 10 reports the bivariate correlations for the variables of interest.

Table 10 – Bivariate correlations for the mediation model

Bivariate Correlations (N=2633)		1	2	3	4	5	6	7
1	ROA							
2	Reputation (Lagged)	0.03						
3	Impact (Lagged)	0.04	-0.05					
4	Policy (Lagged)	0.04	0.49	0.08				
5	Focal Signaling (Lagged)	0.06	0.17	-0.01	0.20			
6	Firm Size (Lagged) (sales, million \$)	0.03	0.27	0.12	0.13	0.04		
7	Firm Profitability (Lagged) (ROA)	0.56	0.04	0.01	0.08	0.05	0.03	
8	Market Concentration (Lagged)	0.03	0.07	-0.06	-0.03	0.03	-0.10	0.03

Correlation coefficients significant at $p < 5\%$ are printed in bold.

The only correlation of interest are *Focal Signaling* and *Reputation*, and *Focal Signaling* and *Policy*. The correlation matrix does not highlight any multicollinearity concerns.

Empirical analysis and results

Given the unbalanced panel dataset with focal-rival dyads across years, we use the generalized estimation equation (GEE) technique for the same reasons as described in Chapter 2. To test mediation from environmental performance variables, Baron and Kenny's (1986) three step approach is used as depicted in Figure 3. In Model-1, the mediating environmental performance variable is regressed against the independent variable, EM signal. In Model-2, the dependent variable, ROA, is regressed against the independent variable, EM signal. Finally, in Model-3, the dependent variable, ROA, is regressed against both the independent variable and the mediating variable. As per this approach a significant relationship should be established in both Model-1 and Model-2.

To establish full mediation, Model-3 should result in a significant relationship between the mediating variable and the dependent variable, while reporting a lack of significance between the independent variable and the dependent variable.

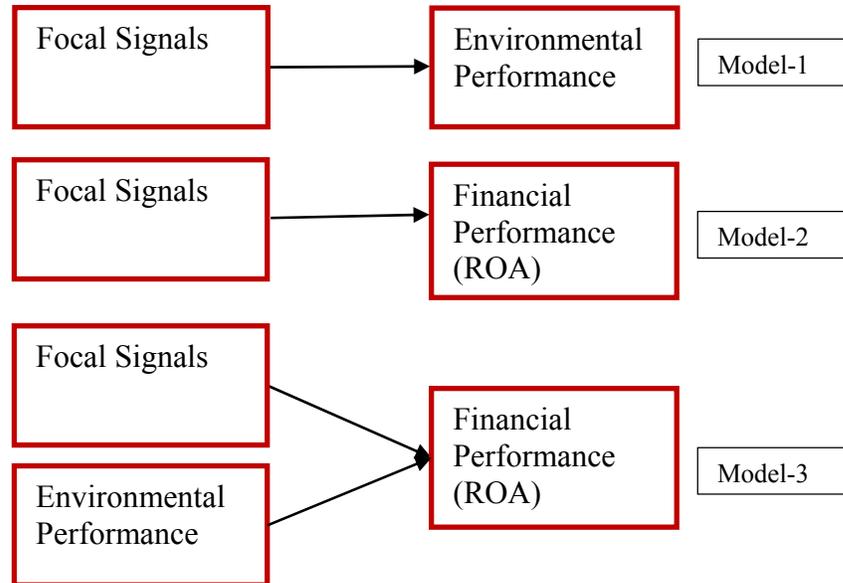


Figure 3 – Baron and Kenny (1986) model for testing mediation

Furthermore, as advocated by the authors, when there is correlation between the independent variable and the mediating variable, as is the case with *Focal Signal-Focal Reputation* and *Focal Signal-Focal Policy* it is important to compare both the size and significance of the independent variable between Model-2 and Model-3. For the application of this approach, environmental performance variables (*Reputation, Impact, and Policy*) are each assessed individually using the Baron and Kenny (1986)

methodology to test for mediation. The results with *Reputation* as the mediating variable are reported in Table 11.

Table 11 – Results for the *Reputation* mediation model

GEE (AR1) regression results (N=2443)			
	Model -1 (Reputation)	Model -2 (ROA)	Model -3 (ROA)
	Coef.	Coef.	Coef.
Constant	-4.242 (0.284)	2.504 (1.396)	3.343 (1.524)
Focal Signaling	0.028*** (0.003)	0.052* (0.024)	0.046* (0.024)
Reputation			0.197~ (0.132)
Firm Profitability	0.006~ (0.003)		
Firm Size	0.370*** (0.023)	-0.132 (0.109)	-0.204~ (0.118)
Market Concentration	0.117*** (0.020)	0.559*** (0.121)	0.534*** (0.124)
Wald χ^2	349.35	27.38	27.44

Standard errors are shown in parentheses below the parameter estimates.

~ $p < 0.10$

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Two-tailed tests for controls, one-tailed tests for hypothesized variables.

Based on the results in Table 11, it can be seen that *Focal Signaling* has a positive and significant association with *Reputation* in Model-1. A positive and significant association between *Focal Signaling* and *ROA* is noticed in Model-2. It is also observed that the introduction of *Reputation* in Model-3 results in a slight reduction in the

significance as well as the size of the *Focal Signaling* coefficient along with a marginal significance of the *Reputation* variable on *ROA*. This suggests a partial mediation from the introduction of *Reputation* in Model-3. Next, the results with *Impact* as the mediating variable are reported in Table 12.

Table 12 – Results for the *Impact* mediation model

GEE (AR1) regression results (N=2443)			
	Model -1 (Impact)	Model -2 (ROA)	Model -3 (ROA)
	Coef.	Coef.	Coef.
Constant	-1.450 (0.695)	2.504 (1.396)	3.0167 (1.419)
Focal Signaling	0.004 (0.015)	0.052* (0.024)	0.052* (0.024)
Impact			0.345*** (0.107)
Firm Profitability	0.006 (0.012)		
Firm Size	0.153* (0.064)	-0.132 (0.109)	-0.186~ (0.112)
Market Concentration	-0.030 (0.028)	0.559*** (0.121)	0.567*** (0.121)
Wald χ^2	7.23	27.38	40.08

Standard errors are shown in parentheses below the parameter estimates.

~ $p < 0.10$

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Two-tailed tests for controls, one-tailed tests for hypothesized variables.

Based on the results in Table 12, we see that *Focal Signaling* lacks a significant association with *Impact* in Model-1 violating the prerequisites of a mediating model. The

positive and significant association between *Focal Signaling* and *ROA* has already been established. The introduction of *Impact* in Model-3 does not affect the *Focal Signaling* on *ROA*, but there is a positive and significant association of the *Impact* variable with *ROA*. The results suggest an independent effect of both the independent and mediating variable on *ROA*. Next, the results with *Policy* as the mediating variable are reported in Table 13.

Table 13 – Results for the *Policy* mediation model

GEE (AR1) regression results (N=2443)			
	Model -1 (Policy)	Model -2 (ROA)	Model -3 (ROA)
	Coef.	Coef.	Coef.
Constant	-2.660 (0.247)	2.504 (1.396)	3.094 (1.426)
Focal Signaling	0.031*** (0.003)	0.052* (0.024)	0.045* (0.023)
Policy			0.223~ (0.139)
Firm Profitability	0.012*** (0.003)		
Firm Size	0.250*** (0.020)	-0.132 (0.109)	-0.187 (0.114)
Market Concentration	0.044* (0.019)	0.559*** (0.121)	0.547*** (0.121)
Wald χ^2	254.66	27.38	29.57

Standard errors are shown in parentheses below the parameter estimates.

~ $p < 0.10$

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Two-tailed tests for controls, one-tailed tests for hypothesized variables.

Based on the results in Table 13, we find that *Focal Signaling* has a significant and positive association with *Policy*. With the association between *Focal Signaling* and *ROA* already established, the introduction of *Policy* in Model-3 results in a slight reduction in the significance as well as the size of the *Focal Signaling* coefficient. The results also show a marginal significance of the *Policy* variable. The reduction in size and significance of the coefficient of *Focal Signaling* along with a marginal significance of *Policy* suggests a partial mediation from the introduction of *Policy* in Model-3. Based on the above results, the direct effect of EM signals on financial performance is reinforced. Although the marginal significance of *Reputation* and *Policy* serve as an important reminder for firms to maintain an environmentally friendly posture, the real impact is realized from the *Impact* score suggesting the need for meaningful investments in EM. Compared with prior studies that have found a significant relationship between firm reputation and financial performance (Roberts and Dowling, 2002; Basdeo et al., 2006), the relationship finds partial support in the EM context.

Discussions

The intent of this chapter was twofold. The first objective was to gain additional insights on the impact on performance with a larger set of performance measures, both environmental and financial. The second objective was to gain a more comprehensive understanding of the dynamics amongst EM signaling, environmental performance, and financial performance through the use of a mediating model.

