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How firms leverage internal and external sources of environmental capabilities: Three essays on environmental sourcing

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How firms leverage internal and external sources of environmental capabilities: Three essays on environmental sourcing

by

Prabhjot Singh

A dissertation submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Major: Business and Technology (Supply Chain Management)

Program of Study Committee:

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The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this dissertation. The Graduate College will ensure this dissertation is globally accessible and will not permit alterations after a degree is conferred.

Iowa State University

Ames, Iowa

2019

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ABSTRACT

This dissertation provides a comprehensive investigation of environmental sourcing strategies from both inter-organizational and business-to-consumer (BTC) perspectives. The dissertation consists of three essays that shed insight into the dynamics of a firm's environmental sourcing strategies. The dissertation begins with a systematic literature review to analyzing prior literature's stances on a firm's pursuit of environmental management (EM) capabilities. The first essay provides an up-to-date and comprehensive review of environmental supply chain management literature. The second essay examines environmental sourcing strategies from an inter-organizational perspective and aims to investigate why buying firms are willing to increase their overall business-volume with suppliers who have strong environmental expertise. The study empirically tests proposed hypotheses using a unique buyer-supplier dyadic data set drawn from multiple secondary data sources. The third essay takes a business-to-consumer (BTC) perspective and seeks to understand how consumers can become affected by a firm's environmentally-irresponsible sourcing practices. The study employs a series of three vignette-based experiments that test study hypotheses. Overall, this dissertation contributes to the advancement supply chain, environmental sourcing, consumer behavior, and product-harm crises literatures by providing a nuanced understanding of factors that influence firms to opt for environmental sourcing.

CHAPTER 1. GENERAL INTRODUCTION

Firms face ever-increasing challenges related to environmental management (EM) issues. Some firms respond to such challenges by enhancing internal EM capabilities, while others may strategically rely on external EM capabilities. We define environmental management (EM) capabilities as a complex bundle of a firm's skills and knowledge in the environmental domain (Wong 2013). Given that firms rarely internally possess all requisite EM capabilities, environmental sourcing can play an essential role in helping properly manage a firm's environmental needs (Carter and Carter 1998; Schoenherr et al. 2014). Environmental sourcing refers to a set of practices used by firms engaging in sourcing external EM capabilities. Firms often make a mistake by viewing environmental sourcing as a set of "should do" activities rather than a set of "must do" activities (Whelan and Fink 2016). Further, some firms may even turn a blind eye, hoping that their environmental sourcing practices would not affect consumers, obviously influential stakeholders in a firm.

The purpose of my dissertation research is to investigate how environmental sourcing strategies affect both buying firms and consumers. While environmental sourcing has been at the core of a wide body of environmental supply chain management research (Carter and Carter 1998; Schoenherr 2012; Schoenherr et al. 2014), very little empirical work exists considers the role of external EM capabilities on a buying firm's procurement spending and consumer behavior. When a firm attempts to leverage EM capabilities externally, it is important to address many issues, including opportunistic behavior that frequently arises in buyer-supplier relationships (Lee and Klassen 2008; Pagell and Wu 2009). In many cases, suppliers may not allow sustained access to buying firms to their environmental expertise. At the other extreme, a buying firm may face adverse consumer and media reaction if it fails to source from

environmentally-responsible suppliers (Bregman et al. 2014; Hartmann and Moeller 2014).

Because such challenges arise from issues specific to external EM capabilities, fresh theoretical insights are required to examine how firms can successfully leverage external EM capabilities.

This dissertation consists of three essays that examine the role of external EM capabilities in affecting buyer-supplier relationships and affecting consumer behavior. Chapter 2 comprises of the first essay that aims to provide a systematic review of environmental management (EM) in supply chain literature. In so doing, the study provides a deep understanding of the topics investigated, methods employed, and prior research findings with respect to environmental management in the supply chain discipline. The study sheds important insight into key theoretical tenets described in prior literature that act as guiding principles for how firms develop internally and acquire external environmental supply chain capabilities. The study also investigates the antecedents and outcomes of a firm's internal and external pursuit of environmental capabilities. The study makes an important contribution to the literature by illustrating and documenting benefits that previous EM and supply chain management (SCM) research has derived from the use of theory-driven research.

Chapter 3 makes the second essay that examines environmental sourcing strategies from an inter-organizational perspective and aims to investigate why buying firms are willing to increase their overall business volume, particularly with suppliers who have strong environmental expertise. Drawing upon transaction-cost economics (TCE) and agency theory framework, this part of the dissertation attempts to understand *how* and under *what* conditions suppliers' environmental expertise influences a buying firms' procurement spend. The study empirically tested proposed hypotheses using a unique buyer-supplier dyadic data set drawn from multiple secondary data sources. The findings from this study support the baseline

hypothesis that there is a positive relationship between supplier environmental expertise and a buying firm's procurement spend. The results also support the moderating hypotheses that firm's financial profitability and absorptive capacity positively moderate the effect of supplier's environmental expertise on a buying firm's procurement spend. This study also describes negative moderating effects of executive compensation linked with environmental, social, and governance (ESG) performance and a firm's environmental concerns with respect to the relationship between supplier's environmental expertise and a buying firm's procurement spend. The essay fills an important gap in the literature by demonstrating that buying firms value a supplier's environmental expertise as a means for addressing their internal EM limitations.

The third essay (Chapter 4) takes a business-to-consumer (BTC) perspective and seeks to understand how consumers can become affected by a firm's environmentally-irresponsible sourcing practices. The study also theorizes about how a firm's subsequent corrective actions might impact consumers. The study draws upon both cue utilization theory and signaling theory to build hypotheses and interpret results. A series of three vignette-based experiments was performed to test the study's hypotheses. While prior literature on environmental sourcing represents accumulated knowledge highlighting factors influencing firms to adopt environmental sourcing practices, there remained an opportunity to better understand how consumer perceptions of product quality are affected by a firm's environmental sourcing practices. This is the first study that attempts to develop new theoretical insights into the importance of environmental sourcing practices to consumers' product quality judgments. The findings from this study indicate that consumer perceptions of product quality can become affected by a firm's environmentally-irresponsible practices. This study also tested how a firm's corrective actions

such as a voluntary product recall, self-disclosure of negative information, and termination of supplier relationships could affect consumer perceptions of product quality.

Chapter 5 summarizes the overall conclusions and highlights how this dissertation makes several theoretical contributions to supply chain, environmental sourcing, and consumer behavior literatures. From an inter-organizational perspective, the dissertation develops new and original theoretical insights as to why a supplier's environmental expertise influences a buyer firm's procurement spending. From a consumer standpoint, this is also the first study that develops new theoretical insights into the importance of environmental sourcing practices to consumer product quality judgments and purchasing intentions. The dissertation also extends the product-harm crises literature by providing a better understanding of how a firm's corrective actions can influence consumers reactions. Finally, the dissertation follows the research guidelines proposed by Craighead et al. (2019) to keep a balance between theoretical and pragmatic impact by offering several practical suggestions for managers.

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CHAPTER 2. A SYSTEMATIC LITERATURE REVIEW OF ENVIRONMENTAL SUPPLY CHAIN MANAGEMENT CAPABILITIES: EVOLUTION AND FUTURE RESEARCH DIRECTIONS

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Abstract

The purpose of this study is to provide a systematic review of environmental management (EM) in the supply literature. The study provides a deep understanding of the topics investigated, methods employed, and prior research findings by analyzing 252 papers published between 1996 and 2018. The study also sheds important insight into key theoretical tenets described in prior literature that act as guiding principles for how firms develop internally and acquire external environmental supply chain capabilities. Finally, the study proposes future research opportunities that would benefit from the use of secondary data and behavioral experiments.

Introduction and Background

There is significant scholarly interest in examining the role of environmental management capabilities in the supply chain. Environmental management (EM) capabilities develop based upon the complex bundling of a firm's skills and knowledge in the environmental domain (Wong 2013). Firms develop or acquire EM capabilities for the purposes of enhancing its innovation performance (Dai et al. 2015; Theyel 2000), environmental performance (Chiou et al. 2011; Li et al. 2016; Montabon et al. 2000; Montabon et al. 2007), and environmental reputation (Foerstl et al. 2010; Kumar et al. 2012). Because there isn't a universal standard in

the implementation, monitoring, and reporting of EM activities, firms remain challenged on how to effectively develop EM capabilities. Likewise, when the firm attempts to leverage EM resources externally, it must address many issues including opportunistic behavior that frequently arises in buyer-supplier relationships (Lee and Klassen 2008; Pagell and Wu 2009).

Given that firms continue to struggle in the development of its environmental capabilities, supply chain scholars remain interested in conducting research in this domain. For the purposes of facilitating continued interest and research in this stream of research, the purpose of this study, then, is to provide a systematic review of the environmental management (EM) in supply chain literature. In so doing, this study seeks to report on several important developments and trends in this line of research. In particular, this study will describe: 1) several EM topics that been previously investigated, 2) predominant research methods employed, 3) popular data sources used, and 4) summarize some of the research findings. Based on the study's findings, this study will then highlight future research opportunities.

This study makes several important contributions to the literature. First, this study demonstrates how theory driven research in the EM and supply chain literature is in a nascent stage. Thus this study contributes to the literature by illustrating and documenting the benefits that previous EM and SCM research has derived from the use of theory driven research. As an example, our findings demonstrate that it is important to adopt a theoretical driven perspective to examine the interplay between internal and externally sourced environmental capabilities. Next, our analysis reveals that prior research has primarily focused on either an upstream (e.g., supplier-facing activities) or focal firm perspective and, thus, has rarely considered the downstream implications of EM capabilities (e.g., consumer-facing issues) in the supply chain. Third, we contribute to the literature by providing evidence that supply chain scholars have not

emphasized the interface of EM capabilities within the context of the supply chain network (e.g., Wilhelm et al. 2016). Fourth, we contribute to the literature by reporting recent advancements in the use of non-survey methods to enrich our understanding of the interface of supply chain and EM issues. For instance, there is a limited understanding on how scholars have used secondary data to examine EM and supply chain phenomena (Benlemlih et al. 2018; Villena and Gioia 2018). We also find that the use of behavioral experiments related to understanding environmental attitudes and behaviors at the individual level has not received substantial attention in the literature (Davis-Sramek et al. 2018; Gattiker et al. 2014). Fifth, this is the first literature review that integrates two different research streams, internal and external acquisition of environmental expertise into a unified study. Finally, the study proposes future research opportunities that would benefit from the use of secondary data and behavioral experiments.

This paper is organized in the four main parts. First, we describe the methodology used for conducting the systematic literature review. Second, we present our results from our comprehensive review of the literature. Third, we propose an organizing framework to synthesize our findings related to internal and external EM capabilities. Finally, we summarize potential areas of future research and present our conclusions.

Methodology

We now turn to describing the literature review protocol. Our study followed the literature review guidelines used in previous research (Tranfield et al. 2003; Denyer and Tranfield 2009). It should be noted that a systematic literature review differs significantly from a narrative literature review. The process of drawing a sample from a systematic review is replicable and transparent, whereas the narrative reviews are more subjective, and the process

involved in drawing a sample from narrative reviews is not completely replicable (Carter and Easton 2011).

The study reviews the literature over the time period 1996-2018, a 22-year time horizon. This time period was chosen because much of empirical work in the supply chain management literature that links with environmental sustainability began to emerge in 1996. This time period is also consistent with previous literature reviews (Winter and Knemeyer 2013; Wong et al. 2015). Next, to ensure that we were able comprehensively search for articles, we used the ABI/Inform and Science Direct databases to search relevant articles (Durach et al. 2015; Wong et al. 2015).

We focused our search for articles in both the supply chain/operations management and management journals. We specifically targeted the following prominent journals from the supply chain/operations management field: *Decision Sciences*, *International Journal of Logistics Management*, *International Journal of Operations and Production Management*, *International Journal of Physical Distribution and Logistics Management*, *International Journal of Production Research*, *International Journal of Production Economics*, *Journal of Operations Management*, *Journal of Supply Chain Management*, *Journal of Business Logistics*, *Journal of Purchasing and Supply Management*, *Production and Operations Management*, *Transportation Journal and Transportation Research Part E*. These journals have been consistently cited in previous literature reviews (Cantor 2008; Carter and Easton 2011; Giunipero et al. 2008; Mir et al. 2018). Given the focus on environmental supply chain management research, we also included three leading (empirical) management/strategy journals that fit the criteria of research focused on the intersection of supply chain management and environmental management. The management

journals included were the *Academy of Management Journal*, *Strategic Management Journal*, and *Journal of Business Ethics*.

To identify relevant articles, we searched the most commonly-used search terms related to environmental supply chain management (Wong et al. 2015; Touboulic and Walker 2015). This enabled us to use a combination of search terms related to both environmental management and supply chain management (see Table 2.1). The search terms were applied to the titles and abstracts of the journal publications. A total of 1,914 articles were retrieved from this process. Given our exclusive focus on the empirical environmental supply chain management research, we excluded articles employing analytical or mathematical modeling techniques. We also excluded those articles not related to environmental supply chain management (e.g., topics related to social/governance). In addition, we eliminated articles that were conceptual, editorial/letters, call for papers, or mostly descriptive in nature. After reading the abstracts, we carefully scanned through each article to ensure inclusion of studies that empirically examined issues related to environmental supply chain management. After applying the exclusion criteria, a final sample of 252 articles published between 1996-2018 was obtained.

Following Durach et al. (2015), the coding manual (see Table 2.2) was developed to classifying knowledge into pre-determined structures. The coding schema was evaluated with three cycles of pilot coding with the help of a second independent researcher. This procedure assured inter-coder reliability (averaged 86%) by comparing the two sets of the coding schema. Finally, the coding process for each article was performed manually to deal with the subjectivity involved in identifying research design, theoretical foundations, etc. A similar approach has been used in previous systematic literature reviews (Carter and Easton 2011; Touboulic and Walker

2015). Figure 2.1 presents the step-by-step approach used to conduct a systematic literature review, and Table 2.2 provides a summary of the coding scheme used in this study.

Results

General Publication Trends

Our analysis showed that the largest number of environmental supply chain management articles were published between the year 2010 and the present. Our analysis also revealed that surveys are the leading sources of data, and the firm remains the prominent level of analysis throughout the period from 1996-2018. Environmental performance and supply chain environmental practices were the first and second most popular research themes, respectively. We noted that empirical research in this area is becoming theoretically driven with 9 % of articles using theory (or theories) in early 2000's as compared to 50% of articles that using theory (or theories) in 2015-18. The dominant theoretical perspective applied in environmental supply chain management studies is the stakeholder theory. The following section provides detailed information on the number of yearly publications, research methods (e.g., qualitative, behavioral, experiment, survey, etc.), unit of analysis, and a list of theories.

Timeline

Given that our search criteria for publication years ranged from 1996 to 2018, we grouped our selected sample in a four-year or five-year time intervals to represent a half-decade of research on the current topic. As shown in Table 2.3, the number of articles written during the first publication period (1996-1999) was significantly low, only six articles. During the second period (2000-2004), the number increased to 22 journal publications, indicating a growing concern for EM within supply chains since the 2000s. While we saw no increase in the number of journal articles during the third-period (2005-2009) compared to the second time period

(2000-2004), a significantly increased level of interest can be seen during the last two publication period (2010–2014) and (2015-2018) in this topic. This suggest that scholars hold a view that EM should be placed within the core of a firm' supply chain strategy.

Classification by Journals

Table 2.3 shows the journal distribution of our sample articles. The overall distribution is quite fragmented with articles being published in 16 different journals. We noticed that a significant number of journal publications were published in the Journal of Business Ethics (15%) and Internal Journal of Operations and Production Management (14%). It can also be seen that, during the period (2010-2014), the Journal of International Journal of Production Economics published a greater number of articles than any of the other logistics/supply chain management journals (see Table 2.3). These statistics reflect the fact that the topic of environmental supply chain management has increasingly been gaining attraction among academic scholars. From the SCM Journal ListTM, The Journal of Supply Chain Management is by far the most common outlet, with 19 papers, followed by the Journal of Operations Management (15 papers) and the Journal of Business Logistics (12 papers).

Types of Methods

Table 2.4 provides a breakdown of the 252 papers by methods and year. Surveys are the leading sources of data, with almost 50 percent of the articles included in our sample using a survey as its primary methodology for data collection. Surveys have been used to study a broad range of issues, including top management support to address environmental supply chain issues (Björklund 2011; Goebel et al. 2012), enviropreneurship (entrepreneurial orientation that particularly focuses on the environmental dimension) behavior (Paulraj 2011), and institutional pressures influencing firms' environmental practices (Schoenherr et al. 2014; Tachizawa et al.

2015). While we noticed a slight decline in the use of surveys during the most recent years, survey research is still the primary research method in environmental supply chain management. Recently, Montabon et al. (2018) commented that the slight decrease in the use of single-respondent surveys in recent years doesn't necessarily reflect the abandonment of this research method. In fact, we notice an increasing interest in using multi-methods that involve survey-based research methods in recent years. We identified 12 articles (7%) that combined surveys with either secondary data or qualitative research methods.

The qualitative research methods (case studies/interviews) was the second most used method with 28 percent of articles (69 papers) employing this methodology. The qualitative research method has been used to examine various environmental supply chain topics such as the impact of a firm's transport portfolio (Liljestrand et al. 2015) and logistics structure (Aronsson and Brodin 2006) on reducing carbon emissions.

Secondary data methods ranked third as a research method used in this area of research. We identified 25 articles (10%) that used secondary data methods. In our review of secondary data method used in the sample articles, we noticed an increase in the use of this method. One can attribute the reason for an increase in the use of secondary data sources to the vast amounts of data that firms, public agencies, auditing firms, and other regulatory bodies generate, collect, compile, and archive. Some of the secondary data sources are now easily accessible for research. Ellram and Tate (2016) recently documented some of the notable benefits of using secondary data, including less money and time, longitudinal research support, and triangulation of findings from other data collection methods such as case studies or surveys, etc. Our review of articles reveals that secondary data methods have generally been used to address the topic of environmental performance (Chen 2017; Kumar and Paraskevas 2018; Lin 2012; Wolf 2014).

While there are several potential benefits to using secondary data, secondary data does have its limitations that include longitudinal data availability and non-audited (or self-reported) data (Ellram and Tate 2016). Researchers should be very knowledgeable about how data gets into data source and should caution about causality issues based on cross-sectional data. We also provide a detailed description of secondary data sources in Table 2.5.

Finally, we note that behavioral research methods are adopted to lesser extent compared to other research methods in environmental supply chain management. We found 6 articles (2%) that used behavioral research methods. Scholars interested in studying the effect of human behavior commonly prefer behavioral research method. The findings reveal that scant attention has been paid to study individual attitudes and behaviors within this area of research. This is also consistent with the view that behavioral research in supply chain management “is still at its infancy” (Donohue and Siemsen 2011, p. 8).

Unit of Analysis

We now turn to reporting unit of analysis within environmental supply chain management research. We found 146 articles were at the firm level (58%), 38 articles were focused on inter-organizational level or business-to-business (B2B) (15%), 23 articles were at individual-level (9%), 9 studies were focused on business-to-consumer (BTC) level (4%), 8 were at plant-level (3%), 5 studies focused on the network-level (2%), and the remaining 23 articles used other units of analysis (9%) such as process, and project etc. While this overview of unit of analysis is important to understanding the general focus of the studies, it draws attention to the area of business-to-consumer (B2C) research that has been understudied relative to the others.

Table 2.6 provides a brief description of research related to B2C.

Theories Employed in Environmental Supply Chain Management

We now report the list of the theoretical foundations that have been used in the environmental supply chain management research. Our results indicate that researchers studying environmental supply chain management have drawn on a wide range of theories, with the use of theoretical foundations first evident in early 2000. There has been an increasing trend of theory application over the four time periods, as shown in Table 2.7. More specifically, we can see that more theories have been used as bases for studying supply chain environmental issues between 2010 and 2018. Clearly, this shows a growing trend towards theory-driven research. Indeed, there has been an increased emphasis within supply chain and operations management research on the use of theories to advancing the current theoretical discourse (Choi and Wacker 2011; Hitt et al. 2016). In general, our analysis reveals that previous environment research in SCM has taken a theory contextualization approach i.e., using theory from other disciplines (e.g., management, psychology, and economics etc.) in studying industry specific situation (Craighead et al. 2019).

In many studies, we found that scholars have chosen to integrate two or more theoretical lenses to examine a topic of interest. For example, scholars have integrated resource-based view (RBV) with stakeholder theory (Pålsson and Kovács 2014; Multaharju et al. 2017; Sarkis et al. 2010); and knowledge-based view (KBV) (Cheng 2018). Similarly, transaction cost economics has been integrated with institutional theory (Tate et al. 2014.), signaling theory (King et al. 2005), and resource-based view (RBV) (Pagell et al. 2010). Other theoretical lenses that have been integrated into a single study are stakeholder theory and resource dependency theory (Brockhaus et al. 2013), agency and institutional theory (Wilhelm et al. 2016). We take the view that, with a broad delineation of the supply chain management into a field, researchers often deal

with cross-functional or cross-disciplinary issues. This may require researchers to employ more than one theory to examine a topic of their interest because it is sometimes impossible to obtain a comprehensive perspective from only one theory. In our view, unless a stronger theoretical paradigm emerges, a significant opportunity exists for researchers to address EM research within supply chain management by employing multiple theories.

Dominating Theoretical Frameworks

We now turn our attention to highlighting the most widely used theories in this research area. Although researchers have examined these issues from multiple theoretical perspectives, our results indicate that researchers studying EM capabilities have frequently drawn upon from five theories: stakeholder theory, resource based-view (RBV), institutional theory, transaction cost economics theory, and natural resource-based view (NRBV). These theories provide unique insights into the firms' pursuit of building EM capabilities. Table 8 briefly summarizes the current or future applications of these theories related to the internal and external acquisition of EM capabilities.

We now provide a brief historical background to highlight how these five theories have been used within this area of research. Our results indicate that during the early 2000s, the field of environmental supply chain sustainability was mainly advanced through the use of the stakeholder theory. This implies that scholars primarily viewed that a firm's actions towards developing internal and external environmental capabilities being driven by situational needs to satisfy the needs of multiple stakeholders (e.g., shareholders) (Buisse and Verbeke 2003; Lai et al. 2004; Sarkis et al. 2010). The predominant use of stakeholder theory supports the idea that firms recognize the importance of how stakeholders can affect the way the firm views environmental management. Later, during the period after 2005, institutional theory started to

parallel the stakeholder theory perspective by viewing firms' adaptation toward developing both internal and external environmental capabilities as being imminent because of isomorphic pressures (coercive, normative and mimetic pressures) (Chin-Chun et al. 2013; Huang et al. 2017; Zhu and Sarkis 2007; Zhu et al. 2013). In a more general context, the institutional theory presents the case of why firms behave in similar way when it comes to adopting environmental management in the supply chain management.

Our results indicate that the transaction cost economics (TCE) framework has also been used to examine a wide range of environmental supply chain management issues. The TCE framework has served as a solid foundation for conducting inter-organizational empirical research that include topics such as environmental collaborative relationships (King et al. 2005; Luo et al. 2014), effect of supply-base continuity on sustainable sourcing (Pagell et al. 2010), the relationship between supplier-related transaction costs and suppliers' environmental practices (Tate et al. 2014), and suppliers' incentives for sustainable practices (Huq et al. 2014).

The resource-based view (RBV) also provides a valuable way to examine how a firm's internal and external environmental capabilities relate to firm performance. Scholars have used RBV to explain how a firm's environmental capabilities can positively affect long-term competitive advantage (Leonidou et al. 2017), environmental and operational performance (Longoni et al. 2018; Schoenherr et al. 2014), and environmental innovations (Cheng 2018). Accordingly, the resource-based view (RBV) has sharpened the understanding of how environmental capabilities affect firm performance by either owning (internal) or controlling (external) knowledge about EM.