The results from the use of an expanded set of performance measure highlights some inconsistencies in terms of the impact on performance from EM signaling as a proxy for EM activity. First, the lack of significance in the relationship between EM signaling and *Impact* is surprising. One would have expected higher levels of EM signaling resulting in improvement such as reduced GHGs, reduced water consumption etc. for an improved *Impact* score. Second, it has been articulated that going *green* could possibly serve the dual objective of increased revenue and increased efficiency (Porter, 1991). While the study do find a short term and long term shareholder value perspective from EM lending support to the cost savings argument, it does not find support for a growth perspective. Given that the dataset conforms to a period of sluggish economic activity, it is difficult to definitively interpret the outcome with growth as the dependent variable.

In line with studies that have established financial return from firm reputation (Roberts and Dowling, 2002), the results from the mediating model with *Reputation* support, albeit a marginal impact of environmental reputation. Though not as strong, the finding is still significant. A similar argument can be made for the marginal significance observed in terms of the impact of the policy measure. Firms with a better environmental policy score do seem to have better financial results. . The main result from this analysis was not the lack of a mediating, but rather the significant direct effect of the *Impact* measure on financial performance. In summary, the results do indicate the importance of making meaningful investments in *green* initiatives.

As a robustness check, the procedure introduced by Sobel (1982) to test for mediation was also performed with the same dataset. Though Baron and Kenny (1986) is

the most prevalent testing methodology in OM literature, alternative methodologies have been applied as well, specially the Sobel test (Malhotra et al., 2014). A central criticism of the Baron and Kenny methodology is the requirement of an overall effect of the independent variable on the dependent variable without controlling for the mediating variable. It has been pointed out that the emphasis should be on the relationship between the mediating variable and the dependent variable when a mediating relationship has been hypothesized. It has been shown that the Baron and Kenny requirement can lead to misleading results if the direct effect of the independent variable on the dependent variable differs in sign from the indirect effect through the mediating variable on the dependent variable (Malhotra et al., 2014). While this is not a big concern given that the predicted direct and indirect paths of influence are hypothesized to have a similar positive effect on financial performance, for the sake of robustness, Sobel test is done for assessing mediation from the environmental performance on financial performance. As a specialized t-test, Sobel test allows to assess if the indirect effect of the mediation effect is significant based on the size and standard error of the coefficient. Table 14 presents the results of the Sobel testing with all three environmental performance variables as mediating variables. These results have been generated at

<http://quantpsy.org/sobel/sobel.htm>.

Table 14 – Results from *Sobel* test for mediation

REPUTATION

Input:		Test statistic:	Std. Error:	p-value:
a	0.027543	Sobel test: 1.46148234	0.00371453	0.14388312
b	0.1971	Aroian test: 1.45059852	0.0037424	0.14689169
s _a	0.003438	Goodman test: 1.47261487	0.00368645	0.14085491
s _b	0.1326	Reset all	Calculate	

IMPACT

Input:		Test statistic:	Std. Error:	p-value:
a	0.00381	Sobel test: 0.25524725	0.0051527	0.79853214
b	0.3452	Aroian test: 0.24389032	0.00539264	0.80731577
s _a	0.01488	Goodman test: 0.2683544	0.00490103	0.78842654
s _b	0.1069	Reset all	Calculate	

POLICY

Input:		Test statistic:	Std. Error:	p-value:
a	0.03131	Sobel test: 1.57926355	0.00441915	0.11427562
b	0.2229	Aroian test: 1.57050453	0.00444379	0.11629778
s _a	0.00336	Goodman test: 1.58817078	0.00439436	0.11224773
s _b	0.1391	Reset all	Calculate	

The above results are nearly identical to the results obtained with the Baron and Kenny approach. Both *Reputation* and *Policy* are marginally significant (one-tailed) suggesting partial mediation, but there is no such support for the *Impact* variable as a mediator.

Beyond the results of the mediation test, the lack of significance of EM signaling on *Impact* resurrects the arguments around *greenwashing*. While this cannot be definitively ascertained without a careful analysis of the CSR reports, the results do highlight continued concerns.

Conclusion

Much has been said about *greenwashing* and the fact that companies like to claim the *green* label without really investing the effort or resources. While we cannot debunk such a proposition, the stronger association of *Impact* on financial performance is encouraging. The data does seem to support genuine efforts by the firm even if firms are engaging in some level of *greenwashing*. Though, from a managerial perspective, it is important to research how firms are overcoming the information asymmetry aspect of EM. Are some taking undue advantage by creating a perception of reality?

As a next step, this work can be built upon by leveraging signaling theory to better understand the impact of environmental signals. The impact from signaling through CSRs is dual, it should improve the firm's operational performance as well as improve its reputation. In terms of parsing out the impact of signaling further between these dual impacts, additional research is required in assessing the quality and intent of a firm signal. A significant body of work exists in signaling that deals with credible signaling (Kirmani and Rao, 2000) that can be leveraged to classify signals for further investigation of this topic.

Chapter 4: Competitive Dynamics and Inter-firm Rivalry

Introduction

This chapter is dedicated to expanding the prior work done by Hofer et al. (2012) on inter-firm rivalry in the EM domain. In chapters 2 and 3, the same basic measure for focal and competitive behavior established by Hofer et al. (2012) was used to test out the various relationships. In this chapter, we attempt to add richness to the set of competitive dynamic measures while at the same time expanding the set of rivals.

Inter-firm rivalry as evidenced by actions and counteractions of firms and rivals has been reported in multiple studies (Young et al., 1996; Ferrier et al., 1999). Hofer et al. (2012) found evidence of this recurring phenomenon in the EM domain as well by restricting their focus to a measure of total volume of activities by a firm as gleaned from the CSR reports. The authors leveraged Schumpeterian economics and signaling theory as the theoretical underpinning for studying EM from a competitive dynamics perspective. The Schumpeterian viewpoint has been elaborated in Chapter 2. The following section provides a recap of signaling theory as applicable to the current study.

Signaling Theory

According to Spence (2002), signaling theory is essentially concerned with reducing information asymmetry between two parties. In this respect, studies have looked at price as a signal of quality (Kihlstrom and Riordan, 1984; Milgrom and Roberts,

1986), CEO stature providing credibility to the financial statement of the firm (Zhang and Wieserma, 2009) etc. Given that many of the activities a firm undertakes are hidden from the consumers as well as competitors, signaling theory provides a suitable basis for studying EM behavior in the context of competitive dynamics. In the context of this study, a central question is the definition of a signal.

According to Porter (1980), market signal is any action by a firm that provides direct or indirect indication about its intentions, motives, goals, or internal situation. He broadly classifies signals as both preannouncements of market action (intent); and market actions, thereby providing an expanded basis to study inter-firm competition. Besides signals emanating from the firm itself, studies have also looked at signals (awards, competitive ranking etc.) that convey information about the firm through external monitors (Fombrum and Shanley, 1990; Klassen and McLaughlin, 1996). Heil and Robertson (1991) borrow from Porter's (1980) expanded definition of signal, but nuance it from the perspective of the signal sender. Whereas Porter's (1980) signals are focused on interpretation of actions by the receiver, Heil and Robertson (1991), shifts the focus to the signal sender by acknowledging that a signal not received can be attributed to a failed signal. This nuance assumes importance in this study since it is difficult to measure reception of EM signals. Signaling theory relies on the observability of market signals that allows competitors to respond. The theory forms the basis for two distinct components that apply to competitive dynamics: 1) the signal is what conveys a firm's intent, and 2) it is observable, as in, is detectable by sensory systems of other firms as per their scanning capabilities (Smith et al., 2001). The aforementioned theoretical basis of

our work is similar to the approach adopted by Hofer et al. (2012) with the difference being that this study relies on Heil and Robertson's (1991) definition of a market signal.

Hypotheses

As argued by Smith et al. (2001), a firm and its set of competitors share a level of interdependence as they feel the impact of actions taken by others and interact through their own moves and countermoves. A firm's effort to improve upon their performance at the cost of others depends on the action of others as well. Based on the Schumpeterian discourse, the markets are never in a state of static equilibrium in the presence of competition. Entrepreneurial actions by firms and their rivals are constantly eroding the status quo as they take actions to improve upon their performance. A majority of these actions can be generally classified as: pricing actions, marketing actions, new product actions, capacity-and-scale related actions, service and operations actions, signaling actions, etc. (Smith et al, 2001). In the context of *green*, Hofer et al. (2012) look at the interactions between leader-challenger pairs and find evidence of rival EM activity as a driver of the leader's EM activity. The study looks at firm and rival competitive activity between leader and challenger firms in the US within a specific 6 digit NAICS. The authors find that higher levels of rival competitive activities lead to higher levels of focal firm activity in the EM domain.

This study builds on the work of Hofer et al., (2012), by leveraging Heil and Robertson's (1991) viewpoint and looks at the competitive interplay amongst firms via signals. Heil and Robertson (1991) have adopted Porter's (1980) definition of signals as

market actions as well as preannouncement of market actions, but anchor the intentions of the signal from the sender's perspective. This study also adopts arguments by Fombrum and Shanley (1990) to include signals about firms sent by external monitors (awards, ratings etc.).