More recently, the natural-resource-based view (NRBV) has been used by investigators in providing a more fine-grained view to examine the impact of pollution-prevention

technologies on a firm's performance (e.g., Chan et al. 2016; Schmidt et al. 2017; Shin et al. 2018). The NRBV framework is considered to be an extension of RBV to the area of environmental management (Hart 1995; Vachon and Klassen 2008). In general, the NRBV theory argument is that sustainability strategies such as minimizing waste or life-cycle costs of products could result in cost savings, thereby affecting a firm's financial performance. Table 2.9 gives an overview of applications of these five theories with respect to internal development and external acquisition of EM capabilities.

Antecedent Factors

In this study, we synthesize our findings centered around the two research domains: internal and external EM capabilities. The first dimension, internal, depicts a firm's set of activities aimed towards building environmental capabilities within its boundary. Our second classification dimension, external, depicts a firm's set of practices in which a firm acquires the environmental knowledge residing outside its boundary. The next section will summarize the antecedents related to internal development and external acquisition of EM capabilities.

Antecedents: internal development factors

Table 2.10 outlines the key driving factors that influence the development of a firm's internal EM capabilities. Our analysis of the environmental supply chain management literature suggests that internal environmental capabilities can be clustered into five groups: environmental investments, eco-product design, environmental practices (logistics/supply chain), environmental management systems (e.g., EMS, ISO 14001 certifications), and environmental monitoring. We briefly discuss these five groups of internal environmental capabilities in this section.

Environmental investments

Prior research notes that the firms are more likely to commit more resources toward environmental investments when they have higher levels of integration between supplier and customers (Vachon and Klassen 2006; Vachon and Klassen 2007). Klassen and Hajmohammad (2017) suggested that the firms are motivated to invest in environmental technologies because in doing so, they can enhance their manufacturing capabilities. Pagell et al. (2013) provide a different perspective on environmental investments, and their study observed that firms with higher levels of internationalization exposure are more likely to make greater investment in environmental technologies.

Eco-product design capabilities

Eco-product design remains a relatively under-researched area in the environmental supply chain management literature. Empirical work on eco-product design focuses on how a plant's resources positively affect a firm's ability to design environmentally-friendly products (Gavronski et al. 2011). Organizational support has also been shown to positively affect a firm's eco-product design capability (Cantor et al. 2013; Jung Wan et al. 2018; Leonidou et al. 2017; Lin et al. 2011; Wu et al. 2012). Mainly through the impact of consumers' expectations, there seems to have developed a tendency for firms to design eco-friendly products (Ates et al. 2012; Barbarossa and De Pelsmacker 2016; Caniato et al. 2012; Gualandris and Kalchschmidt 2014).

Environmental management practices (logistics/supply chain environmental practices)

Environmental management practices are the set of operating procedures through which a firm can observe and control the impact of its operations on the natural environment (Montabon et al. 2007). Research on environmental practices highlights several important antecedents. For example, Caniato et al. (2012) show that firms adopt environmental practices to reduce

operational costs. In a similar vein, a positive correlation has been associated between a firm's lean operations and the adoption of environmental practices (Piercy and Rich 2015). Barbarossa and De Pelsmacker (2016) and Caniato et al. (2012) associate consumers pressures with a firm's adoption of EM practices.

Environmental management systems (EMS)

EMS describes a system in which a firm develops, implements, evaluates, and reviews its policy with respect to environmental performance (Montabon et al. 2000; Melnyk et al. 2003). Many studies have examined the impact of stakeholder pressures (e.g., Dai et al. 2014; Sarkis et al. 2010), buyer-supplier relationships (King et al. 2005), and a firm's integration with its suppliers (Vachon 2007) on its adoption of EMS.

Environmental monitoring

Environmental monitoring involves a firm's assessment and monitoring of environmental impacts that have occurred or may occur because of its own or its suppliers' operations (Klassen and Vachon 2003). Studies have found that stakeholders pressures positively influence a firm to monitor both its own and suppliers' environmental performance (Dai et al. 2014). Caniato et al. (2012) noted that the key drivers for a firm's environmental monitoring are related to efficiency objectives (e.g., lowering production costs).

Antecedents: external development factors

Environmental sourcing/green supplier selection

Environmental sourcing is a firm's environmentally consciousness purchasing practice aimed toward reducing environmental impacts, such as reducing waste and emissions, etc. (Carter and Carter 1998; Min and Galle 2001). This topic is a recurrent theme within environmental supply chain management research (see Table 11). Several studies highlight the

critical role of stakeholder pressures (from investors, customers, etc.) in the adoption of environmental sourcing practices (e.g., Carter and Carter 1998; Carter and Jennings 2004; Chin-Chun et al. 2013; Hsu et al. 2014; Preuss 2001). According to three studies, purchasing managers' intrinsic and extrinsic motivation can also play a critical role in adopting environmental sourcing practices (Goebel et al. 2012; Goebel et al. 2018; Mansi and Pandey 2016). The tendency for a firm to adopt conscious environmental sourcing is also associated with corporate level factors such as firm's environmental policy (Bowen et al. 2001) or a firm's desire to achieve environment-friendly reputation (Chin-Chun et al. 2016). A few studies have associated top-management support with influencing a firm's environmental sourcing practices (Blome et al. 2014; Carter and Jennings 2004; and Goebel et al. 2012).

Several papers have also explored green supplier selection issues. For example, Thornton et al. (2013) found significant financial performance benefits in selecting suppliers from the sustainability dimension. Similarly, Paulraj (2011) found that the selection of sustainable suppliers enables firms to leverage relational (external) environmental capabilities. Other contingent factors related to the availability of relevant resources at plants/manufacturing facilities are also associated with green supplier selection (Gavronski et al. 2011). Table 2.11 presents a detailed summary of the descriptive analysis of factors that drive environmental sourcing practices.

Environmental collaboration with suppliers

Environmental collaboration allows firms to meet their internal environmental needs by developing joint capabilities with their suppliers (Gavronski et al. 2011). The extant literature indicates that environmental collaboration with suppliers is a critical issue (Dai et al. 2014; Murfield and Tate 2017; Simpson et al. 2007). Prior research has examined various conditions

leading to successful environmental collaboration. For instance, committing manufacturing plants' resources is a crucial determinant for successful environmental collaboration (Gavronski et al. 2011). At the corporate level, the literature reflects the growing importance of a firm's orientation (e.g., eco-reputation, and eco-innovative orientation) in playing a crucial role in successful environmental collaboration with suppliers (Chin-Chun et al. 2016; Roehrich et al. 2014). The ability of a firm to successfully engage suppliers in environmental initiatives also depends on the incentives and rewards to suppliers (Porteous et al. 2015). Luo et al. (2014) add that interpersonal linkages in buyer-supplier exchange relationships can affect positively affect the implementation of sustainable supply chain practices. Table 2.11 provides a detailed summary of the descriptive analysis of factors that drive environmental collaborations with suppliers.

Outcome Factors

In our systematic review, we categorized articles that linked environmental capabilities with outcome measures with respect to environmental sustainability and other performance indicators. A total of five dimensions of outcome measures emerged from the literature: environmental performance, environmental innovations, and environmental reputation or image, financial performance, and manufacturing performance (see Table 2.12).

Our literature review reveals that a view of environmental innovations and environmental reputation as an outcome measure is still underdeveloped (see Table 2.13). In contrast, the main focus of prior research has been on environmental performance as an outcome, with examples that include the relationship between internal EM capabilities and environmental performance (Chiou et al. 2011; Li et al. 2016; Montabon et al. 2000; Montabon et al. 2007; Porteous et al. 2015; Zhu and Sarkis 2004). Only a few studies have examined environmental innovations (Dai

et al. 2015; Theyel 2000; Song et al. 2018) and environmental reputation (or image) (Foerstl et al. 2010; Kumar et al. 2012).

A firm's manufacturing performance is another critical issue that surfaced from our literature review. Both internal and external EM capabilities can positively influence a firm's manufacturing performance. For example, Schoenherr (2012) found a positive relationship between a plant's ISO 14000 certification and improvements in its cost, quality, delivery, and flexibility performance. Similarly, Sroufe (2003) found that internal EM systems can enhance a firm's operational performance (cost, quality, speed, and delivery).

Prior studies also provide evidence that EM capabilities can have far-reaching effects on financial performance. Several studies (Longoni et al. 2018; Schmidt et al. 2017; Shin et al. 2018; Wong et al. 2012) report a positive relationship between EM capabilities and financial performance. This suggests that firms with greater environmental capabilities may be in a better position to minimize costs by reducing energy consumption and influencing financial market perceptions of its long-term sustainability.

Discussion and Future Research Directions

The purpose of this systematic literature review was to examine how environmental supply chain management research has evolved. In carrying it out, this study aimed to synthesize existing knowledge and provide future research directions. We synthesized research studies that articulate both internal development and external acquisition of environmental capabilities. The results of this systematic literature review provide several insights into environmental supply chain management research. We identified six crucial areas in this area of research that require more attention.

First, while engaging suppliers on environmental initiatives is an important issue, it is currently estimated that only 25% of companies engage their suppliers in reducing emissions embedded in its supply chain (McKinsey 2016). Only a few studies have attempted to address concerns of environmental collaboration relationships from the suppliers-engagement perspective (Cantor et al. 2015; Foerstl et al. 2015). This suggests that there remains a lack of widespread acceptance of buyer-supplier engagement on the environmental front. It is noteworthy that a firm's supply chain creates far greater environmental costs than its operations (McKinsey 2016). Clearly, more research is needed to investigate various ways in which buyers can engage their suppliers proactively in environmental initiatives. Future research should explore questions related to how a buying firm's bargaining power can influence supplier engagement in reducing supply chain environmental impact (see the example research question in Table 2.14). Evidence suggests that since a buying firm's bargaining power can positively influence building of cooperative relationships with suppliers (Benton and Maloni 2005; Nair et al. 2011), it would be interesting to find out how a buying firm can exercise its bargaining power in ways (e.g., reduce plastic packaging) that motivate suppliers to cooperate in environmental initiatives.

Second, scant research exists in the environmental sourcing domain that focuses on how a buying firm can incentivize its suppliers to gain access to external environmental expertise (e.g., Huq et al. 2014). Much of the previous literature concentrates on a buying firm's willingness to incorporate environmental dimension in supplier selection or purchasing decisions, while neglects supplier incentives resulting from engagement in environmental initiatives. The topic of supplier incentives warrants a discussion on how buying firms can use supplier incentive structures to encourage access to external knowledge and thereby reduce their burden of

developing internal environmental capabilities. Specifically, a transaction cost economics (TCE) perspective can offer numerous avenues for future research in this area. For example, future researchers could explore whether a buying firm prefers to allocate more business volume to suppliers demonstrating environmental expertise (see the example research question in Table 2.14).

Third, we encourage researchers to examine how environmental practices affect consumers. While the prior literature has recognized ‘consumer pressures’ as an important factor for driving a firm’s environmental sourcing practices, relatively little is known about how consumers take environmental supply chain practices into account in their purchasing decisions. As a whole, our review indicates that scant research exists that examines how knowledge of a firm’s sourcing practices affects consumer judgments (Bregman et al. 2015; Hartmann and Moeller 2014). There remains an opportunity to further advance the understanding of consumer behavior related to the potential effects of irresponsible sourcing practices. Future researchers might explore how knowledge about a firm’s environmental sourcing practices impact perceptions of product quality (see Table 2.14 for sample research question).

Fourth, a research gap exists in understanding how EM practices influence a firm’s marketing performance. Although we have seen that the link between environmental sustainability and a firm’s financial performance has been consistently examined in past research (Longoni and Cagliano 2018; Narasimhan et al. 2015; Wong et al. 2012; Zhu and Sarkis 2007), marketing-related outcomes have been understudied. Common elements of marketing-related outcomes generally include brand reputation, corporate image, consumer loyalty or commitment, market share, etc. Given the vast number of options related to marketing-related outcome

measures, we expect that researchers will take note and use a more diverse set of outcome measures (see Table 2.14 for sample research question related to consumer boycotts).

Next, we uncovered an important gap from a research design standpoint. The firm remains the predominant unit of analysis, but only recently have supply chain scholars begun to investigate the issues from an individual-level (Bregman et al. 2015; Cantor et al. 2015; Gattiker et al. 2014; Hartmann and Moeller 2014) and plant-level (Schoenherr 2012). Another notable issue is that network level issues remain an understudied area of inquiry. Only a few studies have examined sustainable supply chain management issues at dyadic/network-level (Touboulic et al. 2014; Wichmann et al. 2015). Despite the recent progress related to dyadic or network level issues, more research is needed to examine impact of the structure and dynamics involved in inter-organizational relationships (Wichmann and Kaufmann 2016). For example, future researchers can investigate how social network characteristics (e.g., centrality, embeddedness etc.) might be related to a buying firm's learning of EM knowledge from suppliers at tier-1 or lower-tiers (see the example question in Table 2.14).

A final concern regarding a gap in the literature involves how theories have been used. We note that forty-five theories have been used in the environmental supply chain management research, and of these forty-five theories, the five most widely-used are: stakeholder theory, the resource-based view (RBV), institutional theory, transaction cost economics (TCE), and natural-RBV (NRBV). These five theories have played a greater role in advancing the discipline from a theoretical standpoint. At the same time, we note that much of the existing body of empirical literature centers around theory-testing rather than theory-building approach. Moreover, there have been increasing calls for theory-building approach within the SCM discipline (Carter et al.

2015). In summary, we offer several future directions for environmental supply chain management research in Table 2.14.

Conclusion

A systematic literature review was conducted to provide an up-to-date and comprehensive review of the environmental supply chain management literature. The study reviews a total of 252 articles from the most premier supply chain and management journals. In presenting results from this review, we synthesized the findings based on two key aspects, internal development, and external acquisition, of how firms undertake environmental management (EM) capabilities. This study contributes to the environmental supply chain management literature by identifying important research gaps and providing future research directions. We hope that this study will provide useful insight into the manner in which this field of research has developed and that our illustration of findings will spur future research opportunities.

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Figures and Tables

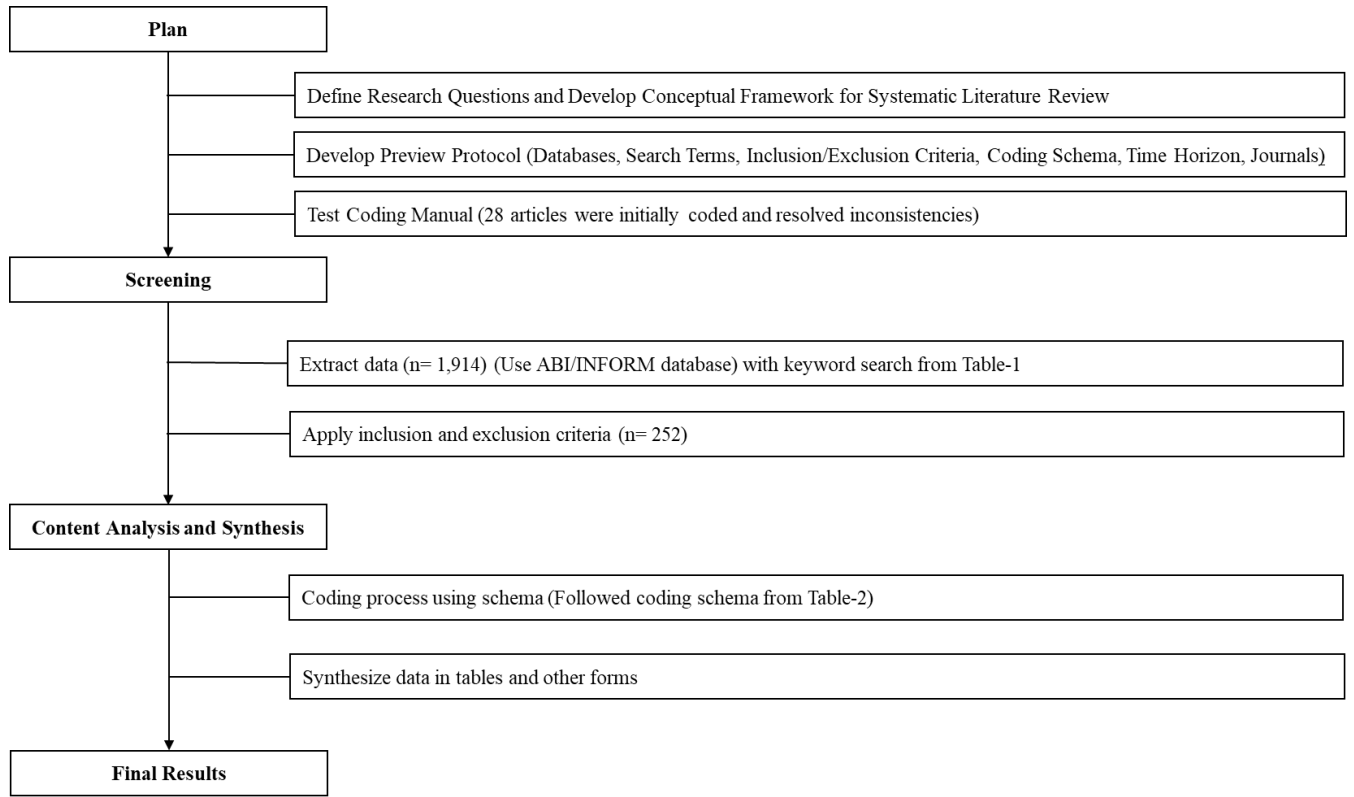


Figure 2.1: Overview of the Systematic Literature Review Process

Table 2.1: Search Terms for Articles

Environmental Related Keywords		Supply Chain Related Keywords
environment*		supply chain*
sustainab*		logistics
green*		operations
climate*	AND	sourcing
triple bottom		purchasing
Emissions		suppliers
		partners
		procurement

Table 2.2: Coding Schema for Systematic Literature Review

Coding Family	Description
Internal development or external acquisition of EM capabilities Antecedents	Determine whether the topic of interest relates to internal or external EM capability. Internal development factors e.g., customer focused, regulatory focused. External acquisition factors e.g., knowledge sharing, supplier's superior capabilities.
Outcome/Goals	Different types of impacts (outcome)-financial performance, operational (inventory, or eco-design products), environmental reputation, or environmental performance
Theoretical Lens	The overarching theoretical lens(s) employed in the study. Use of dominant theories to examine issues in internal development and external acquisition of environmental capabilities.
Method	The methodology employed in the study (e.g. survey, secondary data (TRI, KLD, Bloomberg etc., experiment)- or multiple methods.
Environmental SCM Strategies Focus	Determine the specific environmental dimension that the study is focused on e.g. eco-products, resource reduction programs, regulatory, recycling programs, material sourcing, environmental compliance, environmental innovations, environmental image or reputation, remanufacturing, green supplier selection etc.
Unit of Analysis	Determine whether the unit of analysis of the study: individual level, plant, firm level, inter-organization-level, dyadic or network level.
Timeline	The manuscript's publishing timeline.
Authors	Investigators/contributors.
Journals	Journal distribution of environmental internal development or sourcing external EM capabilities.

Table 2.3: Yearly Publications by Journals

	Journal Name	1996-1999	2000-2004	2005-2009	2010-2014	2015-2018	# Articles (by Journal)	% of Total Articles
1	Academy of Management Journal			1		1	2	1%
2	Decision Sciences	2			2	3	7	3%
3	International Journal of Logistics Management			1	3	10	14	6%
4	International Journal of Operations and Production Management		5	5	10	16	36	14%
5	International Journal of Physical Distribution and Logistics Management			1	14	9	24	10%
6	International Journal of Production Research			7	8	5	20	8%
7	International Journal of Production Economics	1		2	15	5	23	9%
8	Journal of Business Ethics		1	3	11	22	37	15%
9	Journal of Business Logistics	1	2		3	6	12	5%
10	Journal of Operations Management	2	2	2	5	4	15	5%
11	Journal of Purchasing and Supply Management				14	3	17	7%
12	Journal of Supply Chain Management		4	1	9	5	19	7%
13	Production and Operations Management		4			3	7	3%
14	Strategic Management Journal		1			2	3	1%
15	Transportation Journal		2			2	4	2%
16	Transportation Research Part E.		1		9	2	12	5%
Number of Articles (by Year)		6	22	23	103	98	252	

Table 2.4: General Trends of Methods Used

Method Used	1996-1999	2000-2004	2005-2009	2010-2014	2015-2018	Total (%)
Design Science Methodology					1	1 (0%)
Experimental						
Behavioral Experiment				2	4	6 (2%)
Field Experiment				1		1 (0%)
Multi-Method						
Multi Method (Qualitative and Secondary Data)		2		2	5	9 (4%)
Multi Method (Qualitative and Survey)		1		2	2	5 (2%)
Multi Method (Survey and Secondary Data)	1				6	7 (3%)
Qualitative						
Case Study/Interviews	2	3	6	29	28	68 (27%)
Delphi Method				1		1 (0%)
Secondary Data			3	11	12	26 (10%)
Survey	3	16	14	55	40	128 (50%)
Total						252

Table 2.5: Detailed Description of Secondary Data Sources

Data Source	Current/Future Implementation of Constructs	References
Asset 4	ASSET4 collects both quantitative and qualitative data and scores them on environmental, social, governance, and economic dimension for more than 4,500 global companies. The data source also provides an overall ESG score consisted of the equally weighted pillars. Researchers can use the overall ESG score to construct a variable that reflects a firm's environmental performance relative to its industry peers.	Benlemlih et al. 2018; Villena and Gioia 2018.
Bloomberg ESG	Bloomberg ESG module provides a comprehensive range of environmental measures such as ESG disclosure score, greenhouse gas (CO ₂) emissions, water/energy consumed/waste generated for more than 11,300 companies around the world. Researchers can use these measures to construct both process (water/energy consumed) and outcome (emissions/waste generated) related environmental measures.	Benlemlih et al. 2018
Carbon Disclosure Project (CDP)	The Carbon Disclosure Project (CDP), a not-for-profit organization, asks large companies around the world to voluntarily disclose their greenhouse gas (GHG) emissions, risks, and opportunities in the annual survey questionnaire. Researchers can use this data source to draw a binary measure of whether or not a firm voluntarily participates in the Carbon Disclosure Project (CDP).	Chen 2017; Kim and Davis 2016; Peters and Romi 2014

Table 2.5 (Cont'd)		
Data Source	Current/Future Implementation of Constructs	References
Corporate/CSR Reports	Researchers can perform content analysis to analyze a firm's corporate social responsibility (CSR) disclosure, which reflects a firm's voluntary to which goes beyond legal requirements.	Hofer et al. 2012; Montabon et al. 2007; Roehrich et al. 2017; Tate et al. 2012; Tate et al. 2013; Tate et al. 2010
EPA Toxics Release Inventory (TRI) Database	The U.S. Environmental Protection Agency (EPA) requires manufacturing facilities (with ≥ 10 full-time employees that use certain classified toxic chemicals in quantities greater than the established threshold in the course of a calendar year) to report their emissions levels and waste management strategies annually. Since the data is available at a plant-level, researchers typically aggregate data from plant-level to firm-level in their research.	Klassen and Whybark 1999; Geffen and Rothenberg 2000; Theyel 2000; King et al. 2005
Global Forest Stewardship Council (FSC) Certificate Database	The Forest Stewardship Council (FSC) offers certifications to firms for sustainable forest management. Researchers can obtain data on firms' FSC certification, which reflects a firm's ability to manage and trace the flow of materials in upstream of the supply chain, signaling that the products are made from responsibly managed supply sources.	Narasimhan et al. 2015.
MSCI KLD	Researchers can use the MSCI KLD database to obtain firms' environmental, social, and governance (ESG) ratings. MSCI KLD operationalizes a firm's ratings from two dimensions: environmental strengths (positive dimension) and concerns (negative dimension). Environmental strengths capture firm's strategic capabilities that enhance environmental performance,	Longoni and Cagliano 2018; Kumar and John-Patrick 2018; Lin 2012; Peters and Romi 2014; Rodrigue et al. 2013; Flammer 2018.