To bolster the competitive dynamics viewpoint of action and reaction, this study also incorporates Heil and Robertson's (1991) argument on pre-emption as a reason for competitive market signaling by firms. By signaling intent, a firm conveys its commitment to a set of actions, and the necessary steps it is willing or undertaking to bring that intent to fruition. These could include: locking in suppliers, locking in customers via forward booking, building capacity, announcing new technology etc. In doing so, the signaling firm might discourage competitors from following as long as the signal is credible, as in, it should convey a high level of commitment from the signaler. The pre-emption argument seemingly favors strong credible signals and complements the support for inter-firm rivalry resulting from interdependence in the context of competitive dynamics. Viewed in tandem, the two approaches suggest that not only would a firm counter rivals' signals, but would also send a stronger signal back to discourage pursuit.

Given the theoretical underpinnings and prior research in competitive dynamics, the impact of competitor behavior on focal firm behavior is captured via an inter-firm rivalry model as depicted in Figure 4. It is expected that given the interdependencies and with the intent to pre-empt firms would respond forcefully to counter competitive moves by their rivals. As with other types of actions such as pricing or advertising, higher levels of rival signaling in the EM domain would lead to a higher level of signaling response from the focal firm. Besides a higher level of signaling, firms also compete aggressively

through a broader range of actions (Ferrier et al., 1999). Borrowing from the work by Ferrier et al. (1999), the study also looks at complexity of actions as an element of competition.

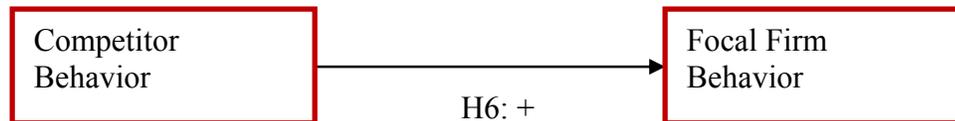


Figure 4 – Signaling rivalry model

By leveraging arguments on firm level interdependence as well as a desire to pre-empt, the competitive interaction among firms in the *green* domain is formally proposed as the following:

H6a: A higher level of environmental signals from its competitors leads to a higher level of environmental signals by the focal firm.

H6b: A higher level of signaling complexity from its competitors leads to a higher level of signaling complexity by the focal firm.

Sample, data, and variables

In support of the study for Chapter 2, a data frame of 582 unique firms across the four years of *Newsweek* data with their top three rivals identified through *Hoover's* was established. The CSR collection and subsequent content analysis resulted in EM signaling data ranging from 2008 to 2011. To study the relationship between rival and focal signaling, we lag the rival signals (2008-2010) by a year to focal signals (2009-2011). Additional filters are subsequently applied to create the inter-firm signaling dataset. The data used for assessing inter-firm rivalry is restricted to ensure rivalry by filtering where both focal and rival record signals in the year of impact with either reporting in the lagged year of relevance. For the study of inter-firm rivalry, we use both actual thematic scores as well as a binary coding of themes (1 if significant, 0 otherwise) for deriving the various competitive dynamic measures. Consistent with prior work (Hofer et al., 2012), we assign a zero signal value to firms that either do not report significant activity or do not report at all.

Measurement of variables

In addition to the total volume of signaling, signaling complexity is also calculated for assessing inter-firm rivalry. The importance of complexity is noted in several studies (Ferrier et al., 1999; Nodofor et al., 2012) as a driver of improved performance. To expand the prior work of Hofer et al. (2012), a measure of complexity is included and researched within the same modeling framework depicted by Figure 3. The methodology

for measuring total signaling is elaborated in Chapter 2. For signaling complexity, we use the Montabon et al. (2007) categorization for EM signals and is measured as below:

1. Signal complexity: adopted from Ferrier et al. (1999) measures the dispersion in signaling across the different categories of the Montabon et al. (2007) typology. It measures if signals are spread across operational, tactical, and strategic or concentrated in a specific category. It is calculated as:

$$1 - \sum_i (N_i / NT)^2, \text{ where}$$

i - signal category (operational, tactical, strategic)

NT – total amount of signaling for the respective focal or rival

Besides measures of focal and rival signaling, various industry level controls are included in the model for studying inter-firm rivalry. Measures of competitive behavior are lagged by a year to the measures of focal firm signals, with ROA, Sales, HHI and Industry dummies used as controls. ROA, Sales and HHI are used as proxies for profitability, firm size, and market concentration respectively for the same reasons of firm flexibility, investment potential, and signal reception cited in chapter 2. The descriptive statistics for the different variables using thematic scores is provided in Table 15.

Table 15 – Descriptive statistics for signaling rivalry score model

Descriptive Statistics (N=840)		
Variable	Mean	Std. Deviation
Complexity	0.35	0.22
Focal Signal	0.37	0.39
Competitor Signal (Lagged)	0.30	0.35
Competitor Complexity (Lagged)	0.33	0.22
Focal Signal (Lagged)	0.32	0.39
Size (Lagged) (sales, million \$)	38564.90	58470.26
ROA (Lagged)	0.06	0.07
Market Concentration (Lagged)	1381.23	1647.57

Table 16 lists the correlations among the different variables. The only correlations of significance are the expected ones between measure of total signal and signaling complexity.

Table 16 – Bivariate correlations for the signaling rivalry score model

Bivariate Correlations (N=840)							
	1	2	3	4	5	6	7
1 Complexity							
2 Focal Signal	0.37						
3 Competitor Signal (Lagged)	0.08	0.10					
4 Competitor Complexity (Lagged)	0.10	0.05	0.45				
5 Focal Signal (Lagged)	0.14	0.33	-0.03	0.05			
6 Size (Lagged)	-0.11	-0.12	-0.08	-0.02	-0.03		
7 Profitability (Lagged)	0.09	0.05	0.04	0.07	0.01	0.09	
8 Market Concentration (Lagged)	-0.01	0.12	0.03	-0.02	0.14	-0.09	0.09

Correlation coefficients significant at $p < 5\%$ are printed in bold.

Given the possibility that minor differences in theme scores does not convey much in terms of differences in firm signals, a 1/0 coding is used as in Chapter 2 to account for the significance of a theme. This follows the logic from the Hofer et al.

(2012) paper of assigning a significant theme a value of 1 and 0 otherwise. The same dataset used for measuring signal score is also used for calculating signal count as described above along with measures for complexity. The descriptive statistics for the different variables based on counts is provided in Table 17. An over-dispersion in the dependent variable *Focal Signals* is noticeable.

Table 17 – Descriptive statistics for signaling rivalry count model

Descriptive Statistics (N=840)		
Variable	Mean	Std. Deviation
Complexity	0.35	0.21
Focal Signal	6.85	5.69
Competitor Signal (Lagged)	5.66	5.47
Competitor Complexity (Lagged)	0.34	0.22
Focal Signal (Lagged)	5.75	5.83
Size (Lagged) (sales, million \$)	38564.90	58470.26
ROA (Lagged)	0.06	0.07
Market Concentration (Lagged)	1381.23	1647.57

Table 18 lists the correlations among the different variables using significant theme counts as the basis for quantifying signals and developing additional competitive dynamic measures.

Table 18 – Bivariate correlations for the signaling rivalry count model

Bivariate Correlations (N=840)							
	1	2	3	4	5	6	7
1 Complexity							
2 Focal Signal	0.45						
3 Competitor Signal (Lagged)	0.06	0.09					
4 Competitor Complexity (Lagged)	0.11	0.07	0.49				
7 Focal Signal (Lagged)	0.13	0.33	-0.01	0.05			
8 Size (Lagged)	-0.10	-0.07	-0.07	-0.04	0.04		
9 Profitability (Lagged)	0.10	0.11	0.05	0.07	0.07	0.09	
10 Market Concentration (Lagged)	0.04	0.09	0.03	-0.02	0.13	-0.09	0.09

Correlation coefficients significant at $p < 5\%$ are printed in bold.

As with correlation with data on signal scores, *Competitor Complexity* and *Competitor Signal*; and focal *Complexity* and *Focal Signal* are highly correlated. Since complexity and total signal are not used in the same model, there are no multicollinearity concerns from the above correlations.

Empirical analysis and results

Estimation methodology

Generalized linear modeling techniques are employed for assessing the impact of competitive signaling on focal firm response. The impact of inter-firm rivalry is assessed using both scores and counts. A negative binomial regression is used for counts because of over dispersion in the *Focal Signal* count variable. Separate models are run for assessing rivalry along signaling complexity and total signaling. The regression models are constructed as below:

$$X_t = X_{t-1} + XC_{t-1} + \log(\text{Sales}_{t-1}) + \log(\text{HHI}_{t-1}) + \text{ROA}_{t-1} + \text{Industry}_d$$

Where,

X_t – *Focal Signal* or *Signal Complexity* at time t

XC_{t-1} – *Competitor Signal* or *Signal Complexity* lagged by 1 year

$Sales_{t-1}$ – Focal sales (Size) lagged by 1 year

HHI_{t-1} – Focal HHI (*Market Concentration*) lagged by 1 year

ROA_{t-1} – Focal ROA (*Profitability*) lagged by 1 year

$Industry_d$ – Industry dummies

The study tests the impact of lagged competitor signaling on focal firm signaling while controlling for lagged focal firm signaling, focal firm size (lagged), focal firm profitability (lagged), focal firm' industry concentration (lagged), as well any fixed effects of the focal firm industry. These models are run with both signal score and signal counts. Given the non-normality and over-dispersion of focal firm signal counts, a negative binomial generalized linear model is used for testing the relationships. All statistical tests in this chapter are performed using R.