Table 2.5 (Cont'd)		
Data Source	Current/Future Implementation of Constructs	References
	whereas, environmental concerns capture a firm' lack of compliance on environmental standards (e.g., pollution levels, hazardous waste, or other violations, etc.)	
Trucost.com Environmental Cost Dataset	Trucost.com collects data on firms' overall supply chain emissions levels and assigns financial values to environmental impacts. Future research can use this data source to operationalize environmental costs as a potential variable of interest.	Kim et al. 2017.
www.ecolabelindex.org	Researchers can compile data on eco-labels to examine consumers related issues such as how consumers perceive eco-labels concerning perceptions of product quality. There exists an opportunity for researchers to use this data source to develop a construct on product eco-friendly orientation.	Castka and Corbett 2016

Table 2.6: Overview of Business-To-Consumer (BTC) Factors

Authors	Consumer perceptions about firm	Consumer perceptions of products	Consumer perceptions of quality	Consumer purchase intentions	Consumer reactions	Consumer recycling behavior	Consumer satisfaction
Barbarossa et al. 2016				X			
Bask et al. 2013				X			
Bregman et al. 2015	X						
Carvalho et al. 2010				X			
Hartmann and Moeller 2014					X		
Hazen et al. 2011			X				
Jayaraman et al. 2012				X			
Johnstone and Tan 2015		X					
Kochan et al. 2016						X	
Lindgreen et al. 2009	X						
Shin et al. 2017							X

Table 2.7: List of Theoretical Foundations

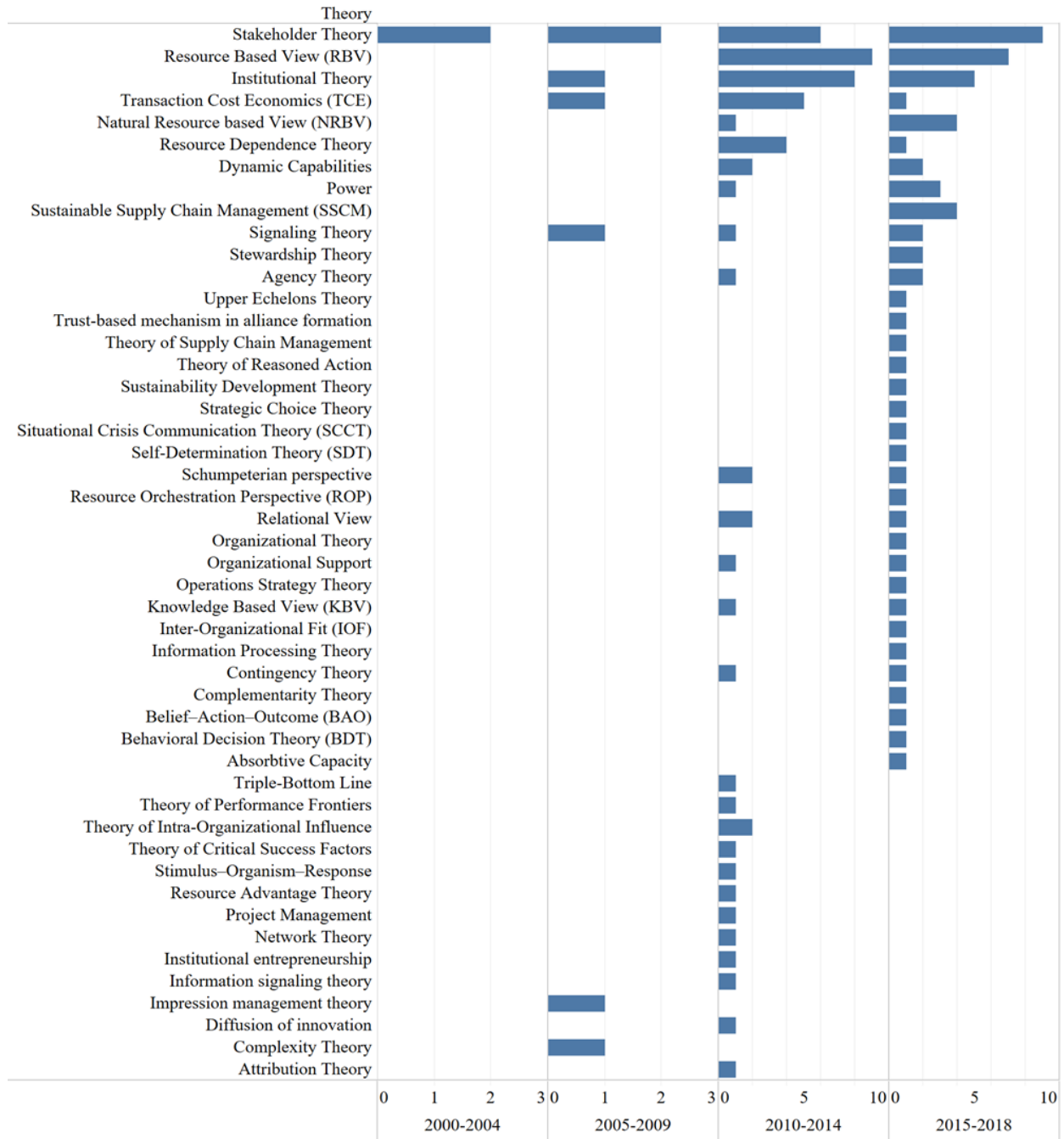


Table 2.8: Summary of Most Widely Used Theories

Theory	Brief conceptualization	Current utilization (Examples)	Future research applications?
<i>Stakeholder Theory</i>	Stakeholder theory suggests how firms operate while satisfying the goals of multiple stakeholders (e.g., governments, investors, suppliers, employees, communities, and customers) (Donaldson and Preston 1995; Freeman 1984).	<p><i>Internal capabilities:</i> Stakeholder pressures influence a firm’s internal environmental commitment (Cantor et al. 2015), and environmental management practices (Lai and Fryxell 2004; Sarkis et al. 2010; Gonzalez-Benito and Gonzalez-Benito 2006).</p> <p><i>External capabilities:</i> Stakeholders (e.g., investors) positively influence firms to adopt environmental purchasing or sourcing (Thornton et al. 2013).</p>	Stakeholder theory can be used to examine how and in what ways supplier firms can influence a buyer firm in achieving sustainable supply chain management practices?
<i>Resource-Based View (RBV)</i>	RBV identifies sources of competitive the advantage in a firm’s resources that are valuable, rare, inimitable, and non-substitutable (Barney 1991).	<p><i>Internal capabilities:</i> RBV scholars have studied how a firm’s internal environmental capabilities (e.g., plant resources, environmental management systems, and logistics structures, etc.) impact positively on a firm’s environmental performance (Gavronski et al. 2011; Pålsson and Kovács 2014).</p> <p><i>External capabilities:</i> RBV has been used to examine how external green supply chain practices (GSCM) can positively impact on a firm’s environmental performance (e.g., Longoni et al. 2018).</p>	RBV can be used as a theoretical lens to examine how supplier environmental capabilities can be a source of competitive advantage to a buyer firm?

Table 2.8 (Cont'd)

Theory	Brief conceptualization	Current utilization (Examples)	Future research applications?
<i>Institutional Theory:</i>	Institutional theory predicts institutional isomorphism, a behavioral state of firms for adopting similar (homogenous) norms. Three types of isomorphic factors that drive firms to adapt norms are: coercive, normative, and mimetic (DiMaggio and Powell, 1983).	<p><i>Internal capabilities:</i> Institutional pressures positively influence a firm's environmental stewardship (Huang et al. 2017), and environmental performance (Zhu et al. 2013).</p> <p><i>External capabilities:</i> Studies using institutional theory show that isomorphic factors (coercive, normative, and mimetic) influence firms to adapt external green supply chain management (GSCM) practices (Chin-Chun et al. 2013; Hojmosse et al. 2014). Additionally, the theory explains how buying firms can play an influential role in engaging their lower-tier suppliers in environmental supply chain practices (Glover et al. 2014).</p>	Future research studies can use institutional theory to examine issues such as: how buyer firms can increase set norms for supplier firms to deliver superior environmental performance?
<i>Transaction Cost Economics:</i>	Transaction Cost Economics (TCE) theory provides a basis why some activities are best internalized within the boundaries of a firm rather than externalized (Williamson 1975).	<i>Internal capabilities:</i> The theory provides a valuable perspective for understanding how ISO 14001/EMS certifications can reduce a firm's transaction costs by resolving information asymmetry/opportunism-related problems with foreign-based customers (King et al. 2005).	Given the focus of TCE theory on make vs. buy decisions, there exists an opportunity to use this theory to examine what drives firms to develop internal or external environmental capabilities?

Table 2.8 (Cont'd)			
Theory	Brief conceptualization	Current utilization (Examples)	Future research applications?
		<i>External capabilities:</i> The theory provides a foundation to understand how buyer-supplier relationships can influence firms to collaborate with suppliers on environmental management (Luo et al. 2015). Additionally, the TCE theory helps in understanding how supplier firms can achieve benefits from buying firms by engaging in sustainable practices (Huq et al. 2014).	
<i>Natural Resource-Based View (NRBV):</i>	Natural Resource-based View (NRBV) is an extended version of RBV, which suggests that pollution prevention, product stewardship, and sustainable development contribute to gaining a sustained competitive advantage (Hart 1995).	<p><i>Internal capabilities:</i> Studies show that environmental practices (e.g., green product design, green logistics, and renewable energy utilization) can positively impact a firm's financial performance (Schmidt et al. 2017; Shin et al. 2018; Wong et al. 2012)</p> <p><i>External capabilities:</i> It has been studied that a supply chain partner firm's environmental proactiveness can positively impact on satisfaction in buyer-supplier relationship (Norheim-Hansen 2018).</p>	Using NRBV, studies can examine how a supplier firm's reduction in emissions/wastes can impact on a buying firm's financial performance?

Table 2.9: Overview of Five Theories Used in Environmental Supply Chain Management Research

Topic (EM)	Stakeholder Theory	Resource Based View (RBV)	Institutional Theory	Transaction Cost Economics (TCE)	Natural Resource Based View (NRBV)
Environmental purchasing/sourcing	■	■	■	■	
Environmental collaboration/engagement with suppliers	■	■	■	■	■
Environmental management/practices	■	■	■	■	
Environmental performance	■	■	■	■	■
Environmental innovations		■			
Environmental reputation/image			■		
Financial/marketing performance	■				■
Manufacturing performance		■	■		

Table 2.10: Key Driving Factors Influencing Internal Environmental Capabilities

Key drivers for internal environmental capabilities						
Factors	Authors	Environmental investments	Eco-product design	Environmental practices (logistics/supply chain)	Environmental Management Systems/ISO14001	Environmental Monitoring
Manufacturing related factors						
Enhance manufacturing capabilities	Klassen and Hajmohammad (2017)	X				
Reduce manufacturing/operational costs	Caniato et al. (2012)			X		
Plant level factors						
Manufacturing plants' resources	Gavronski et al. (2011)		X			X
Lean operations	Piercy and Rich (2015)			X		
Corporate level factors						
Organizational support/comittment	Cantor et al. (2013); Jung Wan et al. (2018); Leonidou et al. (2017); Lin et al. (2011); Wu et al. (2012)		X	X		
Corporate environmental strategy	Ates et al. (2012)	X				
Internationalisation (global exposure)	Pagell et al. (2013)	X				
Relational level factors						
Buyer-supplier relationships	King et al (2005); Vachon (2007)			X	X	
Integration with suppliers, customers	Klassen and Vachon (2003); Vachon and Klassen (2006); Vachon (2007); Vachon and Klassen (2007)	X		X	X	X
Other pressures						
Consumer Pressures	Ates et al. (2012); Barbarossa and De Pelsmacker (2016); Caniato et al. (2012); Gualandris and Kalchschmidt (2014)	X	X	X		
Stakeholder/competetive pressures	Dai et al. (2014); Sarkis et al. (2010)		X	X	X	X

Table 2.11: Antecedents of External Environmental Capabilities

Factors	Authors	Environmental Sourcing/Green Supplier Selection	Environmental collaboration/engagement with Suppliers
Customer pressures	Bregman et al. (2015); Carter and Carter (1998); Carter and Jennings (2004); Chin-Chun et al. (2013); Gualandris and Kalchschmidt (2014); Hartmann and Moeller (2014); Preuss (2001)	X	
Competitive pressures	Dai et al. (2014)		X
Stakeholder/institutional pressures			
Coercive, mimetic, and normative pressures	Hoejmose et al. (2014)		X
Government regulations/legislation	Carter and Carter (1998); Carter and Jennings (2004); Chin-Chun et al. (2013); Hsu et al. (2014); Preuss (2001); Sancha et al. (2015)	X	
Stakeholder pressures	Foerstl et al. 2015; Reuter et al. (2012)	X	X
Purchasing managers (individual level)			
Managers' self-enhancement values	Goebel et al. (2018)	X	
Manager's incentives (employees)	Goebel et al. (2012)	X	
Manager's tenure/position/qualification	Mansi and Pandey (2016)	X	
Top management (individual level)			
Top management's support	Carter and Jennings (2004)	X	
Top management's ethical behavior	Goebel et al. (2012)	X	
Top management's commitment	Blome et al. (2014)	X	
Plant level factors (tactical level)			
Plant's available resources	Gavronski et al. (2011)	X	X
Focal firm operational level factors			
Focal firm's green manufacturing capabilities	Gavronski et al. (2011)	X	
Focal firm's quality management/needs	Carter and Carter (1998); Jabbour et al. (2014)	X	
Focal firm's environmental performance	Simpson et al. (2007)		X
Focal firm's financial/marketing performance	Blome et al. (2014)	X	
Focal firm's size	Min and Galle (2001)	X	
Focal firm's strategic level factors			
Corporate environmental initiatives	Murfield and Tate (2017)		X
Corporate environmental policy	Bowen et al. (2001)	X	
Corporate environmental transparency	Vaccaro and Patiño Echeverri (2010)		X
Corporate headquarters' pressure on its subsidiary firms	Hsu et al. (2014)	X	
Corporate eco-innovation orientation	Chin-Chun et al. (2016)	X	
Corporate eco-reputation orientation	Chin-Chun et al. (2016); Roehrich et al. (2014)	X	X
Corporate enviropreneurship	Paulraj (2011)	X	X
Socio-cultural responsibility	Chin-Chun et al. (2013)	X	
Supplier factors			
Supplier's transaction costs	Tate et al. (2014)		
Suppliers diversity and supplier's environmental focus	Thornton et al. (2013)	X	
Perceived supplier's greenness	Norheim-hansen (2015)	X	
Suppliers' rewards and penalties	Porteous et al. (2015)		X
Relational factors			
Buyer-supplier relationships	Luo et al. (2014)		X
Network level factors			
Network globalization	Golini and Jury (2018)	X	
Internal manufacturing network integration	Golini and Jury (2018)	X	
Network effects (embeddedness, centrality)	Tate et al. (2012)	X	

Table 2.12: Outcome Measures

Metric	Description	Authors
Environmental Performance	Reduction in emissions, waste, water consumption, and environmental violations.	Longoni et al. (2018); Melnyk et al. (2003); Montabon et al. (2000); Vachon and Klassen (2008); Zhu and Sarkis (2004)
Environmental Innovations	Technical innovation that comprises of new products and processes used to either avoid or reduce an environmental burden.	Da et al. 2015; Ziegler and Nogareda 2009
Environmental Reputation	Impressions of a firm's competence, commitment, genuine concerns, trustworthiness pertaining to environmental practices.	Foerstl et al. (2010); Kaipia et al. (2013); Kumar et al. (2012)
Financial	Increase in return on assets (ROA), return on equity (ROE), net profits, earning per share (EPS).	Longoni and Cagliano (2018); Montabon et al. (2000); Montabon et al. (2007); Narasimhan et al. (2015); Wong et al. (2012)
Manufacturing Performance	Improvement in cost, quality, delivery, and flexibility.	Schoenherr (2012); Sroufe (2003); Vachon and Klassen (2008); Zhu et al. (2012)

Table 2.13: Studies Examining Outcome Measures

Studies	Method	(Outcome measures)				
		Environmental performance	Manufacturing performance	Financial performance	Environmental innovations	Environmental reputation/image
Dai et al. (2015)	Survey				X	
Zhu and Sarkis (2004)	Survey	X				
Narasimhan et al. (2015)	Secondary Data			X		
Golini and Jury (2018)	Survey		X			
Longoni and Cagliano (2018)	Multi Method (Survey and Secondary Data)			X		
Piercy and Rich (2015)	Case Study/Interviews		X			
Rao and Holt (2005)	Survey	X				
Theyel (2000)	Multi Method (Qualitative and Secondary)				X	
Foerstl et al. (2010)	Case Study/Interviews					X
Chen et al. (2015)	Survey		X			
Kaipia et al. (2013)	Case Study/Interviews	X				X
Montabon et al. (2000)	Survey	X	X	X		
Montabon et al. (2007)	Secondary Data	X	X	X		
Melnyk et al. (2003)	Survey	X				
Pálsson and Kovács (2014)	Survey	X				
Pietro De and Vincenzo Esposito (2014)	Survey	X		X		
Dubey et al. (2015)	Survey	X				
Lai et al. (2015)	Survey	X	X	X		
Schoenherr (2012)	Survey		X			
Vachon and Klassen (2008)	Survey	X	X			
Wiengarten et al. (2012)	Survey		X			
Wong et al. (2012)	Survey			X		
Ates et al. (2012)	Survey	X				
Das (2018)	Survey	X	X			
Field and Sroufe (2007)	Case Study/Interviews	X				
Kumar et al. (2012)	Case Study/Interviews					X
Li et al. (2016)	Survey	X		X		
Mitra and Datta (2014)	Survey			X		
Yu and Ramanathan (2015)	Survey	X				
Zhu and Sarkis (2007)	Survey	X		X		
Zhu et al. (2012)	Survey	X	X			
Schmidt et al. (2017)	Multi Method (Survey and Secondary Data)			X		
Chiou et al. (2011)	Survey	X		X		
Jabbour et al. (2014)	Survey	X				
Lun et al. (2015)	Survey	X				
Porteous et al. (2015)	Survey	X				
Sroufe (2003)	Multi Method (Interviews and Survey)		X			
Aronsson and Brodin (2006)	Case Study/Interviews	X				
Bajec et al. (2015)	Survey		X	X		
Choi et al. (2018)	Survey		X	X		
Song et al. (2018)	Secondary Data				X	
Longoni et al. (2018)	Survey	X		X		
Shin et al. (2018)	Secondary Data			X		

Table 2.14: Future Research Opportunities

Research domain (Internal/External Environmental Capability)	Sample Research Questions	Key constructs	Operationalizing methods (Examples)
External	Do buying firms allocate more business volume to suppliers who have greater environmental capabilities?	Procurement spend Environmental capability	Secondary data: Bloomberg SPLC; The US Patent and Trademark Office (USPTO) patent database) for green patents
External	Do firms with greater power influence their suppliers to reduce emissions levels?	Relationship asymmetry Greenhouse gas emissions, water/energy consumed, hazardous waste	Secondary data: Bloomberg SPLC, Bloomberg ESG, Asset 4 Survey questionnaire (e.g., dyadic survey)
External	To what extent supplier environmental capabilities enhance a buying firm's environmental performance?	Environmental Performance	Secondary data: Bloomberg ESG, Asset 4, and CDP
External	Do pre-existing relationships with suppliers that have environmental expertise prevents firms to develop internal environmental expertise?	Prior-relationships Make vs. Buy decisions	Behavioral Experiment
External	How supplier network embeddedness influences a focal firm's learning capability on environmental innovations?	Network centrality (e.g., closeness, betweenness)	Social network analysis
External	Does the negative publicity of suppliers w.r.t environmental wrongdoings affects a focal firm's corporate reputation and earnings?	Earnings surprise Consumer boycotts Reputation Negative publicity	Fortune's "most admired" companies, Compustat, LexisNexis database
Internal	Does a buying firm's superior environmental performance experience a lower number of product recalls?	Greenhouse gas emissions Number of product recalls	Secondary data: The US Consumer Product Safety Commission (USPSC).

Table 2.14 (Cont'd)

Research domain (Internal/External Environmental Capability)	Sample Research Questions	Key constructs	Operationalizing methods (Examples)
Internal	How does a top management executive's salary linked with environmental, social, and governance (ESG) affect a firm's strategy to develop internal environmental expertise?	ESG Disclosure	Carbon Disclosure Project (CDP)
Consumer-focused	How do consumers care about a firm's environmental sourcing practices?	Consumer perceptions (e.g., perceived product quality)	Behavioral Experiment
Consumer-focused	Do consumers recycle more when they know products are made from responsibly managed supply sources?	Consumer recycling behavior	Vignette-based experiment Secondary data: product eco-labeling index; recycling data from city councils.
Consumer-focused	Do consumers perceive "greenwashing" when an eco-friendly brand (firm) source from suppliers that engage in environmental wrongdoings?	Consumers reactions to greenwashing	Behavioral Experiment

CHAPTER 3. DO FIRMS SPEND MORE ON SUPPLIERS THAT HAVE ENVIRONMENTAL EXPERTISE? AN EMPIRICAL STUDY OF U.S. MANUFACTURERS' PROCUREMENT SPEND

Modified from a manuscript under review in Journal of Business Logistics

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Abstract

Many stakeholders increasingly expect focal firms to improve their environmental performance. While these firms may be able to accumulate the environmental expertise needed to achieve this goal internally, doing so may require significant time and resource commitments. Alternatively, buyers may choose to leverage their suppliers' environmental expertise and increase their purchases of products and services from these suppliers in an effort to gain access to such expertise. The purpose of this study, then, is to develop a theory regarding whether and under what conditions suppliers' environmental expertise influences a buying firms' procurement spend with these suppliers. The associated hypotheses are grounded in transaction cost economics (TCE) and agency theory and empirically tested using a unique buyer–supplier dyadic data set drawn from multiple secondary data sources. We find that buyer firms are willing to increase their overall business spend with suppliers that have strong environmental expertise, particularly when the buyer firms are more profitable and have higher levels of absorptive capacity. The results also indicate that linking executive compensation to the buyer firm's environmental, social, and governance (ESG) performance and the buyer's environmental

concerns both negatively moderate the relationship between the supplier's environmental expertise and the buyer's procurement spend with the supplier. In addition, theoretical and managerial implications are discussed.

Introduction

Many stakeholders are increasingly expecting focal firms to continue to improve their environmental performance (Eroglu et al. 2016). Firms are under pressure both from customers, to manufacture environmentally sustainable products, and from regulatory agencies, to comply with environmental standards and regulations (Hofer et al. 2012; Carter and Jennings 2004). While firms may be able to develop environmental expertise internally, doing so requires potentially significant time, financial, and human resource commitments (Teece 2007). Given these constraints, buyer firms are motivated to source inputs from suppliers with strong environmental management expertise as a means to satisfy stakeholder expectations (Carter and Carter 1998). Stronger business ties between buyers and environmentally competent suppliers enable buyer firms to acquire ecofriendly products and components and, hence, effectively outsource the cost of developing environmental management expertise. For instance, Panasonic, one of the world's largest suppliers of electric batteries, announced a \$256 million investment in Tesla's U.S. auto-production plant (Reuters 2016). Relatedly, Walmart sources environmentally friendly products such as efficient LED lighting and refrigeration systems from suppliers like General Electric. In so doing, Walmart has been able to reduce its carbon footprint and operating costs (Walmart 2014). Based on this motivation, we theoretically and empirically investigate the association between supplier environmental expertise and buyer procurement spend.