Empirical results

Since the dataset conforms to a time series cross sectional (TSCS) set with few time periods and an unbalanced panel, OLS regressions using generalized linear models (GLM) are performed to assess the strength of the hypothesized relationships. Dynamic

linear modeling technique is employed via inclusion of the lagged dependent variable in the model to account for autocorrelation. Results from the GLM regressions performed in R using the total signaling score and signal complexity are presented in Table 19.

Table 19 – Results for the signaling rivalry score model

Generalized Linear Model (Scores)		
	Focal Signal	Complexity
	Coef.	Coef.
Constant	0.844 (0.203)	0.510 (0.183)
Focal Signal (Lagged)	0.287*** (0.034)	
Competitor Signal (Lagged)	0.089* (0.038)	
Focal Complexity (Lagged)		0.234*** (0.050)
Competitor Complexity (Lagged)		0.055 (0.049)
Size (Lagged)	-0.174*** (.013)	-0.035** (0.011)
Profitability (Lagged)	0.060 (0.213)	0.040 (0.149)
Market Concentration (Lagged)	0.010 (0.024)	0.001 (0.020)
AIC	648.1	-122
AIC (Controls only)	715.1	-210.8

Standard errors are shown in parentheses below the parameter estimates.

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

The regression results using total signaling based on counts and signaling complexity based on counts is presented in Table 20.

Table 20 – Results for the signaling rivalry count model

Generalized Linear Model (Counts)		
	Focal Signal	Complexity
	Coef.	Coef.
Constant	2.47 (0.430)	0.407 (0.182)
Focal Signal (Lagged)	0.036*** (0.005)	
Competitor Signal (Lagged)	0.012* (0.005)	
Focal Complexity (Lagged)		0.211*** (0.050)
Competitor Complexity (Lagged)		0.053 (0.045)
Size (Lagged)	-0.165*** (.027)	-0.031** (0.011)
Profitability (Lagged)	0.490 (0.437)	0.0723 (0.149)
Market Concentration (Lagged)	0.037 (0.050)	0.015 (0.020)
AIC	4617	-120.5
AIC (Controls only)	4670	-206.7

Standard errors are shown in parentheses below the parameter estimates.

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Hypothesis testing results

Hypothesis 6a states that higher level of competitor signaling will lead to higher levels of focal response. The positive and statistically significant coefficient for *Competitor Signaling* (lagged) using both scores ($\beta = 0.089$, $p \leq 0.05$) and count model ($\beta = 0.012$, $p \leq 0.05$) as reported in Table 19 and Table 20 provides evidence in support of hypothesis 6a. But the lack of significance of *Competitor Complexity* (lagged) fails to provide

support for hypothesis 6b, which stated that greater complexity of competitor signaling will elicit a greater complexity of focal response.

Conclusion

The intent of this section was to build on the prior work of Hofer et al. (2012). While similar results are obtained in terms of the competitive dynamics between firms, additional competitive dynamic measures calculated for this study are unable to provide further insights into EM rivalry between firms. Nevertheless, competitive dynamic literature has documented several ways to look at rivalry and more needs to be done for a thorough understanding of rivalry between firms in the EM domain. Given the anecdotal evidence as reported in the media such as the “bottle wars” to introduce bioplastics in water bottles, or recyclable paper in coffee cups, competitive dynamic measures such as action timing, and scope (limited introduction or introduction in all markets) provide a rich basis to further the research on inter-firm rivalry in the EM domain.

Chapter 5: Additional Analysis – Advantage Supplier

Introduction

“Currently, 48 percent of firms reward suppliers with good sustainability practices or jointly improve processes with suppliers that do not. About 44 percent of firms measure the sustainability performance of major suppliers, and 24 percent require a third party to certify suppliers’ sustainability practices.” – Mahler (2007)

The importance of the supplier network has been emphasized by Rice and Hoppe (2001). In their view supplier networks and the capabilities companies can cultivate via their supplier network will play a dominant role in competing successfully. Mahler (2007) further notes that in terms of trends there is an expectation of more joint participation with suppliers to improve sustainability processes, track sustainability metrics, and more external certification of suppliers. A careful analysis of the CSR reports indicates the importance firms place on a supplier code of conduct around sustainable practices. Given the highly outsourced nature of business nowadays, achieving *green* has to be an all-inclusive effort receiving support from every member of the supply chain. With the supplier network becoming a source of competitive advantage, the above viewpoints make a strong case to look at EM contributions from the suppliers to the firm’s performance. The following section details the current state of efforts in developing this research stream further.

Hypothesis

The relational view by Dyer and Singh (1998) advocates the advantages firms might reap from resources outside firm boundaries to include suppliers and other alliance partners in the network. The strategic importance of suppliers to the success of a firm has been explored from several different perspectives. In the study on specialized supplier networks as a source of competitive advantage, Dyer (1996) notes that transaction specific investments by suppliers could create a source of competitive advantage. The relational viewpoint looks at complementary capabilities, knowledge sharing, relation-specific assets, and effective governance as sources of advantage in the network. Dyer and Singh (1998) expand the resource based view of valuable, rare, inimitable, and non-substitutable resources from within firm boundaries to a firm's network emphasizing the importance of suppliers. They have argued that firms who have worked with their suppliers to combine resources and capabilities draw a distinct competitive advantage. Azadegan et al. (2008) find that firms derive competitive advantages from supplier innovativeness. In their work on strategic networks, Gulati et al. (2000) contend that the conduct and performance of a firm can be much better understood by examining the network of relationships rather than by taking an atomistic view of the firm. For example, the tight relationships with its suppliers have often been cited as an example of Toyota's success. As pointed out by Dyer and Singh (1998), the need for cooperation and alignment between buyer-suppliers is ever increasing with firms purchasing more and more of the value of the product they produce.

While evidence of improved operational performance from a firm's supply management orientation has been noted by Shin et al. (2000), the results of supplier

involvement in the EM context require additional research. Based on case studies in the furniture industry, Walton et al. (1998) advocate the need of supplier and purchaser involvement to lower cost and meet or exceed environmental expectations of stakeholders. *Greening* of the supplier network gets complicated with appropriation of financial gains, distribution of costs, and a whole host of issues surrounding boundary spanning activities. In a survey based study, Rao (2002) looks at the link between *green* supply chains, and its association to competitive and economic performance. While the study did not establish a direct link between *green* supply chains and economic performance, it did find a mediated effect of competitiveness from *green* activities on financial performance.

By leveraging arguments around the relational view proposed by Dyer and Singh (1998) of the supplier network being a unique and valuable resource for the firm, the relationship between supplier EM behavior and focal firm performance is formally proposed as follows:

H7: Higher levels of environmental signaling by supplier will have a positive effect on the performance of the focal firm.

Sample, data, and variables

For the initial analysis to assess the impact of EM signaling by the supplier network on focal firm performance, the focal firms are identified through the *Newsweek* data for which we have existing environmental performance data. As noted earlier,

Newsweek publishes *green* rankings for the top 500 U.S. firms. The rankings from 2009-2012 covers twenty different industries under a classification system developed by *Newsweek*.

Identification of suppliers is achieved by leveraging the ³*Bloomberg* dataset. *Bloomberg* data lists major manufacturing firms as well as a subset of their suppliers. For this initial analysis, only direct suppliers are included in the consideration set. Focal firm and their suppliers are matched up with the EM dataset already developed for this dissertation. Through this matching process a list of 240 focal-supplier dyads are generated comprising EM signals, focal firm performance, and data associated with control variables (Sales, ROA, and HHI). Table 21 presents the descriptive statistics on the initial dataset. The same measures as before are used for the purpose of this analysis. *Supplier Signaling* is the count of significant themes recorded against firms that match up as suppliers in the dataset used for performance studies in chapters 2 and 4.

³ The *Bloomberg* data was shared by Isaac Elking and John-Patrick Paraskevas, Ph.D. students at the University of Maryland. I would like to note their cooperation in making this data available upon request with adequate explanation.

Table 21 – Descriptive statistics for the supplier network dataset

Descriptive Statistics (N=240)		
Variable	Mean	Std. Deviation
Focal ROA	5.29	6.99
Focal Reputation	53.06	22.29
Focal Signal (Lagged)	5.96	6.83
Supplier Signal (Lagged)	5.29	6.20
Focal Size (Lagged) (sales, million \$)	27300.00	16800.00
Focal ROA (Lagged)	5.86	7.13
Market Concentration (Lagged)	3170.00	3120.00

Logarithms of *Focal Size* and *Market Concentration* are used in the models to reduce the disparity in the scale of measures. Table 22 presents the correlation table for this dataset.

Table 22 – Bivariate correlations for the supplier network dataset

Bivariate Correlations (N=240)		1	2	3	4	5	6
1	ROA						
2	Focal Reputation	0.00					
3	Focal Signal (Lagged)	-0.20	0.27				
4	Supplier Signal (Lagged)	-0.03	0.04	-0.06			
5	Focal Size (Lagged)	-0.07	0.27	0.04	-0.06		
6	Focal Profitability (Lagged)	0.50	-0.06	-0.14	0.02	-0.12	
7	Market Concentration (Lagged)	-0.22	0.00	0.25	-0.09	0.35	-0.23

Correlation coefficients significant at $p < 5\%$ are printed in bold.

None of the bivariate correlations are indicative of multicollinearity issues in the model. One would have expected a positive and significant correlation between *Focal Signal* and *Supplier Signal* as opposed to the negative and insignificant value noted in Table 22. A similar argument could be made for supplier signaling and focal firm *ROA*, which is not the case as reported in Table 22.

Empirical analysis and results

For similar reasons cited earlier, generalized estimation equation (GEE) techniques are employed for assessing the impact of supplier signaling on focal firm performance. The impact on focal firm performance is assessed using both *Reputation* and *ROA*. The regression model is constructed as below:

$$X_t = F_{t-1} + S_{t-1} + \log(\text{Sales}_{t-1}) + \log(\text{HHI}_{t-1}) + \text{ROA}_{t-1}$$

Where,

X_t – Focal performance with *Reputation* or *ROA* at time t

F_{t-1} – *Focal Signal* lagged by 1 year

S_{t-1} – *Supplier Signal* lagged by 1 year

Sales_{t-1} – Focal sales (Size) lagged by 1 year

HHI_{t-1} – Focal HHI (*Market Concentration*) lagged by 1 year

ROA_{t-1} – Focal ROA (*Profitability*) lagged by 1 year

Instead of a dynamic panel model, an autoregressive model is used for testing with *ROA* as the dependent variable. Table 23 presents the results of the GEE analysis.

Table 23 – Empirical results for the impact of supplier signals

GEE (AR1) regression results (N=240)

	Reputation	ROA
	Coef.	Coef.
Constant	-1.174 (0.592)	0.035 (0.091)
Focal Signal (Lagged)	0.022*** (0.006)	-0.106* (0.058)
Supplier Signal (Lagged)	0.011~ (0.008)	-0.055~ (0.041)
Focal Size (Lagged)	0.341*** (0.063)	0.459 (1.301)
Focal Profitability (Lagged)	-0.007 (0.006)	
Market Concentration (Lagged)	-0.216*** (0.051)	-2.048* (0.914)
Wald χ^2	63.07	10.25

Standard errors are shown in parentheses below the parameter estimates.

~ $p < 0.10$

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Two-tailed tests for controls, one-tailed tests for main variables.

Based on the results reported in Table 23, *Supplier Signal* has a positive though marginally significant impact on focal firm reputation, but a negative and marginally significant impact on financial performance. Though weak, the results provide partial support to the hypothesis.

Conclusion

The intent of this study was to look at the impact of the supplier network on firm performance in the EM domain by testing the relationship between EM signals from suppliers and focal firm performance. Though the results provide mixed and weak support for the different performance measures, it does lend support to the notion of the importance of the supplier network. The significance of the marginal significance assumes added significance given the limitations of the underlying dataset, which is rather restrictive due to the matching of *Bloomberg* with the existing EM dataset. These results do make a case for further investigation of the arguments made by Dyer and Singh (1998) that the supplier network comprises unique resources for the firm in line with the resource based view. It also assumes managerial significance in terms of selection and management of suppliers. Though it is difficult to make any generalizable claims based on a partial dataset used for this analysis, the results provide sufficient indication of the importance of the supplier network.

Chapter 6: Dissertation Conclusion and Future Research

Future Research

This section discusses two specific future research extensions laying out feasible approaches based on the exploratory work accomplished in these areas. The first extension of the work presented through this dissertation is to expand the exploratory analysis on boundary spanning EM activities with the inclusion of supplier EM signals discussed in Chapter 5. The future research possibilities look into additional possibilities of network analysis from a methodological perspective as well as scope of analysis.

The second proposed extension is to address issues surrounding *greenwashing*, by looking into aspects of credible signaling. *Greenwashing* occurs with firms signaling EM without substantive follow-up actions or investments to benefit the environment. In such a situation the announcements are tantamount to lip service for deriving benefits from the cultivation of a false image. The lack of significance of focal firm signals on *Impact* score coupled with a partial mediation effect of *Reputation* on *ROA*, as reported in Chapter 3, is indicative of this phenomena. Prior work in the area of credible signaling provides a platform to further investigate this phenomena. The subsequent paragraphs lays out feasible approaches for future research on these two topics.

Network Analysis

Focusing on methodological extensions for improved datasets, an alternative approach would entail the preparation of an entirely new dataset by leveraging *Bloomberg*. Post identification of competitors through *Hoover's* for focal firms in *Bloomberg*, one could leverage the *Bloomberg* dataset to capture environmental data on focal, competitor, and supplier firms existing in the *Bloomberg* dataset. *Bloomberg's* Environmental, Social and Governance (ESG) data is collected from published company material and integrated with the financial products the company offers for investor analysis. *Bloomberg* data reports on some 5000 companies and reports on data such as greenhouse gas emissions, water consumption, waste production etc. ESG disclosure scores reported by *Bloomberg* as an indicator of transparency in the firm's reporting has garnered considerable interest (Eccles et al., 2011). An appropriate disclosure score metric in the *Bloomberg* dataset could be a suitable proxy for EM behavior.

A more extensive usage of *Bloomberg* data would also allow investigation on additional supplier attributes including: supply chain tier or echelon; relative importance; and for some industries the possibility to look at both upstream and downstream EM activity. The data is available for different echelons of the supply chain. For a focal firm the database lists direct suppliers and then keeps moving upstream to capture the supplier's supplier. Furthermore, *Bloomberg* provides the percent of the cost of goods sold by the manufacturer that is sourced from the specific supplier thus helping with the identification of top suppliers if needed.

The current EM dataset is limited by both the number of CSR reports and the methodology used for harvesting EM signals. To complete this dataset, additional CSR

reports can be captured where the existing dataset has gaps for quantifying EM behavior. In terms of quantifying EM signals, a simpler codification scheme can be employed for content analysis. The current content analysis methodology employed is restricted by a thematic coding scheme. One could leverage prior studies (Aerts and Cormier, 2009) to implement a simpler coding scheme for collecting EM information on firms from these reports with the expectation of gaining more data. An assessment of the feasibility of such an approach was undertaken with a comparable content analysis tool (Atlas.ti) using a limited number of CSRs and a few select keywords. The output from Atlas.ti is presented in Table 24.

Table 24 – Sample output from Atlas.ti

WORDS	P 1	%	P 2	%	P 3	%	P 4	%	P 5
award	0	0.00%	19	7.88%	26	14.94%	29	7.90%	2
environment	9	37.50%	42	17.43%	34	19.54%	41	11.17%	31
green	4	16.67%	38	15.77%	11	6.32%	60	16.35%	2
greenhouse	1	4.17%	10	4.15%	14	8.05%	21	5.72%	13
iso	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0
packaging	1	4.17%	38	15.77%	24	13.79%	41	11.17%	0
recycle	0	0.00%	5	2.07%	2	1.15%	4	1.09%	0
reduction	2	8.33%	23	9.54%	25	14.37%	55	14.99%	13
waste	7	29.17%	66	27.39%	38	21.84%	116	31.61%	10
Total:	24	100.00%	241	100.00%	174	100.00%	367	100.00%	71

Table 24 records the frequency of words displayed in the first column in the columns with the document name (P1-P5). The columns denoted “%” record the percentage of occurrence of the specific keyword in the set of all the keywords found in the document for a relative importance score. Such an approach could be adopted to test key themes recurring in the supply chain network for network level comparisons.

Along with an expanded dataset, there are several possible ways to extend the work undertaken in this chapter beyond the focal-supplier dyadic analysis. While the above study is undertaken to establish the relationship between supplier signals and focal firm performance, the dynamics behind performance are typically a bit more complex. The focal-supplier context can be extended to research the impact of supplier network in the competitive context by collecting data on the competitors and their suppliers. This extension can replicate the work performed in chapters 2 and 4 to assess the rivalry aspect between focal and rival firms at the network level, and assess the impact of network level rivalry on performance. Moving away from the supplier context, one could also change the tone of the discussions. Thus far, the discussions have centered on focal firms including supplier support for focal firms. The next step would be to look at customer driven approaches by looking at focal-customer dyads. Focal-customer direction recognizes that the customer's preference for sustainable behavior could be an important driver of EM. For example, P&G's focus on green could very well be an outcome of Walmart's green strategy. These extensions would serve to provide a comprehensive viewpoint on EM initiatives and its outcome by taking into account a majority of the stakeholders.

In summary, expanding this research to include supplier networks as well as customers has relevant managerial implications. In terms of the supplier network, given the value of the product outsourced to suppliers, and the relevance of suppliers in complying with *green* guidelines, this research stream represents an existing gap in the literature. Similarly, the importance of the customer as the driver behind *green* initiatives cannot be ignored. It is important to evolve our understanding of EM behavior by looking

at the entire supply chain. The initial analysis on the impact of the supplier network does look promising and provides a reasonable measure of confidence for an undertaking to expand the study of EM and its impact on firm performance to include boundary spanning activities.