A steady stream of purchasing literature points out that firms incorporate environmental sourcing requirements into their purchasing practices. Some scholars have theorized about how a

firm can develop green capabilities by sourcing from ecofriendly suppliers (Carter et al. 2000; Bowen et al. 2001). Other researchers have investigated the types of environmentally friendly inputs that buyer firms can source from suppliers (Carter and Carter 1998). A related emphasis of purchasing research has been on the negative implications associated with procuring environmental harmful materials and the costs associated with the disposal of hazardous materials (Min and Galle 1997). Supply chain scholars have also developed various methods for evaluating suppliers from an environmental perspective (Enarsson 1998). In this vein, Carter and Jennings (2002) found that firms employ life-cycle analysis when evaluating supply options and consider sourcing from suppliers with environmentally sound processes and products. Carter and Carter (1998), in turn, highlighted the importance of evaluating a supplier's willingness to develop close, collaborative relationships and engage in early-stage design initiatives. Based on insights from a focus group of materials managers, Walton et al. (1998) determined that the public disclosure of a firm's environmental record is the most important environmental criteria used in supplier evaluations, followed by second-tier supplier environmental monitoring as well as hazardous waste and pollution management.

While the above-mentioned studies represent important contributions to the purchasing literature, there is a need for further research on the role of a supplier's environmental expertise in a buying firm's procurement decision-making. In a related vein, Grigoriou and Rothaermel (2017) suggest that it is important to examine how a firm's internal knowledge stocks motivate a firm to expand or contract its procurement decisions. The purpose of this study, then, is to address this gap in the literature by investigating the relationship between an individual supplier's environmental expertise and a buyer's procurement spend. In addition, this study examines how a buying firm's characteristics moderate this relationship. We draw on transaction

cost economics (TCE) and agency theory to develop hypotheses about these theoretical relationships. Further, we test our hypotheses using a multilevel model that is based on dyadic buyer–supplier data derived from the Bloomberg, US Patent and Trademark Office, MSCI ESG STATS and Compustat databases.

This research makes multiple theoretical and empirical contributions to the environmental management and purchasing literature. First, drawing from the TCE literature, we develop theoretical insights as to why a supplier’s environmental expertise influences a buyer firm’s procurement spend on the supplier. Thus, our study adds to the TCE literature by providing an increased understanding of how a supplier’s environmental capabilities influence a firm’s decision to source from the market. Second, based on insights from TCE and agency theories, this study investigates the moderating factors that affect the magnitude of this relationship. As such, our study contributes to the agency literature by extending the utility of the theory to a buyer–supplier environmental management context. In so doing, the current study builds on Schoenherr et al. (2014), Carter and Carter (1998), and Bowen et al. (2001) by showing how buying firms value and source from suppliers that have environmental expertise. Importantly, our research also offers meaningful managerial implications. Our findings thus highlight the importance that buyer firms place on a supplier’s environmental expertise in their sourcing decisions. Moreover, it behooves suppliers to increase their environmental capabilities in situations where they recognize that buyer firms can benefit from an improvement in this domain. The findings from our study can also offer guidance to managers at buyer firms in regard to the conditions under which a firm is likely to have the capability and motivation to integrate a supplier’s environmental expertise into its organization. Specifically, we offer insight

into the effects of profitability, absorptive capacity, executive compensation, and environmental performance on this underlying relationship.

Theory and Hypothesis Development

We develop our theoretical model based on the transaction cost economics (TCE) perspective. Building on the work of Coase (1937), Williamson's (1975) TCE theory elucidates the specific conditions that will lead firms to outsource the production of goods and services rather than produce them in-house. Indeed, a substantial amount of prior outsourcing and supplier selection supply chain research has leveraged the theoretical insights provided by the TCE literature (e.g., Ellram et al. 2008; Lonsdale 2001; McIvor 2009; Murray and Kotabe 1999).

In our study, we examine existing buyer–supplier relationships and, thus, do not investigate a firm's decision to make or buy products and services. However, our study builds upon and extends the TCE literature by hypothesizing that the *magnitude* of outsourcing relationships is affected by the extent of a supplier's environmental expertise. We argue that given the cost and uncertainty associated with the internal development of environmental expertise, firms may choose to acquire such environmental expertise from environmentally competent suppliers by allocating greater shares of purchasing spend to such suppliers. Identifying and leveraging a supplier's environmental expertise, however, requires buyer firms to have sufficient financial resources and absorptive capacity. As such, we argue that the buyer's profitability as well as its degree of absorptive capacity moderate the magnitude of the effect of supplier environmental expertise on the buyer's procurement spend allocation with the supplier.

We also integrate agency theory into our theoretical model to further our understanding of the conditions under which a supplier's environmental expertise affects a buyer's procurement spend with the supplier. According to agency theory, a firm is a bundle of contractual

relationships in which a principal delegates some work to an agent (Eisenhardt 1989; Jensen and Meckling 1976). One of the important assumptions underlying agency theory is that agents may not always act in the principal's best interest (Eisenhardt 1989; Lassar and Kerr 1996). Indeed, the extant literature suggests that executives (agents) are typically more risk-averse than what is desired by their shareholders (principals) (Sanders and Hambrick 2007). Our premise is that a corporate manager may, in part, be guided by his or her own preferences and motivations when it comes to defining strategies to achieve superior environmental performance. Notably, such strategic choices include the internal development versus external acquisition of environmental expertise. We contend that such risk-averse agents are likely to avoid undertaking the R&D activities necessary to develop environmental expertise internally given the inherently risky nature of such investments. Instead, agents will prefer to leverage existing external sources of such knowledge. Hoskisson et al. (2002) provides evidence that corporate governance participants, such as institutional owners, boards of directors, and corporate executives exert their influence in directing a firm's choice of internal versus external sourcing of specialized knowledge. Thus, tension may exist between shareholders and agents when it comes to defining a firm's environmental sourcing strategy (Villalonga and McGahan 2005).

Our use of agency theory to study the relationship between a supplier's environmental expertise and the buying firm's procurement spend is well grounded in the supply chain literature. Supply chain scholars have drawn on agency theory to examine an actor's behavior in buyer-supplier relationships (e.g., Hajmohammad and Vachon 2016; Morgan et al. 2007; Steven et al. 2014). In this study, we integrate agency theory to increase our understanding of how linking executive compensation to a buying firm's environmental, social, and governance (ESG) performance as well as a buyer's environmental concerns affect its procurement spend

allocations to environmentally competent suppliers. The resulting model, as summarized in Figure 3.1, is hierarchical because multiple suppliers are associated with a particular buyer firm, and the lower-level effect of supplier environmental expertise on a buyer's procurement spend allocation is subject to higher-level (buyer firm) moderating effects.

Hypotheses

The first element in our multilevel theoretical model is the supplier's environmental expertise. In our study, we define environmental expertise as a firm-specific capability in the environmental domain that gives a firm a competitive advantage (Dibrell et al. 2015). We contend that a buying firm values suppliers that exhibit expertise in the environmental domain for several reasons. First, because procurement managers make sourcing decisions based on cost, these managers recognize that environmental expertise is a scarce and costly resource that is not widely available across organizations. Hence, a buying firm may seek to acquire such competency externally because it can be less expensive to do so, thus resulting in lower short-term fixed costs (Teece 1986, 1992; Weigelt and Sarkar 2009). Likewise, a buyer firm awards more business to environmentally competent suppliers because it offers quicker access to environmental expertise (e.g., supplier) and can result in short-term performance gains (e.g., compliance with environmental regulations and achieving waste reduction goals). Indeed, the Herman Miller Corporation awarded procurement contracts to suppliers that manufactured environmentally friendly components in a desire to meet the needs of customers who want furniture solutions that are built with sustainable ("green") components and processes (Lee and Bony 2007).

A buyer firm may then seek to source environmental expertise from its suppliers because the development of environmental capabilities is an inherently risky and costly endeavor (Ahuja

et al. 2008; Berrone et al. 2013). Indeed, such capability development requires the coalescing of specialized human resources, proprietary materials, and business processes, which occurs over long time horizons (Ramus and Steger 2000). Given the high cost and risk involved with the development of environmental expertise, a buyer firm may be motivated to reduce this uncertainty by sourcing from suppliers that have already developed environmental expertise. The buyer firm will likely find that it is more efficient and effective to acquire such expertise, especially when the suppliers have previously established a dedicated capacity for environmental competency (Xu and Beamon 2006).

We also posit that buyer firms allocate procurement spend to environmentally competent suppliers in an effort to boost their own environmental reputation. Indeed, a buyer firm can derive reputational spillover benefits when it awards contracts to suppliers renowned for environmental competency and expertise (Weigelt and Camerer 1988). In so doing, the buyer firm sends signals to the market that it uses available internal or external resources wisely (Basdeo et al. 2006; Carter 2005; Maignan and Ferrell 2004). Furthermore, we suggest this acts as a signal to other competent suppliers that the focal firm values suppliers that have environmental expertise. As such, this reputational effect helps to reduce a buyer's search costs for suppliers that have environmental expertise.

Finally, we theorize that buying firms increase their purchasing spend with suppliers to ensure sustained access to a supplier's environmental technical expertise and competency (Klein and Rai 2009; Paulraj and Chen 2007). Stated differently, buyer firms award business to suppliers because they want to invest in and preserve a long-term relationship with suppliers to meet their strategic environmental sourcing needs in addition to capturing short-term cost efficiencies. By increasing their procurement spend with environmentally competent suppliers,

buying firms signal that they value suppliers' environmental expertise and can be expected to continue to do so into the future (Heide and John 1990; Poppo et al. 2008). The basic theoretical postulate is that greater procurement spend allocated to a core set of suppliers reflects a commitment to relationship continuity (Brahm and Tarzijan 2016). In so doing, there is a reduction in the risk of opportunistic behavior by either party in the buyer–supplier relationship (Wang and Wei 2007) as well as a lower likelihood that suppliers will discontinue their relationship with the buyer (Morgan and Hunt 1994). In addition to these long-term benefits, Waddock and Graves (1997) find that firms with high environmental standards typically rely upon superior internal resources, including management and production capabilities, that are likely to create cost advantages for these suppliers. This further incentivizes sourcing from environmentally competent suppliers as a less cost-intensive alternative to developing such expertise internally within the buyer firm. In sum, we theorize that there is a positive relationship between a supplier's environmental expertise and the buying firm's procurement spend with the supplier.

H1: *The greater the individual supplier's environmental expertise, the greater the buyer's procurement spend with the individual supplying firm.*

Moderating Effects of Buyer Firm Characteristics

Hypothesis 1 suggests that an individual supplier's environmental expertise will affect the buyer's procurement spend allocation. While the magnitude of this effect is expected to vary across suppliers, we argue that it is subject to buyer-level characteristics, including the buyer's profitability, the buyer's absorptive capacity, the extent to which executive compensation is tied to the buyer's environmental performance, and the buyer's environmental concerns. Stated differently, we suggest that there are higher-level (buyer firm-level) characteristics that moderate

the lower-level relationship between supplier environmental expertise and the buyer's procurement spend allocation.

Moderating Effect of Buyer's Profitability

We now turn to the moderating role of buyer profitability in our multilevel model. Significant financial costs are associated with searching, acquiring, and integrating suppliers with environmental capabilities into the buyer firm's organizational processes. As such, buyer firms with greater financial resources are in a better position to recognize and leverage the environmental expertise that is located outside of the firm's boundaries. First, financial resources are needed to hire specialized human resources that have the expertise to manage relationships with suppliers that are environmentally competent (Ba et al. 2013; Vachon 2007). For instance, scientists and engineers are needed to identify, acquire, and assimilate environmental expertise from outside sources (Menon et al. 2006). Firms that are more profitable can leverage these specialized human resources to help a firm meet its environmental needs (Petersen et al. 2005; Song et al. 2003). Second, more profitable buyer firms have the financial means to award more business to suppliers that offer unique expertise and resources that support the firm's environmental objectives (Koufteros et al., 2007).

Buyer firms that are in a stronger financial position have the resources needed to actively search for knowledge spillovers and to integrate knowledge acquired from environmentally competent suppliers. In order to learn from each of the firm's individual suppliers that are considered environmental experts, a buyer firm needs to make financial investments in support of the transference of environmental knowledge from external suppliers. Because knowledge spillovers can be considered a byproduct of both formal and informal learning activities, this may require substantial financial resource investments such as placing a buyer's representative

within a supplier firm (Grawe et al. 2012; Qiu and Wan 2015), breaking language barriers, and developing interorganizational business processes, systems, and routines (Wolter and Veloso 2008). TCE suggests that buying firms can incur significant opportunity costs if they do not make transaction-specific investments required to facilitate learning from the supplier on environmental management (Hoetker 2006). For example, several financially strong automobile manufacturers and their suppliers have increased their collaborative learning efforts to develop environmentally friendly alternative fuel technologies ever since Tesla introduced battery-operated cars in 2008 (Petschnig et al. 2014). As a result, highly profitable firms are more likely to utilize their strong financial resources to facilitate both formal and informal learning opportunities with those suppliers that possess environmental expertise. In summary, knowledge spillover opportunities, supported through a buyer firm's strong financial position, may influence a buyer firm to form broad and embedded relationships with supplying firms with greater environmental expertise and competency (Autry et al. 2014).

Furthermore, more profitable buyer firms have the financial resources necessary to compensate suppliers for the lengthy technological innovation processes that are inherently risky and uncertain (Ahuja et al. 2008; Berrone et al. 2013). That is, more profitable buyers can afford to pay the higher prices that allow suppliers to invest in developing their environmental expertise. On the basis of these arguments, we offer the following hypothesis:

H2: *Higher levels of buyer profitability positively moderates the relationship between an individual supplier's environmental expertise and the buyer's procurement spend with the individual supplying firm.*

Moderating Effect of Buyer's Absorptive Capacity

We now examine how a buyer firm's absorptive capacity moderates the relationship between an individual supplier's environmental expertise and a buyer firm's procurement spend with the supplier. We define absorptive capacity as a firm's capability to identify, assimilate, and generate new knowledge (Cohen and Levinthal 1990). Absorptive capacity is the product of a prolonged process of knowledge accumulation and investments over time (Cohen and Levinthal 1990; Tsai 2001). In an environmental management context, Vachon and Klassen (2008) suggest a buyer firm's absorptive capacity enables it to recognize and absorb new external knowledge on processes, techniques, systems, and products that might lower air or water emissions and generation of hazardous waste and provide cleaner energy sources. Hence, we suggest that buyer firms that have developed greater absorptive capacity are better able to integrate environmental knowledge when that expertise is held by individual suppliers. As such, we expect a buyer firm with greater absorptive capacity will be further incentivized to increase its sourcing relationship with a supplying firm that has developed environmental expertise.

Stronger levels of absorptive capacity enable a buyer firm to incur lower coordination and transaction costs when establishing sourcing relationships with preferred suppliers (Dibbern et al. 2008; Xiong and Bharadwaj 2011). Specifically, transaction costs are incurred by a buyer firm when coordination activities are required to manage a firm's supply base (Xu and Beamon 2006). While transaction costs are inevitable, a firm's internal knowledge base may help lower these costs (Dibbern et al. 2008). The availability of relevant internal knowledge makes the process of evaluating and transferring the external environmental expertise easier and more efficient (Menon and Pfeffer 2003). Therefore, a buyer firm will incur lower coordination and related transaction costs once it establishes working relationships with environmentally

competent suppliers. This implies that higher levels of absorptive capacity enable a buyer firm to maximize the potential from knowledge-sharing routines with competent suppliers (Dyer and Nobeoka 2000; Krause et al. 2007). As such, a higher level of absorptive capacity enables a firm to develop internal competencies in related environmental domains and thus lowers transaction costs with environmentally competent suppliers, thus promoting greater allocation of procurement spend with these suppliers.

Anecdotal evidence suggests firms with greater absorptive capacity are more likely to engage in business relationships—or even strategic alliances—with environmentally expert and competent suppliers. Automobile manufacturer Daimler AG, for example, recognized that Qualcomm Technologies' (QT) wireless charging technology could be adapted to charge hybrid and electric cars and partnered with QT to gain an edge in the electric vehicle segment (Forbes 2015). Similarly, Ford Motor Company worked with Johnson Controls-Saft to deploy the latter's specialized knowledge in the domain of lithium-ion batteries to increase its specialization in hybrid vehicles across a range of passenger and commercial vehicle product lines (WSJ 2009). Both examples illustrate the importance of a buying firm's absorptive capacity in the integration of a supplier's environmental expertise with its own knowledge stock (Saenz et al. 2014). Therefore, this study hypothesizes:

H3: *A buyer's absorptive capacity positively moderates the relationship between an individual supplier's environmental expertise and the buyer's procurement spend with the individual supplying firm.*

Moderating Effect of Executive Compensation Linked with the Buyer's Environmental, Social, and Governance (ESG) Performance

We now examine the moderating effect of ESG-related executive compensation on the relationship between an individual supplier's environmental expertise and a buyer firm's procurement spend with a supplier. In so doing, we draw upon agency theory to investigate how internalizing environmental expertise can resolve potential principal–agent concerns. Executive compensation is comprised of various components such as fixed salary, stock options, and incentives linked with a desired performance goal (Anderson et al. 2000). Many scholars who study executive compensation draw upon agency theory to examine how incentives linked with performance goals are designed to align the interests of executives (agents) with the primary objectives of the firm (principal)—to maximize shareholder's wealth (Donaldson and Preston 1995; Eisenhardt 1989). Agency scholars suggest that an executive's compensation structure, if linked to firm performance, could act as a mechanism to mitigate uncertainty and opportunism concerns for shareholders (Currim et al. 2012). Building on the notion that agents are incentivized to align their goals with those of their principals in exchange for compensation, several studies have established a positive association between executive pay and firm performance (Finkelstein and Hambrick 1988; Jensen and Meckling 1976; Kerr and Bettis 1987).

Similarly, executive compensation linked with the ESG performance of the buyer firm is intended to align an executive's (agent's) efforts with shareholder's (principal's) expectations related to environmental performance goals. It is evident that firms are increasingly linking ESG performance metrics with executive compensation. For example, Shell, a major oil and gas company, has linked 20% of its executives' annual bonus to environmental performance metrics such as greenhouse gas emissions, operational spills, use of fresh water, and energy usage (Shell

2016). Likewise, Intel Corporation has linked environmental metrics to annual bonuses not only for executives but also for all employees since 2008 to facilitate the pursuit of energy-efficiency innovation goals for new products (Eccles et al. 2014). More generally, academic scholars have asserted that CEOs are rewarded with financial bonuses for pursuing environmental strategies (Berrone and Gomez-Mejia 2009).

An executive's level of risk acceptance may cause a firm to underinvest in the development of internal environmental expertise. Indeed, executives (agents) are typically more risk-averse than what is desired by their shareholders (principals) (Sanders and Hambrick 2007). Agency theorists predict that, when facing make-or-buy decisions, risk-averse executives prefer the "source externally" option, whereas risk-neutral executives are likely to choose the "in-house" option (Eisenhardt 1989). Stated differently, risk-averse executives are more likely to perceive personal risk reduction as a key rationale for relying on external sourcing of environmental expertise. Executives may therefore continue to source environmental expertise externally even when it may be feasible and preferable from the principal's perspective to do so in-house. Risk-averse executives are also likely to underinvest in risky R&D spending, which may have a negative impact on a firm's innovation output (Ghosh et al. 2007). Accordingly, such agent actions may lead to suboptimal investment incentives for the principals.

However, linking compensation to a firm's ESG performance can influence an executive's risk-taking behaviors (Certo et al. 2003). McNally and Griffin (2004) established the compensation-outsourcing link, which points to an important role of compensation structures as a mechanism to reduce an executive's motivation to pursue outsourcing solutions. Specifically, by linking executive compensation with a firm's ESG performance, principals are able to address the aforementioned agency problem by inducing risk-taking behavior in executives and

motivating them to undertake internal environmental initiatives (Finkelstein and Hambrick 1988; Makri et al. 2006; Pagell et al. 1996). This logic suggests organizations need to implement a rewards structure to encourage executives to invest into internal environmental initiatives. Consequently, executives, when rewarded for improving a firm's ESG performance, will exhibit a preference for the development of internal environmental expertise over (indirectly) sourcing environmental expertise from suppliers. Taken together, these arguments suggest that executives with compensation linked to the firm's ESG performance are incentivized to undertake the risky internal development of environmental expertise rather than attempting to extract environmental expertise from suppliers that may prove to be of only limited value to the buyer firm. This, in turn, is likely to attenuate the extent to which suppliers with greater environmental expertise are allocated greater shares of the buyer's procurement spend.

While we contend that linking a buyer firm's ESG performance to an executive's compensation can motivate the executive to take risks in the internal development of environmental expertise, we acknowledge that short-term pressures from stakeholders might lead managers to source environmental expertise externally. This logic may be particularly true when the principal's goal is to improve environmental performance quickly or when developing the environmental expertise internally is exceedingly costly. Yet, based on agency theory, we believe that executives are incentivized to take more risks to develop environmental expertise internally, which outweigh the pressures toward external sourcing of said expertise when compensation is linked to ESG performance. Therefore, we hypothesize:

H4: *An executive's contingent pay compensation linked with the buyer firm's ESG performance negatively moderates the relationship between an individual supplier's environmental expertise and the buyer's procurement spend with the individual supplying firm.*

Moderating Effect of a Buyer Firm's Environmental Concerns

Finally, this study theorizes on how a buyer firm's environmental concerns moderate the relationship between an individual supplier's environmental expertise and a buyer firm's procurement spend with the supplier. In our study, we define environmental concerns as a firm's negative environmental performance rating resulting from that firm's involvement in controversial issues related to environmental impacts of the firm's products or services (MSCI 2016). Stated differently, environmental concerns reflect the firm's deviance from norm-conforming behaviors toward environmental responsibility (Chatterji et al. 2016; Semenova and Hassel 2015). We draw upon agency theory to motivate our proposed moderating effect of environmental concerns on the relationship between an individual supplier's environmental expertise and buying firm's procurement spend with the supplying firm.

There are numerous reasons why a firm's environmental concerns may play a substantial role in the firm's decision to internalize the development of environmental expertise rather than acquire it from their environmentally competent suppliers. Firms with greater environmental concerns are likely to receive negative attention from the press, social media, environmental activists, and regulatory agencies (Henriques and Sadorsky 1999). Indeed, Karpoff et al. (2005) suggest that firms may face adverse economic and noneconomic impacts when they violate environmental regulations. Managers who are employed by firms with poor environmental performance are likely to suffer public humiliation (Chatterji and Toffel 2010). Furthermore,

environmental concerns can lead to a decline in the corporate environmental reputation of the buyer firm (Kumar et al. 2019; Chatterji et al. 2009; Ilinitch et al. 1998). Consequently, environmental concerns can adversely affect a firm's shareholder value. For example, the Volkswagen emissions scandal in 2015 eroded nearly \$16 billion in shareholder value and further cost the firm \$15 billion to settle U.S. lawsuits (Bloomberg 2016).

To address the buyer's environmental concerns, we suggest that shareholders are likely to prefer that the buyer firm enhance its environmental expertise through internal actions. A firm's environmental reputation is formed through a signaling process where a firm's shareholders observe and interpret that firm's environmental actions, thereby building perceptions about the firm's likelihood to deliver value on the environmental dimension (Basdeo et al. 2006; Philippe and Durand 2011). Thus, some shareholders recognize that a firm can improve its environmental reputation by developing environmental expertise internally (Godfrey 2005). Internal environmental activities are more likely to increase the perception that a firm has assumed the responsibility to protect the natural environment than simply relying on sourcing environmental expertise from external parties. A shareholder can also influence a firm's internal environmental practices by requiring agents to implement certain limits on obtaining environmental expertise from external sources. As an example, principals may want their agents to develop stronger knowledge, skills, and abilities related to environmental management practices. A buyer firm can strengthen its own internal environmental expertise by hiring and acquiring employees to internally develop firm-specific environmental knowledge, thereby reducing its reliance upon external environmental know-how (Barthelemy 2003). Similarly, to the extent that sourcing environmental knowledge may lead to a loss in internal capabilities, principles are likely to discourage a buyer firm's reliance on external environmental knowledge. As a result, agents may

impose, at the behest of shareholders, some restrictions on outsourcing transactions that exist, in part, to externally acquire environmental expertise. Therefore, we hypothesize:

H5: *A buyer's environmental concerns negatively moderate the relationship between an individual supplier's environmental expertise and the buyer's procurement spend with the individual supplying firm.*

Methodology

Sample and Data Collection

We empirically test this study's hypotheses in the context of firms that operate in the U.S. manufacturing industry. We selected firms that participate in this industry sector for several reasons. First, environmental management is increasingly becoming integral to manufacturing operations (Klassen and Whybark 1999). Second, manufacturing firms have continued to involve their suppliers to meet the environmental expectations of their customers and regulatory bodies (Walton et al. 1998). Finally, manufacturing firms invest extensively in R&D and patenting activities for developing ecofriendly products and processes (Brunnermeier and Cohen 2003).