Credibility

To further understand the issues surrounding *greenwashing*, a natural extension is to look at credible signaling. Grounded in signaling theory, credibility looks at signal quality and cost tradeoffs. Kirmani and Rao (2000) highlight the applicability of the theory via a model that includes both a high-quality and a low-quality firm where quality is not observable. In this context, the authors explain that high quality firms will undertake signaling if the payoff from signaling is higher than from not signaling to differentiate from the low quality firm. By assessing the credibility of signals, one can better understand the mechanisms by which firms are seeking gains from their *greening* initiatives. The following section details the current efforts in developing this extension further.

A host of studies have looked at the credibility of firm signals (Cohen and Dean, 2005; Janney and Folta, 2006). These studies have presented attributes such as cost, irreversibility, and observability as qualities of good signals with cost itself being a proxy for credibility. In the context of the data employed for research throughout this dissertation, it is important to revisit this issue to try and establish the veracity of information made available through CSR reports. To establish the importance of this

topic, the following section reviews the theory and a select set of papers looking at the quality of EM signals.

Signaling theory has been extensively used in business settings to understand firm behavior vis-à-vis its rivals, and potential for payoffs based on signals (Heil and Robertson, 1991; Basdeo et al, 2006; Connelly et al., 2011). Signaling is typically undertaken to convey an unobservable quality of the firm as well as to educate the stakeholders on intent of a course of action (Stiglitz, 2000). As noted by Connelly et al. (2011), the depth of the theory lies in “ascribing costs to the information acquisition process that resolves information asymmetry.” This aspect was highlighted in Spence’s (1973) formulation of the theory. In the context of a labor market, Spence (1973) explains the importance of educational accomplishment as a signal of quality sent by a candidate to a prospective employer.

In the EM domain, the focus shifts on qualifying a signal as credible. Montabon et al. (2000) find some evidence of performance improvements from ISO 14000 certification. Similar to ISO 9000 for quality, ISO 14000 is awarded based on a third party audit of firm level EM practices. While this study lends partial support to Porter’s (1991) argument of performance improvement through adoption of environmental standards, it leaves the question open on the possible indirect effects from an ISO 14000 certification. ISO 14000 does inform the consumers and competitors of the firm’s friendly *green* posture, but by doing so, does the firm reap some additional benefits over and above its rivals lacking such a certification? In that sense is ISO 14000 a credible signal?

To advance the research around credibility of signals in the EM domain, the following ways of assessing credibility are proposed at different levels including: 1) one could assess the overall credibility of the CSR report; 2) one could assess the credibility of portions of the report; and 3) one could assess the credibility of individual statements or disclosures in a report. Table 25 presents the analysis of a representative CSR report.

Table 25 – Sample analysis of a CSR report for assessing credibility

Company - Agilent		EM Statement	2008	2009	2010	2011
	Total Pages		61	25	38	54
	Environmental Pages		25	7	9	6
	External validator		No	No	Yes	Yes
	Violations		Yes	Yes	Yes	Yes
	Reporting Standard		GRI	GRI	GRI	GRI
	Awards		Yes	Yes	Yes	Yes
	Supplier Code of Conduct		Yes	Yes	Yes	Yes
	Leadership Statement		Yes	Yes	Yes	Yes
11		Set a goal of 1.5 percent energy conservation at our large-owned offices and manufacturing sites worldwide	PL*	P	P	P
12		Supporting an active campaign to engage employees in energy-savings practices in both the home and office;	PL	P	P	
13		Promoting and enabling work-at-home opportunities;	PL			
14		Installing 1.1 megawatts of solar-power generation at our sites (California, U.S. and Waldbronn, Germany sites);	PL	P	P	
15		Setting a goal to increase green-energy use by 0.5 percent worldwide;	PL	P		
16		Participating, for the second year in a row, in the EPA Climate Leaders Program;	PL	Y	Y	
17		Completing the Climate Leaders environmental survey	PL	Y	Y	
18		Efforts to reduce water use by 35 million gallons a year and recycle 20 million gallons	PL	P		
19		Agilent will explore carbon-offset programs as opportunities to further reduce the company's carbon footprint.	PL	PL		

* : PL - Pledge; P-Proof of progress; Y - Continued confirmation

The structure of the above analysis supports the aforementioned approaches of assessing credibility. Elements of a CSR report such as external validation of the report, conformity with an internationally recognized reporting standard could be used for assessing the overall credibility of the report. Alternatively, one could also limit the focus to the CEO or Leadership statement of the report and parse the content to assign an overall EM score based on the content analysis of the CEO statement. In *AMJ*

Proceedings (2013), Nadkarni et al. present their findings on speed of competitive actions based on CEO orientation. They analyze the tense of CEO statements to assess their orientation in terms of an emphasis on past activities or a futuristic perspective to assess timing of competitive moves. A similar approach can be applied to analyze leadership statements included in CSR reports in terms of achievement versus promises and the impact on performance.

The final approach advocated for assessing credibility relies on a careful analysis of individual statements. The approach can be segmented by effort into an automated software based track or a manual coding track. In the automated track, software based keyword or a key phrase search can be deployed using a list of keywords or phrases that signify credible signaling such as ISO 14000. ISO 14000 can be construed as a costly signal because of the resources a firm has to invest in getting certified. But, besides the costly therefore credible paradigm, associating with the ISO institution is an attempt by the firm to seek credibility from an institutional intermediary (Aerts and Cormier, 2009). A similar argument can be made in terms of conforming to reporting standards of institutions such as Global Reporting Initiative (GRI), or reporting to the Carbon Disclosure Project (CDP). By participating in recognized institutions a firm can signal credibility. The above credibility seeking approaches can be leveraged for content analysis of reports for analysis. In the more manual approach, pledges made by the firms can be tracked over a period of time, as depicted in Table 25, and coded to assign a credibility based on the percent of completion. One could also adopt the methodology used by Aerts and Cormier (2009) and assign a relative score to disclosures in the CSR report depending on whether the disclosure is quantified, is specific, or general.

In summary, the aforementioned approaches can be used for pursuing the credible aspects of environmental reporting to assess the impact of reporting credibility as an independent variable. The feasibility of the approaches above is validated from a careful analysis of the CSR reports and prior research in this area. The elements of a CSR report do support a push to look at the credibility of EM reporting and assessing the impact of such reporting on performance in a competitive framework. With theoretical support, this undertaking would better explain firm behavior and its impact on performance.

Conclusion

This dissertation takes a comprehensive look at the EM domain within the competitive dynamics framework merged with complementary viewpoints to explain firm level EM behavior and the impact on performance. The study builds on the prior work by Hofer et al. (2012) and extends their work by assessing the impact of rivalry on performance. Similar to prior studies, the study finds a direct impact of EM behavior on EM performance (Zhu and Sarkis, 2002) with sound theoretical support. The study also articulates the importance of reputation building. Prior studies have pointed at reputation being a valuable resource for the firm that cannot be easily imitated (Roberts and Dowling, 2000). This notion is validated in the EM context through the partial mediation of EM reputation on *ROA*. Contrary to prior work (Rao, 2002), this study finds a direct impact of EM behavior on financial performance. In a surprising result, the study also finds a positive and significant impact of competitive activity on focal firm performance emphasizing the institutional effects of being *green*.

The dissertation also attempts to answer the call for network level analysis. An existing gap in the literature is the network level analysis of EM behavior. Given the relational viewpoint advocated by Dyer and Singh (1998), and the practicalities of outsourcing, it is important to extend research to boundary spanning activities. While a thorough investigation is not accomplished in this dissertation, the preliminary analysis using focal-supplier dyads is encouraging and provides a feasible roadmap for this undertaking.

Finally, the results make a case for advancing the need for EM research surrounding credibility. The varying impact of EM behavior on different environmental performance measures highlights the need for additional research in this area. While the lack of significance of EM behavior on *Impact* suggests *greenwashing*, the significant impact of *Impact* on *ROA* is encouraging. These results call for further research on the analysis of EM behavior that is being self-reported in the context of credibility.

Appendix A

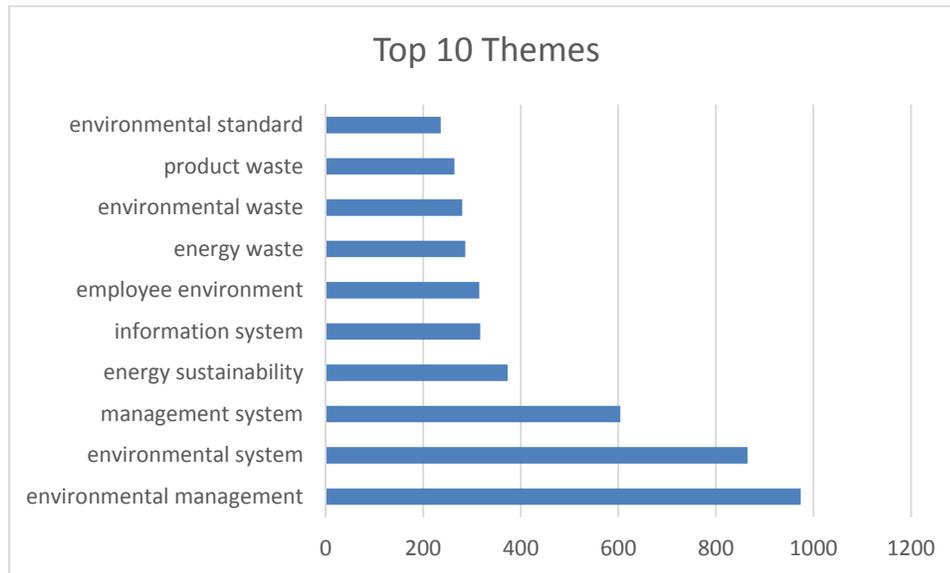
Chapter 2 captures the data preparation activities at a high level. Additional details are provided below with a reproduction of the thematic identification process conducted by Hofer, Cantor, and Dai (2012) that has been reused for the purposes of this dissertation. Following their approach, for the first part of our thematic analysis approach using the centered resonance technique in Crawdad, 250 common keywords with the highest influence scores are generated. The network analysis places more influential words in the center of the network and assigns them an influence score. The parameters were set so that these words appeared in at least two-thirds of the files used for this study. Several other combinations requesting a higher number of keywords commonly occurring in more or less number of files analyzed were tested to obtain the optimal set of keywords across all the 1276 files analyzed. A request for more than 250 keywords introduced a substantial volume of prepositions and conjunctions in the output. A very high degree of commonality reduced the number of common words to a handful. Besides influence scores of keywords, Crawdad also reports on the strength of the keyword combinations via keyword correlation matrix. The correlation is indicative of co-occurrence of text, which allows for the generation of themes and further thematic analysis. Next, we reuse the themes generated by Hofer et al. (2012) to quantify EM signals. As noted by the authors (p.81) *“A top-down approach was then used to filter out the relevant themes that best identify the 33 EM activities defined by Montabon et al. (2007). Through this process, a set of 314 themes (i.e. positively correlated keyword combinations) representing the 33 EM activities was identified.”* The following steps were executed to reuse the themes from the prior Hofer et al. (2012) study:

1. Generate 250 keywords using Crawdad,
2. Harvest all the positively correlated keyword pairs using Crawdad’s output, and
3. Match the keyword pairs with the 314 themes (keyword pairs) used in the Hofer, Cantor, Dai (2012) study

The above steps resulted in 107 thematic matches by reusing themes from the prior study.

The top 10 themes based on the matching process as recorded across the 1276 CSR reports analyzed is presented in Table 26.

Table 26 – Top Ten Themes



As recorded in Table 26, based on the CSR reports analyzed, the theme environmental management appeared in approximately 76% of the reports, while the theme environmental standard appeared in about 18% of the reports.

References

- Aaron, J. R., McMillan, A., Cline, B. N., 2012. Investor reaction to firm environmental management reputation. *Corporate Reputation Review* 15 (4), 304-318.
- Walter, A., Cormier, D., 2009. Media legitimacy and corporate environmental communication. *Accounting, Organizations and Society* 34 (1), 1–27.
- Aktas, N., de Bodt, E., Roll, R., 2007. Is European M&A Regulation Protectionist? *The Economic Journal* 117 (522), 1096-1121.
- Angell, L. C., Klassen, R. D., 1999. Integrating environmental issues into the mainstream: an agenda for research in operations management. *Journal of Operations Management* 17 (5), 575–598.
- Azadegan, A., Dooley, K. J., Carter, P. L., Carter, J., R., 2008. Supplier innovativeness and the role of interorganizational learning in enhancing manufacturing capabilities. *Journal of Supply Chain Management* 44 (4), 14–35.
- Ballinger, G., A., 2004. Using Generalized Estimating Equations for Longitudinal Data Analysis. *Organizational Research Methods* 7 (2), 127-150.
- Bansal, P., Clelland, I., 2004. Talking Trash: Legitimacy, Impression Management, and Unsystematic Risk in the Context of the Natural Environment. *Academy of Management Journal* 47 (1), 93-103.
- Baron, R. M., and Kenny, D. A., 1986. The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology* 51 (6), 1173-1182.
- Basdeo, D. K., Smith, K. G., Grimm, C. M., Rindova, V. P., Derfus, P. J., 2006. The impact of market actions on firm reputation. *Strategic Management Journal* 27 (12), 1205-1219.
- Baylis, R., Connell, L., Flynn, A., 1998. Company Size, Environmental Regulation And Ecological Modernization: Further Analysis At The Level Of The Firm. *Business Strategy and the Environment* 7 (5), 285–296.
- Berg, P. O., 1985. Organization change as a symbolic transformation process. In P. Frost, L. Moore, M. R. Louis, C. Lundberg, & J. Martin (Eds.), *Reframing organizational culture*: 281-300. Beverly Hills, CA: Sage.
- Berry, M. A., Rondinelli, D. A., 1998. Proactive corporate environment management: a new industrial revolution. *Academy of Management Executive* 12 (2), 38-50.
- Bioplastic Innovations, 2012. <http://bioplastic-innovation.com/2012/03/17/coca-cola-plant-bottle-vs-pepsico-green-bottle-the-giants-war/> (last accessed 15.05.2014)

- Boyer, K. K., Swink, M. L., 2008. Empirical elephants—why multiple methods are essential to quality research in operations and supply chain management. *Journal of Operations Management* 26 (3), 338-344.
- Cohen, B. D., Dean, T. J., 2005. Information asymmetry and investor valuation of IPOs: top management team legitimacy as a capital market signal. *Strategic Management Journal* 26 (7), 683-690.
- Connelly, B. L., Certo, S. T., Ireland, R. D., Reutzel, R. R., 2011. Signaling Theory: A Review and Assessment. *Journal of Management* 37 (1), 39-67.
- Delmas, M. A., Montes-Sancho, M., 2011. An Institutional Perspective on the Diffusion of International Management System Standards: The Case of the Environmental Management Standard ISO 140001. *Business Ethics Quarterly* 21 (1), 103-132.
- Delmas, M. A., Toffel, M. W., 2008. Organizational responses to environmental demands: opening the black box. *Strategic Management Journal* 29 (10), 1027-1055.
- Derfus P. J., Maggitti P. G., Grimm C. M., Smith K. G., 2008. The red queen effect: competitive actions and firm performance. *Academy of Management Journal* 51 (1), 61-80.
- Dixon-Fowler, H. R., Ellstrand, A. E., Johnson, J. L., 2013. Strength in numbers or guilt by association? Intragroup effects of female chief executive announcements. *Strategic Management Journal* 34 (12), 1488-1501.
- Doh, J. P., Howton, S. D., Howton, S. W., Siegel, D. S., 2010. Does the Market Respond to an Endorsement of Social Responsibility? The Role of Institutions, Information, and Legitimacy. *Journal of Management* 36 (6), 1461-1485.
- Dyer, J. H., 1996. Specialized Supplier Networks As A Source Of Competitive Advantage: Evidence From The Auto Industry. *Strategic Management Journal* 17 (4), 271-291.
- Dyer, J. H., Singh, H., 1998. The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage. *Academy of Management Review* 23 (4), 660-679.
- Eccles, R. G., Serafeim, G., Krzus, M. P., 2011. Market Interest in Nonfinancial Information. *Journal of Applied Corporate Finance* 23 (4), 113-127.
- Ferrier, W. J., Smith, K. G., Grimm, C. M., 1999. The role of competitive action in market share erosion and industry dethronement: a study of industry leaders and challengers. *Academy of Management Journal* 42 (4), 372-388.

- Fombrun, C., Shanley, M., 1990. What's in a Name? Reputation Building and Corporate Strategy. *The Academy of Management Journal* 33 (2), 233-258.
- Gattiker, T. F., Carter, C. R., 2010. Understanding project champions' ability to gain intra-organizational commitment for environmental projects. *Journal of Operations Management* 28 (1), 72–85.
- Gioia, D. A., Schultz, M., Corley, K. G., 2000. Organizational Identity, Image, and Adaptive Instability. *Academy of Management Review* 25 (January), 63-81.
- Grimm, C. M., Lee, H., Smith, K. G., 2006. *Strategy as Action: Competitive Dynamics and Competitive Advantage*. Oxford University Press, New York.
- Grimm, C. M., Smith, K. G., 1997. *Strategy as action: Industry rivalry and coordination*. South-Western College Pub., Cincinnati, Ohio.
- Grunig, J. E., 1993. Image and substance: From symbolic to behavioral relationships. *Public Relations Review* 19 (2), 121-139.
- Gulati, R., Nohria, N., Zaheer, A., 2000. Strategic Networks. *Strategic Management Journal* 21 (3), 203-215.
- Handelman, J. M., Arnold, S. J., 1999. The Role of Marketing Actions with a Social Dimension: Appeals to the Institutional Environment. *Journal of Marketing* 63 (3), 33-48.
- Hanna, M. D., Newman, W. R., 1995. Operations and environment: an expanded focus for TQM. *The International Journal of Quality & Reliability Management* 12 (5), 38–53.
- Heil, O., Robertson, T. S., 1991. Toward a theory of competitive market signaling: A research agenda. *Strategic Management Journal* 12 (6), 403–418.
- Hoberg, G., Phillips, G., 2014. Text-Based Network Industries and Endogenous Product Differentiation. Working Paper.
- Hofer, C., Cantor, D. E., Dai, J., 2012. The competitive determinants of a firm's environmental management activities: Evidence from US manufacturing industries. *Journal of Operations Management* 30 (1-2), 69-84.
- Hull, C. E., Rothenburg, S., 2008. Firm Performance: The Interactions of Corporate Social Performance with Innovation and Industry Differentiation. *Strategic Management Journal* 29 (7), 781-789.
- Johnstone, N., Hascic, I., Popp, D., 2010. Renewable Energy Policies and Technological Innovations: Evidence Based on Patent Counts. *Environmental and Resource Economics* 45 (1), 133–155.