Because the purpose of our study is to investigate how a supplier's environmental expertise influences procurement spending by buying firms with that supplying firm, we constructed a data set consisting of dyadic buyer–supplier observations. The sampling process consisted of multiple steps. At the time of this study, the first step was the identification of publicly listed U.S. manufacturing firms (NAICS 311-339) and the collection of firm financial data from the Compustat database in 2012. Given the multilevel nature of this study, the second step in the sampling process involved matching the buying firms identified in the Compustat database to supplying firms as identified in the Bloomberg SPLC (supply chain analysis)

database. Bloomberg provides data on buyer–supplier relationships based on the United States Securities and Exchange Commission (SEC) financial disclosure rules as well as proprietary data collection efforts. That is, the SEC requires firms to disclose its customers (suppliers) when the firm generates more than 10% of its total annual revenue with a given customer (supplier) (Cohen and Frazzini 2008). Recent studies that used the Bloomberg buyer–supplier database include Kumar et al. (2019), Elking et al. (2017), Steven et al. (2014), and Osadchiy et al. (2015). The third step in the sample selection process consisted of identifying expertise in environmental technologies’ (patents) for all suppliers and buyers in the sample from the Lexis Nexis’ TotalPatent database, an interface to the United States Patent and Trademark Office’s patent database. Patents are generally considered a good proxy of an organization’s knowledge stocks and technological expertise (DeCarolis and Deeds 1999). Several previous studies measured a firm’s core technical expertise by using patents counts (Hoetker 2006). We also collected data about buyer firms’ ESG-related executive compensation from Bloomberg’s ESG database. This database collects information on executive compensation linked with ESG performance measures from annual proxy statements (e.g., DEF 14A filings) filed with the U.S. Securities and Exchange Commission (SEC) (Bloomberg 2018). Finally, we obtained data on environmental concern ratings for the buying firms in the sample from the MSCI ESG STATS (formerly known as KLD [Kinder, Lydenberg, Domini]) database. The MSCI ESG STATS database has long been used to quantify environmental, social, and governance performance in academic research (e.g., Kumar et al. 2019; Castillo et al. 2018; Chatterji and Toffel 2010; Waddock and Graves 1997).

The final sample consists of 4,778 buyer–supplier dyads, including 1,497 unique supplying firms linked with 439 unique buying firms in 2012. The reference year, 2012, is

selected for the identification of buyer–supplier relationships and 2011 for the measurement of supplier (and buyer) environmental technologies for several reasons. First, by introducing a one-year lag structure, we can examine the effect of a supplier’s environmental expertise (e.g., patents) during one year on transactional volume generated by the buying firm in the subsequent year. Second, we chose the years 2012 and 2011 because data for these years were the most recent at the time of the study. Third, during the data collection phase of the study, we found a substantial time delay between the initial patent application and the approval or rejection of the patent by the United States Patent and Trademark Office (USPTO). Our analysis suggested that the average patent application review time is over two years, which required us to take this delay into account in order to accurately assess the environmental innovation activity of the supplier (Bellamy et al. 2014). The final sample represented the following industries: metal manufacturing (2%), petroleum manufacturing (4%), heavy machinery manufacturing (7%), chemical (10%), transport and vehicle manufacturing (29%), computer and semiconductor (41%), and others (7%).

Measures

Dependent variable

A Buyer’s Procurement Spend with a Supplier is the dependent variable in our model. This variable is calculated as the ratio of a buying firm’s procurement spend (in U.S. dollars), as reported in the Bloomberg’s SPLC database and the buying firm’s cost of goods sold (in U.S. dollars) and is measured in 2012.

Independent variable

The key independent variable is *Supplier's Environmental Expertise*. Following Berrone et al. (2013) and Nameroff et al. (2004), we measure *Supplier's Environmental Expertise* as the number of environmental patents granted by the United States Patent and Trademark Office (USPTO) to each supplier in the sample based on data derived from the Lexis Nexis' TotalPatent database. As pointed out previously, patent counts are a common measure of technical competency (e.g., Modi and Mabert 2010; Shane 2001). *Supplier's Environmental Expertise* is measured in 2011.

The identification of suppliers' environmentally relevant patents followed a multistep process, as illustrated in Figure 3.2. Utilizing the Python programming language and following Berrone et al. (2013) and Nameroff et al. (2004), the first step to identify environmental patents consisted of searching the titles, abstracts, and patent claims in each patent document for the occurrence of environmental keywords and phrases developed by the Green Chemistry Institute. In addition, we searched the International Patent Classification (IPC) codes contained within each patent document for the set of green inventory keywords supplied by the World Intellectual Property Organization (WIPO). The green inventory list of International Patent Classification (IPC) codes has been used in prior research (Cecere et al. 2014; Karvonen et al. 2016).

Moderating variables

We now turn to describing our moderating variables which are measured in 2011. The first moderating variable is the *Buyer's Absorptive Capacity*, which is defined as the firm's capability to identify, assimilate, and generate new knowledge (Cohen and Levinthal 1990). In line with previous literature, we operationalize *Buyer's Absorptive Capacity* as the ratio of

research development expenditures divided by firm sales (Tsai 2001) using data obtained from the Compustat database. The second moderating variable is *Buyer's Profitability*, which is measured as the buyer firm's return on assets (Swink and Schoenherr 2015). This variable was also derived from the Compustat database. The third moderating variable is *Buyer's ESG Executive Compensation*, which is a binary variable obtained from the Bloomberg ESG data set indicating whether the buying firms' executive compensation is linked to ESG goals (Rodrigue et al. 2013). The final moderating variable is *Buyer's Environmental Concerns*. Walls et al. (2012) provide a strong theoretical and empirical justification for focusing on environmental concerns using MSCI ESG STATS (formerly KLD) data. This database operationalizes a firm's environmental concerns by presenting a sum of the binary ratings across seven environmental dimensions: hazardous waste, regulatory problems, ozone-depleting chemicals, substantial emissions, agricultural chemicals, climate change, and other concerns (Chatterji and Toffel 2010). For each dimension, a score of 1 (0) is assigned if a concern exists (does not exist). Following Chatterji et al. (2009), *Buyer's Environmental Concerns* is the sum of these scores.

Control variables

We include several control variables in our model that are likely related to a buyer firm's procurement spend allocation to individual suppliers. All control variables are measured in 2011. First, we control for a buyer's environmental expertise because buyers with greater internal environmental expertise may rely less on outsourcing to any one supplier because the firm has internally developed environmental skills and knowledge. As with *Supplier's Environmental Expertise*, we measure *Buyer's Environmental Expertise* as the number of successful patent applications in the environmental domain filed with the USPTO by each buyer firm in our study. Second, we control for the *Buyer's Number of Suppliers* and the *Supplier's Number of*

Customers. The former refers to the number of suppliers that are associated with a given buying firm, an indicator of the size of the buyer firm's network. Larger supplier networks may be indicative of a strategy to spread procurement transactions across many suppliers, as opposed to concentrating spend with any individual supplier. Similarly, *Supplier's Number of Customers* refers to the number of buying firms with whom a given supplying firm transacts. This measure is an indicator of the size of the supplier's customer network and acts as a proxy for the size of a supplier and its capabilities, which may affect buyers' purchasing allocations. Both of these variables are derived from Bloomberg's SPLC (supply chain) database. Third, we control for buyer firm size in our models by including *Net Income* and *Total Assets*. While our dependent variable is size-independent because it is measured in percentages, larger firms might be motivated to further diffuse their procurement spend across the supply base to ensure access to sufficient capacity. Both *Buyer's Net Income* and *Buyer's Total Assets* are measured in U.S. dollars (billions) and obtained from the Compustat database. To account for industry-level variation, we also included dummy variables based on the buying firms' three-digit NAICS codes.

Statistical Method

We test our hypotheses using a multilevel modeling approach (Bryk and Raudenbush 1992; Raudenbush and Bryk 2002). We chose this statistical approach because it is important to capture correlated error structures in nested observations while accounting for effects that vary within and between buying firms (Mathieu et al. 2012). Indeed, our data contains multiple suppliers that are nested within a buying firm. Given the nested structure of the data, we calculated an intraclass correlation (ICC) value of 0.65, which reveals relatively higher between-group variance than within-group variance (Hofmann 1997). Krull and MacKinnon (2001)

comment that positive ICC values indicate the presence of correlated errors among nested data, which violates the independence of observations assumption of ordinary least-squares estimation (Scariano and Davenport 1987; Scott and Holt 1982). Thus, our ICC finding indicates that multilevel regression is an appropriate statistical technique to account for both between-group variance and within-group variance (Bryk and Raudenbush 1992; Bliese 2000; Raudenbush and Bryk 2002). Following Chae et al. (2017), we scaled the variables using grand-mean centering to avoid any multicollinearity issues.

To verify that multicollinearity issues are not a serious concern, variance inflation factors were calculated and found to be below 4.0 (well below the suggested cutoff value of 5 [Kennedy 2003]), for all variables contained in our regressions. Table 3.1 reports the descriptive statistics for all the variables in the model.

Results

Table 3.2 presents the results from our multilevel analysis. Hypothesis 1 posits that there will be a positive relationship between the individual supplier's environmental expertise and the buyer firm's procurement spend with the supplying firm. The results of Model 1 from Table 3.2 indicate strong support for Hypothesis 1 ($\beta=0.0133, p<0.01$). Hypothesis 2 proposes that higher levels of buyer firm profitability positively moderates the relationship between an individual supplier's environmental expertise and the buyer firm's procurement spend with the supplying firm. The coefficient for the interaction term shown in Model 2 is positive and significant ($\beta=0.0499, p<0.01$), which indicates that Hypothesis 2 is supported. Likewise, in Hypothesis 3, we predicted that a buyer firm's absorptive capacity positively moderates the relationship between an individual supplier's environmental expertise and the buyer firm's procurement spend with the supplier. The results shown in Model 2 offer support for this hypothesis

($\beta=0.1011, p<0.01$). Hypothesis 4 predicted that an executive's contingent pay compensation linked with the buyer firm's ESG performance negatively moderates the relationship between an individual supplier's environmental expertise and the buyer firm's procurement spend with the supplying firm. Again, the results offer strong support for this hypothesis ($\beta=-0.0149, p<0.01$; see Model 2 in Table 3.2). Hypothesis 5, in turn, predicted that a buyer firm's environmental concerns negatively moderates the relationship between an individual supplier's environmental expertise and the buyer firm's procurement spend with the supplier. The results in Model 2 (Table 3.2) show a negative coefficient and significant ($\beta=-0.0086, p<0.01$), thus supporting this hypothesis as well.

Robustness Checks

We conduct additional analyses to demonstrate the robustness of our results. We first consider the possibility that buying firms are more likely to select suppliers with environmental expertise. Hence, we employed a two-stage Heckman selection procedure (Heckman 1979). To operationalize the selection variable (equaling 1 if a supplying firm reports business transactions with the buying firm in Bloomberg SPLC and 0 otherwise), we created a data set of both suppliers and nonsuppliers operating in the same three-digit NAICS industry. We then used this data to construct matched pairs for nonsuppliers and actual suppliers. Following Certo et al. (2016), we employed a probit model in the first stage to model the selection mechanism by regressing the selection variable on our instrumental variable, *If Supplier Innovative* (which takes the value of 1 if a supplying firm has more than 1 successful patent (general patent) and 0 otherwise) and all model covariates and control variables from the baseline model (Model 1). The variable *If Supplier Innovative* is found to be positively and statistically significantly associated with the selection variable (the realized buyer-supplier dyad). At the same time, the

instrumental variable in the first-stage probit model is not statistically significantly associated with a *Buyer's Procurement Spend with a Supplier*, the dependent variable of the second stage of the Heckman procedure. Next, we add the inverse Mills ratio as a control variable in the second stage regression analysis. Table 3.3 (see Models 3 and 4) presents consistent results from the two-stage Heckman procedure by replicating Models 1 and 2, respectively.

We also examine the robustness of our statistical results with respect to a change in measurement. Instead of operationalizing environmental expertise by counting environmental patents, we operationalize environmental expertise as the total number of patent claims reported in all of a supplier's environmental patents. Usually, each patent document contains a number of claims, with each claim reflecting a distinctive characteristic of the invention (Tong and Frame 1994). Previous research also has used patent claims to measure the overall scope of technical innovation (McGrath and Nerkar 2004). The results (reported in Models 5 and 6 in Table 3.3) with patent claims, as opposed to patent counts as the key measures of interest, are consistent with the results reported in Models 1, 2, 3 and 4.

Discussion

The purpose of our study is to investigate how an individual supplier's environmental expertise has an impact on a buying firm's procurement spend with supplier firms. Drawing upon TCE and agency theory, our multilevel study provides new insight into understanding why and under what moderating conditions buyer firms either increase or decrease their overall procurement spend with suppliers that have strong environmental expertise. Our study provides evidence that buying firms recognize the value of an individual supplier's environmental expertise and allocate greater procurement spend to the supplier. Previous environmental sourcing literature has not theorized and empirically examined how firms allocate their

procurement spend to suppliers that have environmental expertise. This study builds upon Carter and Carter (1998), Bowen et al. (2001), and Schoenherr et al. (2014) by showing that buying firms value a supplier's environmental expertise in their sourcing decisions. Thus, our study fills an important void in the environment sourcing literature because we present theoretical and empirical insight into the specific factors that lead a buying firm to increase (or decrease) its procurement spend with environmentally competent suppliers.

Drawing upon TCE theory, this study contends that, by increasing their procurement spend with suppliers, firms can benefit from lower transaction costs arising from the uncertainty associated with acquiring external environmental expertise (Hoetker 2005). Likewise, greater business volume and the prospect of longer-term business ties reduce the uncertainty for supplying firms as well. In addition, relying on a supplier's environmental expertise enables buying firms to fill a void in their own environmental expertise. As we explained previously, a supplier's strong environmental reputation can help buyer firms to reduce search costs associated with selecting suppliers. Another plausible interpretation of this study's findings is that buying firms award procurement contracts to suppliers for the purposes of incentivizing suppliers to continue to develop their environmental expertise (Terpend and Krause 2015).

Our study investigates under what conditions buyer firms allocate higher levels of procurement spend to suppliers that have expertise in the environmental domain. Our study theorizes and empirically examines how a firm's profitability moderates the relationship between a supplier's environmental expertise and a buyer firm's procurement spend. Our findings demonstrate that more profitable firms allocate procurement spend to suppliers with environmental expertise. We contend that this relationship exists because more profitable firms can afford to make the financial investment required to gain access to and integrate a supplier's

environmental expertise into their operations (Peters et al. 2017). In particular, more profitable firms have the financial resources needed to hire specialized human resources who have the expertise to manage relationships with suppliers that have environmental competency (Ba et al. 2013; Vachon 2007). As previously mentioned, scientists and engineers are needed to identify, acquire, and assimilate environmental knowledge from external organizations (Menon et al. 2006).

We also hypothesized and found empirical support that a firm's absorptive capacity positively moderates the relationship between a supplier's environmental expertise and buyer's procurement spend with an individual supplying firm. Although our results are consistent with the existing literature on absorptive capacity that the firm's internal knowledge enhances the ability to integrate external knowledge (Azadegan 2011; Cohen and Levinthal 1990), our analysis provides new insight regarding the role of absorptive capacity in leveraging a firm's purchasing spend on external environmental knowledge. Firms with greater research and development experience are better able to reduce coordination costs and overall transaction costs associated with absorbing external supplier-specific environmental expertise, prompting further business transactions with these suppliers.

We then turned our attention to examining how executive compensation that is linked to a buyer firm's environmental, social, and governance (ESG) performance has an impact on a buying firm's overall procurement spend with suppliers that have environmental expertise. As expected, we find evidence of a negative moderating relationship. Drawing upon agency theory, we theorized that executive compensation linked with a firm's ESG performance serves to mitigate agency issues within the firm (Donaldson and Preston 1995). We theorized that aligning compensation with the firm's ESG performance can influence an executive's decision-making

and the associated choice between internal and external sourcing of environmental expertise. Our results support the argument that a firm's executives, when compensated for ESG performance, are motivated to strengthen internal environmental capabilities instead of relying on external sources (Finkelstein and Hambrick 1988; Makri et al. 2006).

Finally, we contend that firms with greater environmental concerns (issues) are less likely to allocate procurement spend among suppliers that have strong environmental expertise. Our empirical findings show that, contrary to the conventional viewpoint, firms do not seek external assistance to address their own environmental concerns. We ground our arguments in agency theory and posit that shareholders put pressure on firms with greater environmental concerns to develop internal capabilities instead of leveraging external resources (Godfrey 2005).

Theoretical Implications

Our study makes several contributions to the environmental management and buyer–supplier literature. First, our study fills an important gap in the literature by demonstrating that buying firms value a supplier's environmental expertise as a means to address their internal environmental management limitations. In particular, our study theorizes on how allocating a greater proportion of procurement spend to suppliers that have environmental expertise lowers a buyer firm's uncertainty associated with accessing the supplier's environmental capabilities. Next, our study contributes to the literature by broadening our understanding of how the transaction cost perspective can be applied to study a firm's motivation to source environmental expertise externally as opposed to developing it internally. Our study adds to the literature by advancing theory on the conditions under which firms prefer to engage more with suppliers that have strong environmental expertise. Finally, our study provides new theoretical insights into

how agency theory can be used to examine how executive compensation can incentivize a firm to develop environmental expertise internally.

Managerial Implications

Our study offers a number of managerial implications. First and foremost, our results indicate that buyer firms recognize the importance of outside knowledge in the environmental domain. The ability to provide external environmental knowledge over the long-term to buyer firms can, thus, be a major source of competitive advantage for supplier firms. Indeed, our statistical results indicate that, all else equal, a supplier whose environmental expertise is one standard deviation above the mean will increase its procurement spend allocation by about 0.4% of the buyer's cost of goods sold (COGS). Given that the mean share of buyers' COGS allocated to individual suppliers is 0.86%, this corresponds to a 47% increase in business volume for the supplier in an average dyadic relationship. Hence, suppliers have a strong economic incentive to continue to make investments into their environmental capabilities. Moreover, our results point to the need for suppliers to promote their environmental expertise and leverage the same in their negotiations with customers.

Our findings, which are related to the role of a buyer's profitability and absorptive capacity, have important managerial implications as well. Suppliers that have strong environmental capabilities are advised to target their marketing efforts toward buyers with stronger financial resources. In fact, our empirical findings indicate that, for the average supplier in the average buyer-supplier relationship, the effect of greater supplier environmental expertise on the buyer's procurement spend increases from +47% to +72% when the buyer's ROA is one standard deviation above the mean. Similarly, our results suggest that the effect of supplier environmental expertise on the amount of business awarded by a buying firm increases with the

buyer's absorptive capacity. This is presumably due the buyer's greater ability to integrate knowledge from environmentally competent suppliers and, thus, capitalize on the latter's environmental expertise. As such, supplier firms are well advised to actively promote their environmental expertise when engaging buyers that are known to continually survey the market for new insights and knowledge and have a superior ability to effectively leverage the same.

Conversely, we find that a supplier's environmental expertise will have a lesser effect on a buyer's procurement spend allocations when the pay of buying firm executives is tied to ESG goals or when the buyer faces greater perceived environmental concerns. In such instances, buying firms may tend to internalize the development of environmental expertise such that the latter is not a strong selling point for suppliers. Collectively, these findings highlight the need for suppliers to customizing their communications with customers and even consider targeting those (prospective) buyers for whom external environmental expertise constitutes a particularly valuable resource.

Limitations and Future Research

As with any research, our study has limitations that offer opportunities for future research. Our study is couched within the transaction costs economics perspective. As such, we theorize and develop hypotheses regarding the buyer's decision to obtain environmental expertise from its suppliers ("buy") versus developing such expertise internally ("make"). However, it is likely that supplier environmental expertise affects not only a buyer firm's "make-or-buy" decision but may also play a role in the initial supplier selection process, determining spend allocation across competing suppliers, etc. Future research could extend our study to these domains and investigate the effects of supplier environmental expertise on a buyer's broader sourcing strategy.

Moreover, there are limitations inherent to our identification of buyer–supplier relationships. Our study identified buyer–supplier relationships using the Bloomberg SPLC database. While prior research studies have demonstrated the utility of the Bloomberg data to document significant buyer–supplier relationships, we are unable to identify *all* suppliers that a buyer firm conducts business with. Thus, it is plausible that a supplier with some environmental capabilities might not be captured in our data. Future research might acquire data sources that can provide a more comprehensive view of these relationships or, perhaps, leverage alternative methodologies such as case studies to further refine our understanding of the role of suppliers’ environmental expertise in shaping buyer–supplier relationships. We followed previous research to demonstrate a causal relationship in our model by incorporating a one-year lag effect between the key independent variable of our baseline relationship (supplier’s environmental expertise) and the dependent variable (buyer’s procurement spend). Future research might employ instrumental variable techniques and longer time series to further address potential causal concerns. In particular, future studies can potentially employ firm-level measure of environmental performance (e.g., firm’s emissions relative to specific industry segment) as one of the potential instrumental variables. The idea of employing firm’s environmental performance as an instrumental variable is that more polluting and less polluting firms are more likely to engage differently in sourcing from suppliers that have strong environmental expertise.

In terms of measurement, this study relied on environmental patent data to operationalize environmental expertise. While it is common in the strategy literature to use patent data to test theory concerning interorganizational knowledge sharing (Alcacer and Oxley 2014), future research could explore additional or alternative means to evaluate a supplier’s environmental expertise because it is conceivable that some firms may decide to not patent their environmental

capabilities. Likewise, our measure of absorptive capacity, while consistent with prior research, is somewhat generic. As such, future research could consider alternative measures of absorptive capacity that are targeted directly toward environmental management activities. Finally, there may be other supplier-specific factors such as cost advantages and product or service quality that are difficult to observe and measure but may affect a buyer's procurement spend allocations. To the extent possible, incorporating such variables in the empirical analysis is recommended for future research.

Conclusion

The purpose of our study is to investigate how a supplier's environmental expertise has an impact on a buying firm's procurement spend with its suppliers. Drawing upon TCE and agency theory, the current study provides new insights into understanding why and under what conditions buyer firms increase their overall procurement spend with suppliers that have strong environmental expertise. We hope that our study will stimulate further research on the role of environmental expertise on the nature, longevity, and performance of buyer-supplier relationships.