- Janney, J. J., Folta, T. B., 2006. Moderating effects of investor experience on the signaling value of private equity placements. *Journal of Business Venturing* 21 (1), 27–44.
- Jose, A., Lee, S., 2006. Environmental Reporting of Global Corporations: A Content Analysis based on Website Disclosures. *Journal of Business Ethics* 72 (4), 307–321.
- Kihlstrom, R. E., Riordan, M. E., 1984. Advertising as a signal. *Journal of Political Economy* 92 (2), 427–450.
- Kim, W. C., Mauborgne, R., 2005. *Blue Ocean Strategy - How to Create Uncontested Market Space and Make the Competition Irrelevant*. Harvard Business School Press.
- King, A. A., Lenox, M. J., 2001. Lean and green? An empirical examination of the relationship between lean production and environmental performance. *Production and Operations Management* 10 (3), 244-257.
- Kleindorfer, P., Singhal, K., Wassenhove, L. N. V., 2005. Sustainable operations management. *Production and Operations Management* 14 (4), 482-492.
- Klassen, R. D., McLaughlin, C. P., 1996. The Impact of Environmental Management on Firm Performance. *Management Science* 42 (8), 1199-1214.
- Kirmani, A., Rao, A. R., 2000. No pain, no gain: A critical review of the literature on signaling unobservable product quality. *Journal of Marketing* 64 (2), 66-79.
- Liang, K., Zeger, S. L., 1986. Longitudinal data analysis using generalized linear models. *Biometrika* 73 (1), 13-22.
- Mahler, D., 2007. The Sustainable Supply Chain. *Supply Chain Management Review* November (2007), 59-60.
- Malhotra, M. K., Singhal, C., Shang, G., Ployhart, R. E., 2014. A critical evaluation of alternative methods and paradigms for conducting mediation analysis in operations management research. *Journal of Operations Management* 32 (2014), 127-137.
- Milgrom, P., Roberts, J., 1986. Pricing and Advertising Signals of Product Quality. *Journal of Political Economy* 94 (4), 796-821.
- Montabon, F., Melnyk, S. A., Sroufe, R., Calantone, R. J., 2000. ISO 14000: Assessing Its Perceived Impact on Corporate Performance. *Journal of Supply Chain Management* 36 (1), 4–16.
- Montabon, F., Sroufe, R., Narasimhan, R., 2007. An examination of corporate reporting, environmental management practices and firm performance. *Journal of Operations Management* 25 (5), 998–1014.

- Nadkarni, S., Chen, J., 2014. Bridging yesterday, today, and tomorrow: CEO temporal focus, environmental dynamism, and rate of new product introduction. *Academy of Management Journal*, forthcoming.
- Ndofor, H. A., Sirmon, D. G., Xiaoming, H., 2011. Firm resources, competitive actions and performance: investigating a mediated model with evidence from the in-vitro diagnostics industry. *Strategic Management Journal* 32 (6), 640–657.
- Norman, P. M., Artz, K. W., Martinez, R. J., 2007. Does it pay to be different? Competitive non-conformity under different regulatory regimes. *Journal of Business Research* 60 (11), 1135–1143.
- North, D. C., 1986. The New Institutional Economics. *Journal of Institutional and Theoretical Economics* 142 (1), 230-237.
- O'Donovan, G., 2002. Environmental disclosures in the annual report. Extending the applicability and predictive power of legitimacy theory. *Accounting, Auditing & Accountability Journal* 15 (3), 344-371.
- Porter, M. E., 1980. *Competitive Strategy: Techniques for Analyzing Industries and Competitors*. Free Press, New York.
- Porter, M. E., 1991. America's green strategy. *Scientific American* 264 (4), 168.
- Powell, W. W., DiMaggio, P. J., 1991. *The New Institutionalism in Organizational Analysis*. University of Chicago Press.
- Rahman, N., Post, C., 2012. Measurement issues in environmental corporate social responsibility (ECSR): Toward a transparent, reliable, and construct valid instrument. *Journal of Business Ethics* 105 (3), 307-319.
- Rao, P., 2002. Greening the supply chain: a new initiative in South East Asia. *International Journal of Operations and Production Management* 22 (6), 632-655.
- Rao, P., Holt, D., 2005. Do green supply chains lead to competitiveness and economic performance? *International Journal of Operations and Production Management* 25 (9), 898 – 916.
- Rice, J. B., Hoppe, R. M., 2001. Supply Chain vs. Supply Chain – The Hype & The Reality. *Supply Chain Management Review* September/October (2001), 46-54.
- Roberts, P. W., Dowling, G. R., 2002. Corporate Reputation and Sustained Superior Financial Performance. *Strategic Management Journal* 23 (12), 1077–1093.

- Sarkis, J., Gonzalez-Torre, P., Adenso-Diaz, B., 2010. Stakeholder pressure and the adoption of environmental practices: The mediating effect of training. *Journal of Operations Management* 28 (2), 163–176.
- Sanchez, C. M., 1997. Reflections on firm and national inventories. *Business and Society* 36 (2), 140–168.
- Schumpeter, J.A., 1934. *The Theory of Economic Development*. Harvard University Press, Cambridge, MA.
- Shane, S., Cable, D., 2002. Network Ties, Reputation, and the Financing of New Ventures. *Management Science* 48 (3), 364-381.
- Shin, H., Collier, D. A., Wilson, D. D., 2000. Supply management orientation and supplier/buyer performance. *Journal of Operations Management* 18 (3), 317–333.
- Smith, K. G., Ferrier, W. J., Ndofor, H., 2001. *Competitive Dynamics Research: Critique and Future Actions*. Blackwell Press.
- Smith, K. G., Grimm, C. M., Gannon, M. J., Chen, M. J., 1991. Organizational Information Processing, Competitive Responses, and Performance in the U.S. Domestic Airline Industry. *Academy of Management Journal*, 34 (1), 60-85.
- Sobel, M. E., 1982. Asymptotic confidence intervals for indirect effects in structural equation models. *Sociological Methodology* 13, 290–312.
- Spence, M., 1973. Job Market Signaling. *The Quarterly Journal of Economics* 87 (3), 355-374.
- Sroufe, R., 2003. Effects of Environmental Management Systems on Environmental Management Practices and Operations. *Production and Operations Management* 12 (3), 416-431.
- Stiglitz, J. E., 2000. The contributions of the economics of information to twentieth century economics. *Quarterly Journal of Economics* 115 (4), 1441-1478.
- Suchman, M. C., 1995. Managing legitimacy: strategic and institutional approaches. *Academy of Management Review* 20 (3), 571–610.
- Tate, W. L., Ellram, L. M., Kirchoff, J. M., 2010. Corporate Social Responsibility Reports: A Thematic Analysis Related to Supply Chain Management. *Journal of Supply Chain Management* 46 (1), 19-44.
- Walton, S. V., Handfield, R. B., Melnyk, S. A., 1998. The Green Supply Chain: Integrating Suppliers into Environmental Management Processes. *Journal of Supply Chain Management* 34 (2), 2–11.

Wilcox, W. E., Wilcox, M. V., Jares, T., 2014. Does Being Green Result In Improved Financial Performance? *Journal of Business and Behavior Sciences* 26 (1), 155-167.

Wizness Community, 2012.

<https://www.wizness.com/wizness/go.asp?u=/pub/NP&nId=473&lngWiz=EN>
(last accessed 15.05.2014)

Wooldridge, J., 2002. *Econometric Analysis of Cross-Section and Panel Data*. MIT press.

Young, G., Smith, K. G., Grimm, C. M., 1996. Austrian and Industrial Organization Perspectives on Firm-Level Competitive Activity and Performance. *Organization Science* 7 (3), 243-254.

Zhang, Y., Wiersema, M. F., 2009. Stock Market Reaction to CEO Certification: The Signaling Role of CEO Background. *Strategic Management Journal* 30 (7), 693–710.

Zhu, Q., Sarkis, J., 2004. Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *Journal of Operations Management* 22 (3), 265–289.