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Figures and Tables

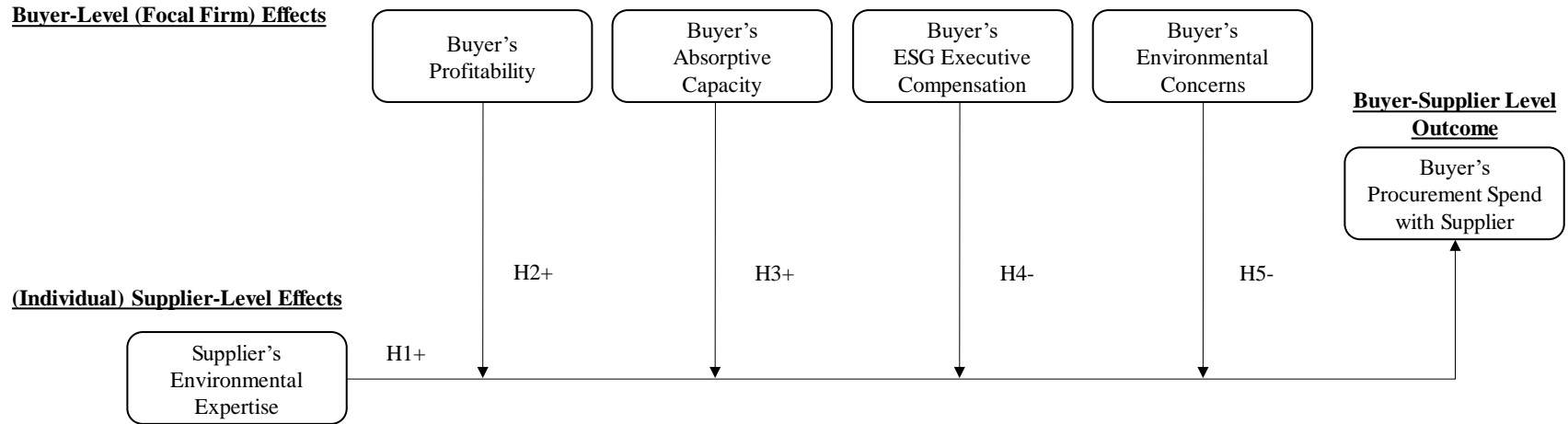


Figure 3.1: A Multilevel Model of Supplier's Environmental Expertise and Buyer's Procurement Spend

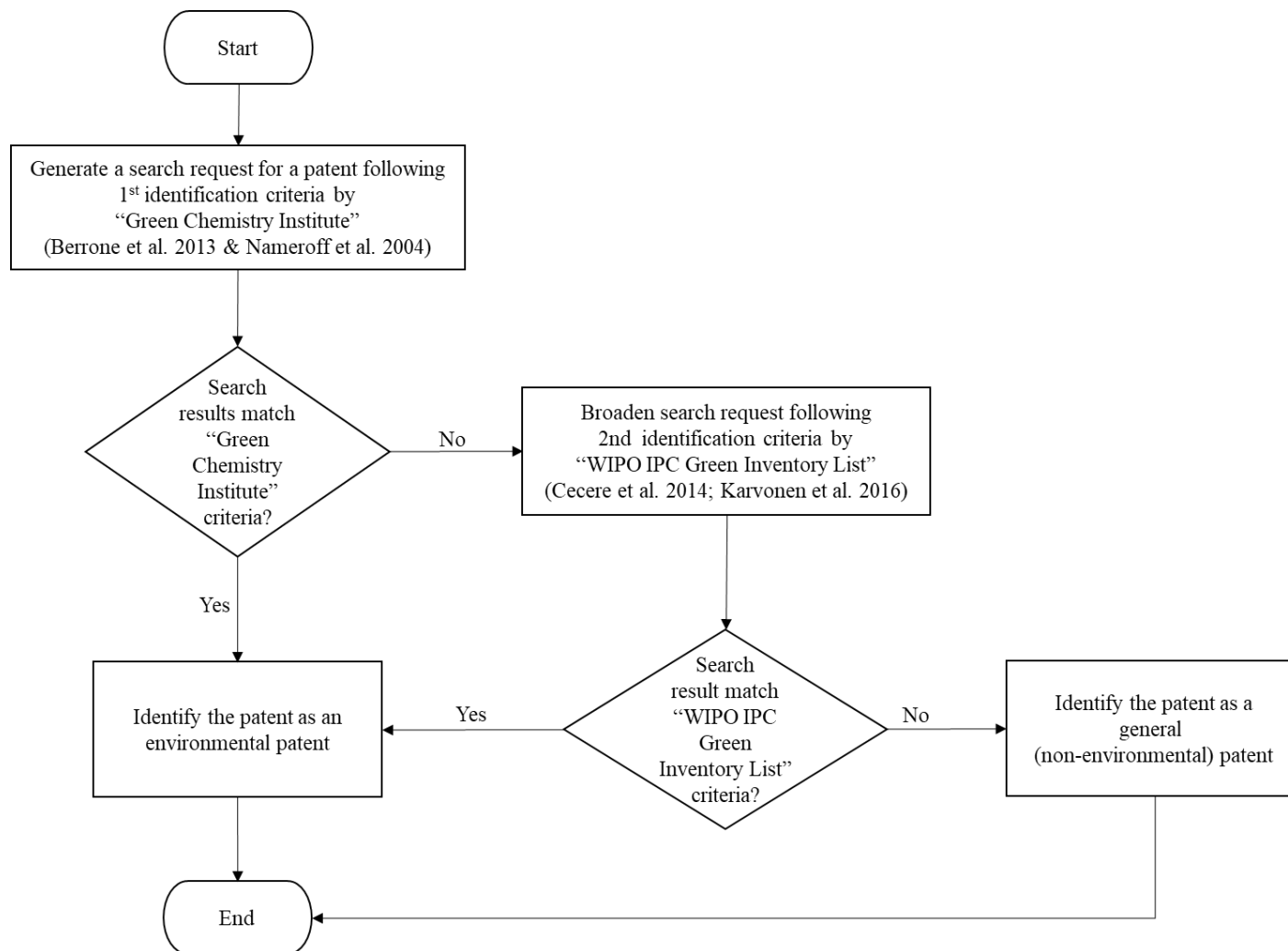


Figure 3.2: Identification of Environmental Patents

Table 3.1: Descriptive Statistics and Correlations (n=4,778)

Variables	Mean	S.D.	Min	Max	1	2	3	4	5	6	7	8	9	10
1 Buyer's Procurement Spend with Supplier	0.86	3.13	0.00	71.56										
2 Supplier's Environmental Expertise	8.17	29.99	0.00	325.00	0.19**									
3 Buyer's Environmental Expertise	18.71	37.91	0.00	325.00	-0.05**	0.01								
4 Buyer's Profitability	0.05	0.12	-4.47	0.55	-0.07**	-0.04**	-0.02†							
5 Buyer's Absorptive Capacity	0.07	0.20	0.00	12.28	0.12**	0.03**	-0.03*	-0.35**						
6 Buyer's ESG Executive Compensation	0.17	0.37	0.00	1.00	-0.07**	-0.05**	-0.02†	0.07**	-0.02*					
7 Buyer's Environmental Concerns	0.66	1.20	0.00	5.00	-0.11**	-0.10**	0.04**	0.05**	-0.10**	0.20**				
8 Buyer's Net Income	4.86	7.83	-5.54	41.06	-0.10**	-0.03*	0.08**	0.21**	-0.08**	0.30**	0.25**			
9 Buyer's Total Assets	75.09	101.51	0.002	408.29	-0.12**	-0.03**	0.46**	0.04**	-0.09**	0.22**	0.11**	0.68**		
10 Buyer's Number of Suppliers	77.51	68.57	1.00	242.00	-0.18**	-0.07**	0.26**	0.11**	-0.13**	0.04**	0.32**	0.37**	0.43**	
11 Supplier's Number of Customers	9.70	9.73	1.00	49.00	0.27**	0.15**	-0.08**	-0.04**	0.08**	-0.07**	-0.10**	-0.13**	-0.13**	-0.24**

Notes: † $p < .10$; * $p < .05$; ** $p < .01$

Table 3.2: Estimation Results (Multilevel Models)

DV= Buyer's procurement spend with supplier

	Model 1	Model 2
Supplier's Environmental Expertise	0.0133** (0.001)	0.0054* (0.002)
Buyer's Environmental Expertise	0.0036 (0.007)	0.0034 (0.007)
Buyer's Profitability	-0.3175 (0.661)	-0.3155 (0.662)
Buyer's Absorptive Capacity	0.3652 (0.363)	0.3638 (0.363)
Buyer's ESG Executive Compensation	-0.6209 (0.8722)	-0.6216 (0.875)
Buyer's Environmental Concerns	-0.2898 (0.336)	-0.2907 (0.337)
Buyer's Net Income	0.0041 (0.102)	0.0041 (0.102)
Buyer's Total Assets	-0.0052 (0.008)	-0.0052 (0.008)
Buyer's Number of Suppliers	-0.0083 (0.008)	-0.0083 (0.008)
Supplier's Number of Customers	0.0572** (0.004)	0.0567** (0.004)
Buyer's Profitability		0.0499**
X Supplier's Environmental Expertise		(0.015)
Buyer's Absorptive Capacity		0.1011**
X Supplier's Environmental Expertise		(0.014)
Buyer's ESG Executive Compensation		-0.0149**
X Supplier's Environmental Expertise		(0.004)
Buyer's Environmental Concerns		-0.0086**
X Supplier's Environmental Expertise		(0.002)
Constant	0.4247 (0.706)	0.4255 (0.708)
Industry fixed effects	Yes	Yes
-2 Log Likelihood	23336.5	23301.0
χ^2 Statistics	710.43	729.63
Prob > χ^2	<.01	<.01

Notes: † $p < .10$; * $p < .05$; ** $p < .01$

Table 3.3: Robustness Checks (Multilevel Models)

<i>DV= Buyer's procurement spend with supplier</i>	With Heckman correction		With Heckman correction and alt. measure of env. expertise	
	Model 3	Model 4	Model 5	Model 6
Supplier's Environmental Expertise	0.0138** (0.001)	0.0055** (0.002)	0.0007** (0.0001)	0.0004** (0.0001)
Buyer's Environmental Expertise	0.0034 (0.007)	0.0032 (0.007)	0.00002 (0.0002)	-0.0001 (0.0002)
Buyer's Profitability	-0.7940 (0.665)	-0.8509 (0.666)	-0.7686 (0.662)	-0.8609 (0.668)
Buyer's Absorptive Capacity	0.5325 (0.362)	0.5518 (0.362)	0.5231 (0.363)	0.5533 (0.363)
Buyer's ESG Executive Compensation	-0.9631 (0.866)	-1.0062 (0.869)	-0.9589 (0.876)	-1.0302 (0.884)
Buyer's Environmental Concerns	-0.4088 (0.339)	-0.4249 (0.335)	-0.4057 (0.339)	-0.4343 (0.342)
Buyer's Net Income	0.0112 (0.101)	0.0121 (0.101)	0.0050 (0.101)	0.0073 (0.102)
Buyer's Total Assets	-0.0070 (0.008)	-0.0072 (0.008)	-0.0063 (0.0007)	-0.0068 (0.008)
Buyer's Number of Suppliers	-0.0176* (0.008)	-0.0182* (0.008)	-0.0170† (0.008)	-0.0189* (0.009)
Supplier's Number of Customers	0.0088 (0.012)	0.0023 (0.012)	0.0030 (0.012)	-0.0085 (0.012)
Buyer's Profitability		0.0506** (0.015)		0.0022** (0.000)
X Supplier's Environmental Expertise				
Buyer's Absorptive Capacity		0.1034** (0.014)		0.0046** (0.000)
X Supplier's Environmental Expertise				
Buyer's ESG Executive Compensation		-0.0154** (0.004)		-0.0006** (0.000)
X Supplier's Environmental Expertise				
Buyer's Environmental Concerns		-0.0093** (0.002)		-0.0003** (0.000)
X Supplier's Environmental Expertise				
Inverse Mills Ratio (λ)	-1.6933** (0.4156)	-1.9036** (0.4144)	-1.6371** (0.407)	-1.9812** (0.402)
Constant	2.8504** (0.917)	3.1528** (0.918)	2.7859 (0.914)	3.2795 (0.914)
Industry fixed effects	Yes	Yes	Yes	Yes
-2 Log Likelihood	23319.9	23279.9	23122.7	22993.6
χ^2 Statistics	617.77	634.91	677.93	730.15
Prob > χ^2	<.01	<.01	<.01	<.01

Notes: † $p < .10$; * $p < .05$; ** $p < .01$

CHAPTER 4. AN EXAMINATION OF THE EFFECT OF ENVIRONMENTAL SOURCING PRACTICES ON CONSUMER PERCEPTIONS OF PRODUCT QUALITY AND CONSUMER WILLINGNESS TO PAY FOR ENVIRONMENTALLY-FRIENDLY PRODUCTS.

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Abstract

Firms often make a mistake by viewing that their environmental sourcing practices would not affect consumers. The study takes a business-to-consumer (BTC) perspective and seeks to understand how consumers can become affected by a firm's environmentally-irresponsible sourcing practices. Drawing upon cue utilization and signaling theories, this study develops a theoretical framework that describes how consumers process information in evaluating product quality based on a firm's environmental strategy. The study also sheds important insight into understanding of a firm's corrective actions that could dampen the effect of environmentally-irresponsible sourcing practices on consumer judgments of product quality. A series of three vignette-based experiments was performed to test the study's hypotheses.

Introduction

Firms recognize the need to attend to environmentally responsible practices across the entire supply chain because of the negative consequences of failing to do so (Jira and Toffel 2013). Many firms are often exposed to negative media coverage if the firm or its supply chain partners are involved in environmental wrongdoing. We define environmental wrongdoing as a situation where the firm was engaged in poor environmental practices such as polluting the natural environment (Du 2015; Simon 2000). For example, the *Wall Street Journal* published a report alleging that suppliers to Pfizer Corporation were dumping toxic waste into the

environment (WSJ 2018). The report further stated that water samples near the suppliers' factories were found to be contaminated with metals and industrial solvents. Similarly, the media accused Ben & Jerry's Corporation of sourcing milk from suppliers who violated their environmental code of conduct; further, the company's products were subsequently found to be contaminated with herbicides (Bloomberg 2018). These anecdotal examples illustrate that consumers might take into account information about a firm's supply chain environmental wrongdoings when making purchasing decisions. Therefore, the focus of this study is to theorize on the effect of a firm's environmentally irresponsible sourcing practices on perceptions of product quality and purchasing intentions. We also theorize on how a firm's subsequent corrective actions might alter a consumer's product evaluations and purchasing behavior.

A steady stream of literature has examined the factors that influence firms to adopt sound environmental sourcing practices. For example, studies have suggested that stakeholder pressure, e.g., regulatory, investors, and consumer pressures can positively influence a firm's environmental sourcing practices (Carter and Carter 1998; Carter et al. 2000; Sarkis et al. 2009). Similarly, scholars have used institutional theory to examine factors that motivate firms to adopt environmental sourcing practices. For instance, Hsu et al. (2014) theorized about the influence of a firm's headquarters (institutional effects) on the adoption of responsible sourcing practices by its subsidiaries. In a similar vein, Delmas and Toffel (2004) and Schoenherr et al. (2014) suggest that institutional norms, i.e., norms set by government regulations, industry associations, and industry leaders, can positively influence a firm's environmental sourcing practices. Another perspective provided by Kumar et al. (2012) suggests that firms are sometimes motivated to pursue environmental sourcing practices to achieve cost savings and enhance financial performance.

In the consumer domain, while studies have found that consumers exert pressure on a firm to pursue environmental sourcing practices, prior research, to the best of our knowledge, has not investigated how a supplier's sourcing and manufacturing strategies have an impact on perceptions of product quality and purchase intentions (Carter and Carter 1998; Carter and Jennings 2004; Gualandris and Kalchschmidt 2014). Scholars have also begun to investigate how irresponsible supplier behavior has an impact on consumer satisfaction with the focal firm's sourcing practices. For example, Bregman et al. (2015) investigated how a consumer's ethical judgments are influenced by controversial sourcing practices. Likewise, Hartmann and Moeller (2014) describe that consumers hold companies responsible when their suppliers commit environmental violations. While the above-mentioned studies represent important contributions to the literature, there remains an opportunity to examine how a firm's environmentally irresponsible sourcing practices may have an impact on consumer evaluations of products and their subsequent purchasing intentions.

Because prior research has not directly investigated how a firm's sourcing practices influence consumer judgments of its products, our study seeks to fill this void in the literature. We draw on cue utilization theory to examine how consumers evaluate product quality after learning of environmentally irresponsible sourcing practices. This study, then, theorizes and empirically examines how consumer perceptions can be managed through the use of a firm's corrective actions to minimize the impact of negative effects (suppliers' environmental wrongdoings) on consumer perceptions of product quality and purchasing intentions. In so doing, we leverage signaling theory to develop our theoretical arguments examining how a firm's corrective actions can improve a consumer's evaluation of product quality. Studying the correction actions strategy is important because it provides us with an improved understanding

on how consumers could differentiate between an effective and ineffective response by the focal firm. Therefore, we seek to investigate the following research questions: Are consumer perceptions of product quality affected by a firm's environmentally irresponsible sourcing practices, suppliers' manufacturing location, or use of environmentally compliant materials? Does a firm's corrective actions strategy dampen the effect of suppliers' environmental wrongdoings on consumer perceptions of product quality? We test our theoretical model using three vignette-based experiments.

This study makes multiple contributions to the environmental management and supply chain literature. This is also the first study, to the best of our knowledge, that theorizes and empirically examines how environmental factors in the supply chain influence perceptions of product quality from a consumer perspective. In particular, it is also the first study that develops new theoretical insights into the importance of environmental sourcing practices to consumers' product quality judgments. In so doing, this study adds to the cue utilization and signaling theory literature by showing how consumers develop perceptions of product quality and purchase intentions based on a firm's sourcing practices. Because firms may need to adopt a proactive strategy for minimizing the impact of a supplier's environmental wrongdoing, this study provides empirical insight into to how consumers respond to a firm's corrective actions. Finally, our study adds to the literature by extending the recent works of Bregman et al. (2015) and Hartmann and Moeller (2014). Figure 4.1 presents our conceptual framework.

In the remainder of this paper, we develop the theoretical arguments in detail, describe the research methodology, present the empirical results, discussions, and conclude.

Theoretical Foundation

Cue Utilization Theory

Cue utilization theory is the theoretical foundation of this study. This perspective suggests that individuals do not possess perfect information when evaluating the quality of an entity; rather, they rely on surrogate (proxy) information or “cues” to develop perceptions about an entity’s quality (Cox 1962; Oslon and Jacoby 1972; Rihcardson et al. 1994). According to this theory, individuals use an array of cues such as subjective feelings and impressions to build perceptions of product quality (Bahadir et al. 2015; Cox 1962; Oslon and Jacoby 1972; Rihcardson et al. 1994). Cue utilization theory is based on two types of cues: intrinsic and extrinsic (Miyazaki et al. 2005; Richardson et al. 1994). Intrinsic cues are defined as the physical properties of a product such as color, odor, taste, and materials. Intrinsic cues cannot be modified without altering the physical characteristic of a product. In contrast, extrinsic cues are defined as the nonphysical properties of a product. These cues can be manipulated without altering a product such as through price, brand name, warranty, etc. (Richardson et al. 1994).

Scholars have used cue utilization theory to investigate how consumers evaluate product quality (Miyazaki et al. 2005). The most commonly studied extrinsic cues are price, brand name, warranty, and country of origin. For example, Boulding and Kirmani (1993) and Teas and Agarwal (2000) provide empirical evidence of the positive association of product warranty and country-of-origin on perceptions of product quality. Similarly, higher price and stronger brand name are also linked with favorable perceptions of product quality (Brucks et al. 2000; Dawar and Parker 1994; Dodds et al. 1991). These studies provide a common understanding of how consumers use cues to build their impression of product quality by suggesting that it is difficult

for consumers to assess product quality objectively. To do so, one may require specialized equipment or technical skills. Because the implication is that consumers do not generally possess adequate skills to assess product quality objectively, consumers tend to rate products subjectively based on a variety of cues. We also take the view that consumers do not rely on a single cue to evaluate product quality. Instead, consumers tend to simultaneously consider both extrinsic and intrinsic cues (Miyazaki et al. 2005). Therefore, we combine both types of cues into our theoretical framework.

The four types of extrinsic and intrinsic cues used in this study are 1) firm's environmental sourcing practices, 2) supplier's location, 3) eco-material compliance, and 4) environmental risk type. Types 1, 2, and 4 are extrinsic cues, as none of these attributes depict physical part characteristics, such as odor, smell, materials, etc. Type 3, environmentally compliant material, is an intrinsic cue because it is an integral part of the physical product.

Signaling Theory

We enhance our theoretical model by integrating signaling theory into this study. Signaling theory serves as an important foundation for the development of an understanding of how firms attempt to differentiate themselves from other firms (Connelly et al. 2011; Hofer et al. 2012; Spence 1973). The key elements of signaling theory used in this study are signalers (e.g., firm), signals, recipients (external to the firm), and feedback (Connelly et al. 2011). At its core, the theory assumes that information asymmetry exists between two transacting parties: the signalers (e.g., firm) and external parties (e.g., consumers) (Connelly et al. 2011; Kirmani and Rao 2000; Spence 1973). An information asymmetry problem occurs when external parties are unaware of what is happening inside a firm because they do not possess the same information as insiders (e.g., a firm's employees) (Connelly et al. 2011; Spence 1973). This, in turn, leads

external parties to speculate about their intent to engage in transactions with a firm. In essence, such an information asymmetry problem may place external parties at risk of withdrawing from an expected transaction (e.g., a consumer's withdrawal from buying a firm's products).

According to signaling theory, firms seek to resolve this problem by sending signals that enhance a firm's credibility, thus increasing the likelihood of transactions between a firm and external parties (Kirmani and Rao 2000; Spence 1973). Firms often send multiple signals to convey valuable information to external parties. For instance, firms use signals such as warranties to convey product quality (Boulding and Kirmani 1993; Purohit and Srivastava 2001), price-cut announcements to communicate competitive responses (Prabhu and Stewart 2001), and product return leniency to convey the unobservable quality of products (Rao et al. 2018).

Signaling theory has been used to examine several supply chain research questions. For example, Jiang et al. (2007) investigated how an outsourcing decision may send a positive signal to the stock market by demonstrating a firm's ability to lower transaction costs. Wagner et al. (2011) employed signaling theory to examine how buyers can use a supplier's reputation as a signal to continue or terminate the exchange relationship. Jacobs (2014) noted that an ability to reduce carbon emissions could signal a firm's concerns for the environment, which, in turn, has a positive impact on financial performance and shareholder value. Interestingly, only a few studies within the supply chain management literature have employed signaling theory to investigate how consumers respond to supply chain issues. For example, Dadzie and Winston (2006) examined how merchandise shortage has a negative impact on consumer evaluations of online transactional experience and merchandizer reputation. A significant number of studies from the marketing literature highlight the utility of signaling theory to examine consumer reactions to a firm's signals (Akdeniz and Talay 2013; Boulding and Kirmani 1993; Rao et al. 1999). In this

study, we use signaling theory to theorize about how a firm's corrective actions can have an impact on consumer perceptions of product quality.

Although both signaling and cue utilization theories have similarities, they differ in two important ways. First, the central tenet of signaling theory concerns the problem of information asymmetry between two parties, whereas cue utilization theory doesn't consider information asymmetry issues. In this sense, signaling theory enables us to examine theoretical relationships pertaining to a firm's undertaking corrective actions directed toward reducing information asymmetry between the firm and the consumer. Second, and more importantly, the greatest difference between cue utilization and signaling theory lies in the prescriptive standpoint with respect to the direction of information flow. In signaling theory, information can flow bi-directionally, i.e., one-party (e.g., firm as sender) decides whether and how to correspond with the other party (e.g., individual as recipient), and the other party can decide whether and how to communicate back to the sender about signal interpretation (Connelly et al. 2011). Thus, signaling theory offers suggestions on how both parties can communicate effectively. In contrast, cue utilization theory suggests that information is sent unidirectionally, with only one party receiving the information, i.e., recipients (e.g., consumers). This helps us to effectively isolate some of the factors that could influence a consumer's perceptions of product quality. Therefore, the combined use of these two theories makes it possible to investigate how consumers attend to cues (based on surrogate information at one's disposal) and signals (explicitly communicated by a firm) to evaluate product quality. Table 4.1 highlights the key elements of both theories, while Table 4.2 depicts how two theories are used to provide insight into the factors examined in this study.

Hypotheses

Impact of a firm's environmentally-irresponsible sourcing practices on perceptions of product quality

Drawing on cue utilization theory, our first hypothesis relates to how a firm's environmentally irresponsible sourcing practices have an impact on consumers' perceptions of product quality. An environmentally irresponsible sourcing practice is considered an extrinsic cue because this situation is not related to a product characteristic (e.g., color, shape, materials, weight). As noted earlier, the term "environmentally irresponsible sourcing practices" refers to suppliers who engage in environmental wrongdoing. Clearly, a buyer firm does not deliberately source from suppliers who are involved in environmental wrongdoings. Rather, it is common for buyer firms to re-evaluate their network of suppliers and switch to an alternative supplier who offers competitive pricing and higher-quality components. Thus, this "churn" in the supply base could result in a buyer firm unknowingly switching to suppliers who violate environmental compliance rules and regulations.

Thus, there are several reasons why a buyer firm may unintentionally conduct business with environmentally irresponsible suppliers. For example, the firm might be under pressure to source from low-cost suppliers (Wagner and Friedl 2007; Wathne et al. 2001). Other reasons might be the formation of new relationships when a firm terminates an unproductive supplier relationship (Gulati et al. 2000) or when the supplier may no longer satisfy a buyer firm's conventional-performance needs (such as cost, quality, technical capabilities, flexibility, delivery, etc.) (Friedl and Wagner 2012; Koufteros et al. 2012; Narasimhan et al. 2001). There might be a change in a firm's leadership team, which in turn could result in changes to their network of supplier relationships (Cao et al. 2006). In fact, we should emphasize that a typical

firm's entire supplier network tends to undergo an evolutionary process in which new suppliers constantly take the place of existing suppliers in the focal firm's network (Baum et al. 2010; Choi et al. 2001). We will thus investigate how consumers react when they learn about a firm's change in supplier base that results in accusations of supplier environmental wrongdoing.

A firm's switch to suppliers who engage in environmental wrongdoing can generate negative media attention. In many cases, the media plays an influential role in publicizing involvement of a focal firm in such wrongdoing (Zavyalova et al. 2017). For example, one of the world's largest toy manufacturing company, Mattel, was accused of sourcing lead-tainted toys from its most trusted first-tier supplier who, without Mattel's knowledge, had turned to cheaper paint suppliers (*New York Times* 2007). Other examples include Pfizer and Novartis AG, who were reported to have sourced ingredients for drugs from low-cost suppliers who violated environmental standards. We contend that such media narratives can be important extrinsic cues for consumers for evaluating a focal firm's products. Following these theoretical arguments, we specifically focus on how consumers interpret extrinsic cues when they learn about suppliers' environmental wrongdoings.

Drawing upon cue utilization theory, we now introduce three theoretical reasons about how consumers obtain extrinsic cues from suppliers' environmental wrongdoings when evaluating product quality. First, we propose that the supplier's environmental wrongdoings may arise due to "spillover effects." We define "spillover effects" as an unintended impact produced by one entity to another entity (Kang 2008; Simonin and Ruth 1998). In the broader sense, the spillover effects are initiated when consumers first learn of a supplier's environmental wrongdoing. These spillover effects influence a consumer's assessment of the focal firm's products (Balachander and Ghose 2003). We build our assertion of negative spillover effects by

suggesting that a consumer's impression of supply chain environmental practices may be intertwined with the broader impression of a firm's products. We believe that suppliers' environmental wrongdoing such as generating pollution and hazardous/toxic waste could result in suspicion that the final products themselves may contain hazardous substances. As such, consumers may develop concerns about the quality of components that reside inside the final product. Therefore, this information may adversely affect consumer attitudes related to product quality.

Second, consumers may develop a negative image of a focal firm when its suppliers are involved in environmental wrongdoing. Corporations are perceived to have human-like images (e.g., ethical, responsible, respectful, selfish, etc.) (Spector 1961; Gürhan-Canli and Batra 2004). Simonin and Ruth (1998) also showed that a firm's corporate image is impacted by its network. For instance, Bendixen and Abratt (2007) showed that a corporation's relationship with unethical suppliers might have an adverse impact on its corporate image. Drawing from cue utilization theory, we posit that consumers may develop a negative image of a focal firm when they learn about its business transactions with environmentally irresponsible suppliers. The key premise of this theoretical stance is that consumers tend to use peripheral cues such as a firm's image to evaluate product quality (Richardson et al. 1994). We contend that consumers are more likely to evaluate product quality unfavorably in an attempt to justify their impression of a firm's negative image when they learn of its sourcing relationships with environmentally irresponsible suppliers.

Finally, consumers develop emotional reactions when appraising a product. We assert that suppliers' environmental wrongdoing might evoke negative emotions and anger. It has been argued that individuals tend to have more fluctuations in their appraisal tendencies under certain emotional conditions (e.g., anger). For example, using an appraisal-tendency framework (ATF),

Han et al. (2007) theorized that specific emotions (such as anger) exert strong effects on product appraisal tendencies. Consistent with the preceding theoretical arguments, Porath et al. (2010) empirically tested the idea that anger can cause consumers to make rapid and negative generalizations about related entities. Taken together, we contend that, if a firm unintentionally switches its sourcing relationships from “environmentally friendly” to “environmentally irresponsible” suppliers, consumers may use this cue to evaluate products to be of lower quality. Therefore, we hypothesize:

H1: *Consumers are more likely to perceive negative perceptions of product quality when a firm unintentionally switches to suppliers that engage in environmental wrongdoings.*

Impact of supplier location on perceptions of product quality

We now turn to examining how supplier location may have an impact on perceived product quality. In this study, we define supplier location as the geographic location of the supplier’s headquarters. We suggest that supplier location is an extrinsic cue because the location of a firm is not a characteristic that is related to a product’s physical characteristic. We believe that supplier location can affect consumer perceptions of product quality for several reasons. Previous studies have suggested that consumers associate a product’s originating point (e.g., country-of-origin) with product quality (Batra et al. 1998; Gürhan-Canli and Maheswaran 2000; Johansson et al. 1985; Maheswaran 1994). For example, a country may have a comparative advantage in terms of competency of its labor pool. Several studies point out that products featuring Japan as their country-of-origin receive favorable evaluation in terms of product quality (Gürhan-Canli and Maheswaran 2000; Schonberger 2007). Similarly, Kumar and Kopitzke (2008) documented that firms relying on labor pools of overseas suppliers may convey an

impression that lower-skilled workers were used in manufacturing their product. Thus, consumers may form a bias about product quality based on the supplier location. As such, a supplier location (the United States versus low-cost overseas country) may therefore provide an important cue about overall product quality.

Next, we suggest that consumers can easily establish deeper emotional connections with firms that source from local communities (Guliz 1999). In a broader sense, a focal firm may demonstrate its sensitivity to the needs of the local community when it allocates more business to local suppliers. Likewise, this logic implies that it could be difficult for a firm that sources from overseas suppliers to establish deeper cognitive and emotional connections with its consumers. We therefore assert that the location of the supplier's facilities can influence consumers' emotional connection to the focal firm's products (Kumar et al. 2009; Verlegh and Steenkamp 1999).

Finally, we believe that low-cost global sourcing is an unpopular strategy that can have an impact on a consumer's product quality ratings. When a firm increasingly acquires components or raw materials from low-cost international sources to achieve economic advantages (Kroes and Ghosh 2010), the firm typically overlooks the environmental and social conditions that are present at those locations. In response to consumer concerns about unfavorable working conditions at a supplier's facilities, the media frequently publicizes controversial sourcing practices of overseas suppliers, e.g., low wages, child-labor exploitation, poor working conditions, environmental violations (Guo et al. 2016). As such, consumers may become skeptical of the focal firm when it becomes known that a firm uses overseas suppliers. Taken together, this suggests that consumers may react unfavorably toward the use of overseas suppliers when evaluating product quality.

H2: *Consumers are more likely to perceive lower product quality when they learn that a focal firm is sourcing from overseas suppliers as compared with local suppliers.*

Impact of environmentally non-compliant materials on perceptions of product quality

We now present theoretical arguments as to how the use of environmentally compliant materials can affect perceptions of product quality. We define “environmentally non-compliant materials” as materials that do not meet environmental standards or environmental quality benchmarks. “Environmentally non-compliant materials” are classified as an intrinsic cue because product materials are an integral part of the physical product. Intrinsic cues provide valuable information to consumers (Richardson et al. 1994). In fact, prior studies show that, while intrinsic cues are more informative (e.g., shape, density, hardness, etc.) than extrinsic cues, they require a greater amount of cognitive effort and expertise to process (Bahadir et al. 2015; Szybillo and Jacoby 1974). Building upon cue utilization theory, when consumers process cues about environmentally non-compliant materials, they form an overall image of the product, including its association with hazardous or toxic substances (e.g., lead, mercury, etc.). This perception influences consumers toward having a negative impression of product quality.

We also draw upon signaling theory to illustrate the link between the use of environmentally non-compliant materials and perceptions of product quality. We contend that consumers generally do not have extensive technical knowledge about how a product is manufactured; for the most part, consumers are not aware of what materials or components reside inside a certain product (Diallo and Seck 2018; Richardson et al. 1994). In contrast, a manufacturer (focal firm) holds relevant know-how that enables a company to build environmentally friendly products. This results in information asymmetry between the consumer

and the manufacturer (Connelly et al. 2011; Spence 1973). As such, consumers may find it difficult to trust a product unless they are provided with additional information on how it was made. Eco-friendly material compliance, as conducted by third-party auditors, can be a valuable source of trust. For instance, products that comply with third-party ENERGY STAR certification requirements serve as a signal that the product meets specific, perhaps strict, energy-efficiency specifications set by the U.S Environmental Protection Agency (EPA). We posit that such signals (e.g., ENERGY STAR) can enhance a consumer's trust in buying the focal firm's products. As such, environmentally non-compliant materials will likely influence consumers to perceive lower product quality. We thus propose the following hypothesis:

H3: Consumers are more likely to perceive lower product quality when they learn that a focal firm uses materials that are environmentally non-compliant as compared with compliant.

Impact of environmental risk type on perceptions of product quality

We now examine the relationship between environmental risk type and a consumer's perception of product quality. As noted previously, environmental risk is an extrinsic cue because it is not part of the physical product. We define "environmental risk" as the degree to which consumers perceive that a supplier's environmental violations pose a threat to human health (Kraft 2017). We focus on environmental risk type because it is a salient attribute for consumers. For instance, a supplier's use of herbicides, such as glyphosate to kill weeds before crop planting poses serious food supply chain risks to public health (Myers et al. 2016). Following this logic, we contend that consumer perception of environmental risk is a central element in an individual's purchasing behavior (Dowling and Staelin 1994; Thompson and Coskuner-Balli 2007). In this context, we draw upon the cue utilization literature to theorize on

how higher perceptions of environmental risk may result in consumers' negative evaluations of product quality and purchasing intentions.

We propose that consumers are likely to feel more uncertain about their own health should they learn that a focal firm's suppliers are involved in serious environmental violations. Previous research has consistently shown that a higher level of uncertainty about product value hinders consumer buying decisions (Bettman et al. 1998; Simonson and Drolet 2004). As such, consumers tend to either postpone their purchase decision or employ strategies that reduce their uncertainty level (Kim and Krishnan 2015; Shimp and Bearden 1982). For example, consumers can actively seek more information about a product when the initial cue represents higher uncertainty about its value (Chaudhuri 2000). Given that consumers increasingly have easy access to online search engines (e.g., Google), they can readily obtain information, e.g., health risks associated with herbicides, about a product's environmental risk. Active information search may also include recalling the information cues stored in personal memory or using relevant prior personal experiences in similar situations (Conchar et al. 2004). Consumers can process such cues to make interpretations as to whether or not the potential environmental wrongdoing that occurs in the supply chain poses a threat with respect to their health. As such, consumers may feel more uncertainty about product quality when the risk level is higher because of a supplier's serious environmental wrongdoing. Based on this logic, we present the following hypothesis:

- H4: *Consumers are more likely to give negative evaluations on product quality when a supplier's environmental violations pose a higher risk to the environment as compared with a lower level of risk to the environment.*

Voluntary product recall as a corrective signal for product quality

We now turn to theorizing about how a firm can respond to the effect of supplier environmental wrongdoings on consumer perceptions of product quality. Drawing upon signaling theory, we investigate how a voluntary product recall (e.g., corrective action) can influence a consumer's perception of product quality. Firms use product recalls to withdraw unsafe products from the market (Ni and Huang 2018; Steven and Britto 2016). Prior literature has suggested that firms can follow two strategies in responding to product safety issues: proactive (e.g., voluntary recall) and passive (e.g., denying or delaying a product recall) (Hora et al. 2011). Several studies have pointed out that product recall announcements can convey negative information to consumers about the company or brand (Davidson III and Worell 1992; Liu and Shankar 2015; Siomkos and Kurzbard 1994). In fact, Chen et al. (2009) show that markets (investors) are more likely to penalize a firm when it undertakes a proactive rather than a passive strategy. This suggests that firms are not always motivated to adopt a proactive product recall strategy, as they may perceive doing so will result in a substantial financial loss. However, consumers may view a voluntary product recall differently than do investors (Chen et al. 2009). Because not all types of product recall strategies carry an equally credible signal of product quality, this leads us to describe some of the underlying logic that can enhance our understanding of how consumers may react to product recall strategies.

First, we theorize that a voluntary product recall strategy will convey a signal of trust that can strengthen the perceived image of a firm's products. When consumers are exposed to safety issues about products, their trust in product quality can diminish (Cleeren et al. 2008; Keinan and Kivetz 2008). In such cases, consumers expect a firm to explain what went wrong because they face an information asymmetry problem. A firm may seek to change the status quo by

undertaking a voluntary product recall strategy to mitigate the information asymmetry problem and potentially protect consumers by disclosing how a recalled product may affect their health and safety. From a signaling theory perspective, we contend that a voluntary recall announcement serves as a firm's maneuver toward resolving an information asymmetry problem with consumers. In turn, consumers may perceive a voluntary product recall as a credible signal for repairing trust in product quality. For example, Conagra Brands disclosed the underlying reason (e.g., the potential presence of mold) for its voluntary recall of Hunt's Tomato Paste product (FDA 2019). Likewise, the Kellogg Company voluntarily recalled its Honey Smacks cereal product because of the possible presence of *salmonella*, which could have resulted in serious illness (FDA 2018). Conversely, when firms do not recall products, consumers may process this signal that the firm is not accepting responsibility for the problem (Kim et al. 2004). We therefore posit that consumers are more likely to develop a favorable impression of a product when they learn about a voluntary product recall strategy as compared with a firm's denial (refusal) to recall the product.

Second, consumers may interpret a voluntary product recall as a signal that a firm seeks to continually improve its products. The basis of our argument can be found in the organizational learning literature, which suggests that individuals learn more when they voluntarily choose to do something as compared with when they are forced to do it (Haunschild and Rhee 2004). Likewise, firms can learn from their product failures by improving or altering operational routines and standard operating procedures (Madsen and Desai 2010). The organizational learning literature also suggests that firms are more likely to learn more from their failures than their successful experiences in reducing the number of future failures (Carmeli and Sheaffer 2008; Madsen and Desai 2010). In several cases, a denial strategy does not ensure that failures

related to violations of environmental standards will not happen in the future (Dutta and Pullig 2011; Puzakova et al. 2013). Following this logic, we contend that consumers may acknowledge a voluntary product recall as a signal of a firm's desire to learn from its mistakes. This suggests that a voluntary product recall sends a signal to consumers that a firm seeks to learn from its failures, which, in turn, causes less damage to consumer perceptions of product quality.

Therefore, we hypothesize:

H5: *Consumers are more likely to give favorable evaluations on product quality when they learn about a voluntary product recall as compared with a non-recall (denial) strategy.*

The moderation role of environmental risk type and product recall strategy

We now turn to examining the moderating role of environmental risk type on the relationship between a voluntary product recall strategy and consumer perceptions of product quality. We draw from both signaling theory and the product-harm crises literature (Cleeren et al. 2008; Dawar and Pillutla 2000) to examine how consumers react to high risk (discrete) events. The term "product-harm crisis" is defined as an event/incident of an unsafe product that causes serious environmental or public health problems (Dawar and Pillutla 2000; Hora et al. 2011). Typically, a product-harm crisis leads to product recalls (Chen et al. 2009). Of particular relevance to our study is how consumers evaluate product quality based upon a firm's voluntary recall (a corrective signal) following a high risk (discrete) event.

We contend that a voluntary product recall strategy may serve as a weak signal of the firm's corrective action when consumers face higher risks from a product-harm crisis. There is accumulating evidence that consumers tend to remain uncertain about product quality when they

learn about serious product safety problems (Cleeren et al. 2008; Dawar and Pillutla 2000). Prior research has also documented that voluntary product recall strategy can be an ineffective response strategy in the event of a serious product-harm crisis (Laufer and Coombs 2006). Hence, we believe that product recalls may not be effective in mitigating consumer panic over serious product-related problems. For high-risk environmental problems, consumers expect a stronger corrective response that can signal a company's willingness to directly resolve a problem. For instance, self-disclosing information via social media (e.g., Facebook, Twitter) about an ongoing problem may signal a firm's commitment to resolving the problem. Building upon signaling theory, we believe that a firm's response (signal) to a product-harm crisis will be a critical determinant of a consumer's reaction (feedback). As such, consumers may process the voluntary recall as inadequate evidence of a product's quality, leaving their perceptions of product quality unchanged. We therefore posit that consumers may perceive a voluntary product recall strategy as merely reactive behavior toward the product-harm crisis and may make negative generalizations based on voluntary product recalls in high-risk situations. Based on this logic, we present the following hypothesis:

H6: High environmental risk will attenuate the positive relationship between a voluntary product recall strategy and consumer perceptions of product quality as compared with low environmental risk.

Self-disclosing negative information as a corrective action for product quality

We now theorize how a firm's self-disclosing of negative information about a supplier's environmental violations can affect consumer perceptions of quality. When a firm or its suppliers are involved in high-risk environmental transgressions, the media will often generate negative publicity about a firm (Zavyalova et al. 2012). As such, the negative media publicity can erode

consumer trust in the firm (Xiong and Bharadwaj 2013). We propose that firms can repair damage to consumer trust by self-disclosing negative information about their suppliers' environmental noncompliance in the public domain. In so doing, a firm can possibly gain control over a situation even before the media releases the negative news. A popular example of the self-disclosing approach was employed by Apple Corporation when the company discovered serious environmental violations by their suppliers (Reuters 2018). In a similar vein, Puma SE, a Germany-based sportswear and clothing company, reports not only its own environmental footprint but also reports its lower-tier supplier's environmental performance, including negative information such as water use, land use, and emissions (Marshall et al. 2016).

Building upon signaling theory, we assert that a firm's self-disclosing negative information (i.e., suppliers' environmental transgressions) serves as a strong corrective signal that embodies integrity-related beliefs for consumers. Integrity-related beliefs reflect a firm's adherence to a set of moral principles (Mayer et al. 1995; Schlosser et al. 2006). Conceptually, integrity beliefs have been viewed as a foundational source for overall trustworthiness (Mayer et al. 1995; Gupta and Kabadayi 2010). Prior research also notes that integrity-related beliefs can alter the attitudes and behavior of consumers (Gupta and Kabadayi 2010; Mayer et al. 1995; Schlosser et al. 2006). In a similar vein, Fennis and Stroebe (2014) found that self-disclosing negative information can help firms lessen the damage to the consumers' trust in the firm. Likewise, we extend and apply this logic grounded in signaling theory to suggest that a firm can send a signal that it adheres to the principles of responsible sourcing and manufacturing of quality products by self-disclosing negative information. We also assert that self-disclosing negative information can address the information asymmetry problem between consumers and the firm. Self-disclosing negative information can enable a firm to present negative information

with integrity, perhaps in a better way than when such information is released by third parties. Thus, we believe that consumers may interpret the self-disclosing negative information as a corrective action (signal) toward the rebuilding trust in a firm's image of making quality products. We therefore hypothesize:

H7: Consumers are more likely to give favorable evaluations on product quality when a firm self-discloses its supplier's serious environmental violations as compared to when they learn about the situation from a third party.

Terminating environmentally irresponsible suppliers as a corrective action for product quality

We now examine how terminating suppliers who are involved in environmental violations may affect consumer perceptions of product quality. In so doing, we ground our arguments using signaling theory to develop our hypothesis for this relationship. Consumers may judge how well a firm responds to extreme environmental transgressions committed by its suppliers. The baseline assumption we make is that a supplier's serious environmental wrongdoings are trust-violating events for consumers. In such situations, consumers expect an offending firm to resolve the environmental transgression. The focal firm can resolve the situation by either taking the risk-acceptance path, making no changes to its relationship with the supplier, or pursuing a risk-avoidance path in which it terminates the relationship with the supplier who transgressed (Hajmohammad and Vachon 2016). In this study, we propose that a focal firm is better off terminating its relationship with its supplier to mitigate the potential negative consequences.

Signaling theory suggests that consumers may interpret a firm's termination of a relationship with a supplier who committed the serious environmental violation as a signal of benevolence. Benevolence is defined as a firm's positive orientation toward consumers beyond profit-centric motives (Mayer et al. 1995; Schlosser et al. 2006). Benevolence is also considered as a key element of overall trustworthiness. By terminating the relationship with the supplier, the company can demonstrate higher levels of persuasion or willingness to take the costlier route of problem-solving rather than taking the escape route of ignoring the problem (Xie and Peng 2009). In summary, we theorize that terminating suppliers who commit serious environmental violations may help a firm to repair consumer trust in its products. Therefore, we expect that consumers will give favorable evaluations of product quality when a firm terminates rather than continue its business relationship with suppliers who have committed serious environmental violations.

H8: *Consumers are more likely to give favorable evaluations on product quality when a firm terminates its relationship with a supplier who committed environmental violations as compared with continuation of its relationship with a wrongdoer supplier.*

Perceived product quality and willingness to purchase

We now theorize on the role of perceived product quality on a consumer's willingness to purchase a product. Consistent with prior research that examines the theoretical linkage between perceived quality and perceived acquisition value of a product (Bolton and Drew 1991; Grewal et al. 1998; Zeithaml 1988), we suggest that perceived quality can influence consumers' path-to-purchase. Prior research considers consumers' path-to-purchase as a journey in which an individual goes through multiple steps (e.g., learning, feeling, etc.) (Lemon and Verhoef 2016;

Srinivasan et al. 2016). The last step in this path-to-purchase journey is converting intentions into actions (Yang and Peterson 2004; Srinivasan et al. 2016). Before an individual attempts to take final action, the consumer needs to overcome certain steps (obstacles). One of the biggest obstacles is to match the net worth and perceived value of a product. Because consumers are known to derive maximum value in their purchasing decisions (Gupta and Kim 2010), we suggest that higher perceptions of product quality may justify the net worth of goods, which, in turn, positively affects consumers' willingness to buy a product. This suggests that consumers may likely buy a product when they perceive higher product quality. Thus, we propose:

H9: Consumers are more likely to purchase a product when the consumer perceives higher product quality as compared with lower product quality.

In summary, Figure 4.2 (a, b and c) depicts our hypothesized relationships. Next, Section 4 describes how we tested our theoretical model.

Experimental Design and Procedure

Experimental Design

To test our hypotheses, we conducted a series of three vignette-based experiments. This approach was selected for two important reasons. First, our research questions require us to examine questions about consumers' perceptions and decision-making. Second, compared with using survey-based questionnaires, a vignette-based experiment allows the simultaneous investigation of manipulating stimuli (written scenarios) that vary at different levels. Therefore, a vignette-based experiment is an ideal method to conduct this study. Moreover, this approach allows researchers to describe a "real-world" scenario through a written description to participants who take the role of consumers (Bregman et al. 2015). We embedded our vignette-

based experiments in an online survey, which allowed us to address both high internal and external validity issues by portraying the scenarios with a greater level of realism (Aguinis and Bradley 2014; Chen et al. 2016). We note that the use of experimental-based methods is increasingly being used in supply chain management research (Eckerd 2016; Knemeyer and Naylor 2011). We followed the research design guidelines prescribed by Rungtusanatham et al. (2011) and adopted the technique described by Hartmann and Moeller (2014) for employing a vignette-based survey approach in our study.

Study 1

Procedure

To test our hypotheses, we employed a 2x2x2 between-subjects full-factorial design. The categorical independent variables were switch in eco-sourcing (eco-friendly to non-eco-friendly suppliers vs. non-eco-friendly to eco-friendly suppliers), supplier location (local vs. global), and environmentally compliant materials (compliance vs. noncompliance). We followed the vignette-based experimental design procedures by Rungtusanatham et al. (2011). In so doing, we provided background information to all subjects in the common module. Participants read background information about a fictitious company and were asked to think about buying a computer display within the next few days. We chose this product for two important reasons. First, many respondents are familiar with this product (i.e., a relatively inexpensive item). Second, electronic devices such as computer displays pose a growing concern to the environment (Meyer and Katz 2016). As such, the display manufacturing industry continues to focus on the eco-friendly nature of the product, including the use of less harmful chemicals and materials during their manufacture (OECD 2000).

All subjects were randomly assigned to each of the treatment conditions in the experimental module (see Table 4.3): environmental sourcing (switch from environmentally irresponsible suppliers to eco-friendly suppliers; switch from eco-friendly suppliers to environmentally irresponsible suppliers), supplier location (local vs. global), and environmentally compliant materials (compliance vs. noncompliance). Table 4.3 presents cell means and standard deviations of all latent variables used in the study.

Several attention and manipulation checks were included in the study to ensure that respondents properly understood the scenario and diligently followed the questionnaires. Finally, participants were removed from the sample if they failed to correctly answer more than two of the seven attention-checking questions. Each participant earned \$2.50 for successfully completing the study.

Sample

A total of 200 participants were recruited from Amazon's MTurk online subject pool to participate in the study. Prior research has documented that MTurk represents a highly defensible source of high-quality data (Buhrmester et al. 2011; Giebelhausen et al. 2014). Schoenherr et al. (2015) noted that the recruitment of participants from Amazon's MTurk website has been growing rapidly in consumer behavior research. Participation was restricted to MTurk workers with high reputation (i.e., workers with more than 95% approval rate and minimum 5000 successful HITs) to ensure high-quality data. All of the participants are located in the United States and were at least 18 years old. Four participants either failed to pass attention-checking questions or did not provide complete responses, resulting in a useable sample of 196 participants whose descriptive information is given in Table 4.4. There were female (47%) and male (53%) participants, with the majority falling into age categories of "22–30" or "31–40."

This indicates that our sample consisted of relatively young and middle-aged adults. With respect to education, about 49% of the subjects had a bachelor's degree, with high school completion representing only 10%. Only two individuals reported having a Ph.D. or equivalent degree. Respondents in our sample were mostly full-time working professionals, with only 13% of subjects reporting being not currently employed.

Realism check

To evaluate the realism of the vignettes, we asked several doctoral students to provide feedback on the language used in the vignettes. The feedback from the doctoral students was then incorporated to ensure that common and experimental modules were realistic. We also conducted a realism check by asking participants to report their perceptions of the scenario's believability, a common practice in role-playing vignette experiments (Eckerd et al. 2013). The three items for measuring the scenario's realism were "The scenarios are believable"; "You can imagine yourself in the situation described above"; and "The situation described above does occur in the real world" on a seven-point scale ranging from (1=Strongly Disagree; 7=Strongly Agree) and the resulting mean score of 5.82 with standard deviation 1.04 indicated highly realistic evaluations of scenarios by participants.

Manipulation checks

All participants correctly identified the environmentally irresponsible sourcing strategy 91.3% of the time ($\chi^2 = 133.91, p < .001$), the supplier location 96.9% of the time ($\chi^2 = 172.80, p < .001$), and the environmentally compliant materials 87.2% of the time ($\chi^2 = 108.82, p < .001$), indicating that the manipulations worked as intended.

Measures

We employed three categorical independent variables to measure our hypothesized factors of interest. The first factor was environmentally irresponsible sourcing (coded with a value of “1” if a firm switched from eco-friendly suppliers to environmentally irresponsible suppliers and “0” when a firm switched from environmentally irresponsible suppliers to eco-friendly suppliers). The second factor was supplier location (coded with a value of “1” if a firm’s suppliers are based locally [in the U.S.] and “0” if a firm’s suppliers are based globally). Our final factor was environmentally compliant materials (coded with a value of “1” if a firm’s product materials are compliant with environmental standards and “0” otherwise).

Perceived quality:

This construct was measured through two important aspects of product quality: global (overall) and product-specific measure. In our study, we deliberately assessed perceived product quality before and after the switch to environmental sourcing. In so doing, we followed a long tradition of the cross-disciplinary experimental research studies that commonly use pre- and post-measures (e.g., Chen et al. 2016; Dierdorff et al. 2010). For the pre-perceived product quality measure, we used a global (overall) measure, while the product-specific measure was used to measure post-perceived quality. The global (overall) measure is intended to evaluate product quality with the given information at the start of the treatment condition, while the product-specific measure assesses an individual’s perception of the product after processing the treatment condition information provided in the latter part of the scenario. By doing this, individuals can take certain product-specific (computer display) attributes into account during product evaluations. The same approach was used in prior studies to measure consumer attitudes with respect to both an attribute-specific as well as a more global basis (e.g., Marks and Kamins

1988; Rao et al. 1999). We adapted the scale used by Rao et al. (1999) and Dodds et al. (1991) to operationalize post-perceived (product-specific) quality; in addition, we adapted the scale from Dodds et al. (1991) to operationalize global (overall) measure of product quality.

Willingness to purchase

The measure for consumer's willingness to purchase was operationalized with a three-item indicator adopted from Grewal et al. (1998).

Controls

We controlled for an individual's predisposition toward environmental values, a measure adapted from Maignan (2001). Previous studies have shown that favorable consumer behavior toward socially/ethically responsible companies influence their purchasing decisions (Halkos and Matsiori 2014). By including this variable as a control, we attempted to minimize effects on purchasing behavior from a consumer's support of environmentally responsible firms. We also measured age, gender, and level of income as control variables to minimize the influence of personal characteristics on product evaluations and purchasing behavior.

Measurement reliability and construct validity

Several general guidelines were followed to ensure the reliability and validity of both categorical variables (operationalized by vignettes) and the latent constructs used in the study. First, to ensure our vignettes were clear, realistic, and complete, we followed the Rungtusanatham et al. (2011) recommendation by asking a panel of four doctoral students and three industry experts (with different educational and professional backgrounds) to provide feedback on our instrument to establish content validity in the scenarios. To test for common method bias, individuals' environmental values were included in this study as marker variables,

and the parameter significances between our independent and dependent variables did not change either with or without the inclusion of this marker variable. Moreover, the marker variable did not significantly correlate with the perceived quality measure taken after the manipulation scenario, suggesting that common method bias presents no significant threat to the validity of this study (Lindell and Whitney 2001; Podsakoff et al. 2003).

Next, we turn our attention to assess measurement reliability and validity of our latent constructs in the model. We examined Cronbach's coefficient alpha values to establish construct reliability (Hair et al. 2006). All of our three latent constructs had an alpha value exceeding 0.90 (recommended value .70). Discriminant validity was assessed by conducting chi-square (χ^2) difference test. All chi-square difference tests were statistically significant ($p < 0.01$), which indicates that measurement characteristics of latent constructs do not overlap with each other in the model (Stratman and Roth 2002). Further, we conducted a composite reliability (CR) test for our latent constructs. The results shown in Table 4.5 reflect internal consistency in the reliability of measurement items as all of the CR values exceeded 0.70.

Finally, we tested the convergent validity of our latent constructs by comparing the magnitude of the factor loadings on each latent variable. The results from the factor analysis (shown in Table 4.5) demonstrate that all our latent constructs passed the convergent validity test as all item indicators had factor loadings > 0.7 (at $p < 0.01$). We also assessed convergent validity by computing the average variance extracted (AVE) for each latent construct. Results from Table 5 indicate that all of our latent constructs had an AVE value exceeding 0.50, the recommended threshold value, confirming the convergent validity of our constructs (Hair et al. 2006).

Results

We estimated our model using structural equation modelling (SEM), which allows us to estimate both direct and indirect paths (e.g., the link from environmental sourcing strategy to willingness to purchase via perceived quality) through mediation analysis (Kidwell et al. 2013). This method has been previously used in many experimental studies to estimate path models with categorical independent variables and latent dependent variables (e.g., Boss et al. 2015; Hartmann and Moeller 2014). The model was specified to estimate the main effects of our three categorical independent variables on perceived product quality. The model also simultaneously estimated the effects of perceived product quality on consumers' purchase intentions. The descriptive statistics and correlations are shown in Table 4.6, and Table 4.7 presents results from our structural model. The results indicate excellent model fit (comparative fit index [CFI]=0.98, root mean square error of approximation [RMSEA]=0.07, and Tucker-Lewis index [TLI]=0.94). The model estimated that the beta coefficient for poor environmental sourcing (as compared with the environmental sourcing) is negative and significant ($\beta = -1.42, z = -8.48, p < .01$), thus indicating support for **H1**, which hypothesized that a switch in sourcing to environmentally irresponsible firms leads to poor perceptions of product quality. We did not find support for **H2** ($\beta = -.17, z = -1.12, p = .26$), thus indicating that consumers' product evaluations on perceived quality did not differ based on supplier location. **H3** is supported ($\beta = -.52, z = -2.82, p < .05$), which states that consumers will perceive lower product quality when product materials are non-environmental compliant. Finally, perceived product quality is significantly related to willingness to purchase ($\beta = .98, z = 19.91, p < .01$), thus supporting **H9**.

Mediation analysis (effects of perceived quality on willingness to purchase)

We employed the Preacher and Hayes (2004) bootstrap approach ($n = 5000$ bootstrap resamples) to examine direct and indirect effects of the independent variables and mediating variables on our dependent variables (see Table 4.8). Prior studies note that the bootstrap method is preferred over the Baron and Kenny (1986) method for testing mediation effects (Gilgor et al., 2015; Zhao et al., 2010). Table 4.8 presents the mediating effects of perceived quality on the willingness to purchase. The results indicate that the mediating effect of perceived quality in the relationship of environmental sourcing on willingness to purchase is statistically significant at $p < 0.01$. The significance of the direct effect ($\beta = -.57^{**}$, $p < 0.01$) from environmentally irresponsible sourcing to the willingness to purchase and indirect effect of environmentally irresponsible, via perceived quality, on willingness to purchase ($\beta = -1.50^{**}$, $p < 0.01$) revealed support for the partial mediation model. Next, we assessed whether perceived product quality mediates the relationship between supplier location and willingness to purchase. We found that perceived product quality fails to mediate the impact of supplier location on willingness to purchase. Finally, we examined the direct effect of environmentally non-compliant materials and indirect effects via perceived product quality on the willingness to purchase. The direct effect of environmentally compliant materials on willingness to purchase was marginally supported ($\beta = -.58$, $p < 0.1$), while the indirect effects from ($\beta = -2.34$, $p < 0.01$) were significant. This again indicates that perceived quality partially mediates the effect of environmentally compliant materials on willingness to purchase. Table 4.8 shows that the indirect effects of product perceived quality based on environmentally compliant materials had a significant and positive impact on willingness to purchase.

Study 2

The purpose of this study was to extend the findings of Study 1 by evaluating how a consumer's product evaluations and subsequently purchasing intentions differ when environmental sourcing poses human health risk. Study 2 also examines how consumer perceptions of product quality and purchasing intentions are affected by a firm's voluntary product recall strategy. The results obtained in Study 1 suggest that consumers are more likely to perceive lower product quality when they learn of a firm's poor environmental sourcing strategy. Study 2 incorporates a scenario to test whether consumers perceive product quality differently based on the level of health risk involved in the environmental sourcing problem. We controlled for age, gender, level of income, and individual environmental values. In addition, we added a measure of social desirability bias as a control variable in Study 2. The social desirability bias (SDB) is viewed as contaminating response bias which stems from the individuals' tendency to respond favorably according to the socially expected norms or manners while answering to the questions in the survey (Daunt and Harris 2011; Reynolds 1982). Therefore, in order to rule out the impact of social desirability bias on the results of the study, we included the social desirability bias as a control variable in our model.

Procedure

To test H4, H5, and H6 (see Study 2 in Figure 4.1), we employed a 2x2 between-subjects full factorial design. Our categorical independent variables are environmental sourcing risk (health risk vs. no health risk) and recall strategy (recall vs. deny recall). We followed the same approach as used in Study 1 to design two modules: common and experimental. The common module described the background information for a fictitious company (a food company) to all our participants. Aided by inputs from panelists who screened our scenarios, and, given that most

participants are familiar with this product, we chose breakfast cereal as the product class in our vignette experiment. Interestingly, the actual number of food product recalls has steadily increased in recent years, with the U.S Food and Drug Administration (FDA) recording 2,945 recall events involving 9,199 recalled products in the year 2017 (FDA 2017). To avoid demand effects, we provided background information that the fictitious company had no history of recalled products. All subjects were briefed about the company's supply chain environmental problem in the common module, and manipulation factors were deployed in the experimental module. Environmental sourcing risk was operationalized in the scenario, with a heading indicating that either a high health risk or a no health risk situation recently occurred; further, we also provided information about the company's response to that event. All subjects were told to imagine buying breakfast cereal manufactured by the company.

Sample

In Study 2, we followed a similar procedure by recruiting participants from Amazon MTurk and ensured that no participants from Study 1 were included in Study 2. Two hundred participants took part in Study 2 for a payment of \$2.50. After reviewing the attention-checking questions, 11 observations were removed because these participants had missed more than two attention-checking questions. A final sample of 189 observations was retained. Of these final observations, 100 (53%) were of men and 89 (47%) were of women. The average age (range) for the participants was 31–40 years. Table 4.9 reports the number of participants by treatment condition.

Realism check

To evaluate the realism of the vignette, we again conducted a realism check by asking participants to report their perceptions of the scenario's believability using three-item indicators (as used in Study 1). A mean score of 5.85 with a standard deviation of 0.99 reflected highly realistic evaluations of scenarios by participants.

Manipulation checks

All participants in Study 2 received at least one question per manipulation factor, regardless of manipulation level. The participants correctly chose the environmental risk type 96.2% of the time ($\chi^2 = 162.05, p < 0.01$) and the recall strategy 96% of the time ($\chi^2 = 162.19, p < 0.01$), results that reflected the effectiveness of the manipulations employed in the study.

Measures

We created two categorical variables to operationalize our independent variables in this study. Environmental low risk in sourcing was coded as "0," while the environmental high risk in sourcing was coded as "1." Similarly, we coded refuse-to-recall strategy as "0" and voluntarily recall as "1" to analyze and interpret our results.

Perceived Quality

In Study 2, we operationalized both pre- and post-perceived quality measures with the global measure instead of product-specific measures for perceived quality. Because of the inherent nature (e.g., color, aroma, taste, etc.) of the product type (breakfast cereals), measuring perceived quality for food/beverage product is often seen as complex due to nonavailability of such intrinsic cues before the actual purchase (Jover et al. 2004); thus, we relied on global

measures (used to measure pre-perceived quality in Study 1) to operationalize both pre- and post-perceived quality by adapting the scale from Dodds et al. (1991).

Willingness to Purchase

The variable was operationalized with a three-item indicator scale similar to that used in Study 1 and adopted from Grewal et al. (1998).

Social Desirability Bias

We adapted the scale from Reynolds (1982) for measuring social desirability bias. This scale has been widely used in prior research to measure social desirability (e.g., Daunt and Harris 2011; Youssef and Luthans 2007).

Results

We estimated our path model using structural equation modeling (SEM). The fit statistic indicators (comparative fit index [CFI]=0.98, root mean square error of approximation [RMSEA]=0.06), and Tucker-Lewis index [TLI]=0.94) reflected good model fit. Table 4.10 provides standardized coefficients for the structural paths. **H4** hypothesized that the health risk involved in an environmental sourcing problem would lead to poor perceptions of quality, and the results showed that health risk involved in environmental sourcing affects perceptions of quality negatively ($\beta = -1.24, z = -5.08, p < 0.01$), indicating that **H4** is supported. **H5** is also supported ($\beta = 1.10, z = 4.55, p < .01$), which hypothesized consumers will perceive higher perceptions of quality upon learning that the firm has voluntarily recalled the product. **H6** hypothesized the interaction effects of environmental risk and product recall strategy on perceived quality, and, consistent with our prediction, we found statistical support for **H6** ($\beta = -0.57, z = -1.67, p < 0.10$), indicating that environmental risk type negatively moderates the

positive relationship between product recall and perceived quality. The effect of the social desirability question on perceived quality and purchasing intentions remained insignificant with respect to perceived quality ($\beta = -0.05, p < 0.38$) and willingness to purchase ($\beta = 0.02, p > 0.75$). These results indicate that consumer perceptions of product quality and purchasing intentions were most likely not influenced by social desirability bias.

We also conducted a simple slope analysis of the interaction effects of product recall and environmental risk on perceived quality. Both slopes for low and high environmental risk were found to be significant ($t = 4.5, p < .01$ for low environmental risk and $t = 2.17, p = .031$ for high environmental risk). The simple slope test indicates that two slopes are different (see Figure 3). It can be noted that, compared with low environmental risk, high environmental risk had a relatively less positive impact on enhancing perceptions of quality when the product is voluntarily recalled (see Figure 4.3).

Mediation analysis

As in Study 1, we employed the Preacher and Hayes (2004) bootstrap approach ($n = 5000$ bootstrap resamples) to examine both direct and indirect effects of the independent variables and mediating variables on our dependent variables. Table 4.11 presents the mediating effects of perceived quality on willingness to purchase, with results indicating that the direct effect from environmental risk type on willingness to purchase is insignificant ($\beta = -0.22, p > 0.10$). Similarly, the direct effect of a voluntary product recall to willingness to purchase is also insignificant ($\beta = -0.09, p > 0.10$). The indirect paths emerging from environmental risk type ($\beta = -0.1.14, p < 0.01$) and a voluntary product recall ($\beta = 0.60, p < 0.01$) on perceived quality were significant, as were the effects of perceived quality on willingness to purchase. We also found that perceived quality fully mediates the effect of the interaction of environmental risk and

product recall on willingness to purchase. Taken together, these results indicate that perceived quality fully mediates the effects of environmental risk type and a voluntary product recall on willingness to purchase.

Study 3

Procedure

Study 3 employed a 2x2 between-subjects full-factorial design. The factors manipulated were (1) disclosure of an environmental supply chain problem (self-disclosure vs. exposed by media) and (2) relationship strategy (termination vs. continuation of the relationship with the supplier). The procedures used in Study 3 were identical to those of Study 2, again following the approach of deploying scenarios in both common and experimental modules. The background information was described in the common module.

Sample

We recruited 200 participants from Amazon MTurk, each for a small payment of \$2.50. Consistent with prior studies, we employed several attention-checking questions to eliminate observations with incorrect answers, and the resulting sample consisted of 193 observations (see Table 4.12) after eliminating seven cases of more than two incorrect answers to attention-checking questions. Among our final sample, 52% were male, 70% were employed (>40 hours/week), the average age (range) was 31–40, and approximately 40% had four-year college educations.

Realism check

A realism check was obtained in a number of ways. First, all subjects responded to the following three-item questions on a seven-point scale: (1) “The scenarios are believable”; (2)

“You can imagine yourself in the situation described above”; and (3) “The situation described above does occur in the real world.” The mean score of this realism-check question was 5.70, with a standard deviation of 1.14, indicating that participants considered the scenarios realistic. We also added questions to determine whether subjects used social media accounts (such as Facebook, Twitter, etc.) and weighed their responses on their actual experience of grocery shopping and eating habits. Ninety-two percent of participants reported to have at least one social media account; 32% reported that they do grocery shopping twice per week, and 51% indicated once-a-week grocery shopping.

Manipulation check

We employed one manipulation check question for each manipulating factor, but, unlike in Study 1 and Study 2, we deployed a manipulation check question after presenting all of the variables of interest, including the dependent variable and controls. We did this because manipulation check questions can potentially create unwanted demand effects and may provide cues to the experimental treatment (Lonati et al. 2018). Similar to Study 1 and Study 2, we deployed one similar (true/false) question per manipulation factor. The participants correctly chose the disclosure of environmental supply chain problems 85.4% of the time ($\chi^2 = 96.7$, $p < 0.01$) and response strategy in a relationship 88.5% of the time ($\chi^2 = 109.13$, $p < 0.01$).

Measures

We constructed two categorical independent variables in our study. The first independent variable, i.e., disclosure of environmental supply chain problem, was operationalized by coding with a value of “1” if consumers learned of an environmental supply chain problem from the company’s self-disclosure and “0” if consumers learned through the media of the environmental supply chain problem. In a similar way, we operationalized our second categorical independent

variable by coding with a value of “1” if consumers learned about the termination of the relationship with a supplier and “0” if consumers learned of continuation of the relationship with a supplier firm. We used the same measures and control variables described in previous studies. Perceived quality was operationalized by the global measure scale adopted from Dodds et al. (1991) in Study 2. Willingness to purchase was assessed with a similar three-item indicator scale used in Studies 1 and 2 and adopted from Grewal et al. (1998). Similarly to Study 2, we assessed social desirability bias by adapting five-item indicators from Reynolds’s (1982) study.

Results

Structural equation modeling (SEM) was used in Study 3 to estimate our model, and the fit statistic indicators (comparative fit index [CFI]=0.99, root mean square error of approximation [RMSEA]=0.03, Tucker-Lewis index [TLI]=0.98) again reflected a good model fit. Table 4.13 reports standardized coefficients for the structural paths. We found support for **H7**, which hypothesized a less favorable evaluation of product quality when the media exposes a firm’s environmental supply chain problem in the form of a scandal compared with when consumers learn directly from a company about the environmental supply chain problem (self-disclosure). The results showed that the self-disclosure strategy positively affects perceptions of quality ($\beta = 0.28, z = -1.66, p < 0.10$), indicating that **H7** is supported. **H8**, hypothesizing that consumers will perceive higher perceptions of quality upon learning that the firm has terminated its relationship with a supplier who had an environmental problem, is also supported ($\beta = 0.57, z = 3.32, p < 0.01$). The effect of the social desirability question on perceived quality was significant ($\beta = 0.13, p > 0.02$) but on willingness to purchase remained insignificant ($\beta = -.05, p > .23$).

Mediation analysis

As in Study 1 and 2, we employed the Preacher and Hayes (2004) bootstrap approach ($n = 5000$ bootstrap resamples) to examine direct and indirect effects of the independent variables and mediating variables on our dependent variables. Table 4.14 presents the mediating effects of perceived quality on willingness to purchase. The direct effects of the environmental problem disclosure strategy ($\beta = -0.03, p > 0.10$) and relationship decision with suppliers ($\beta = 0.06, p > 0.10$) on willingness to purchase were insignificant. While the indirect effects of the environmental problem disclosure strategy, via perceived quality, on willingness to purchase was marginally significant ($\beta = 0.32, p < 0.10$), the indirect effect of the relationship decision with the supplier on willingness to purchase was significant ($\beta = 0.40, p < 0.01$). The results suggest a marginally acceptable fit of the fully mediated model.

Discussion

The primary goal of this research was to examine how consumers' perceptions of product quality are affected by a firm's environmentally irresponsible sourcing practices and the firm's subsequent corrective actions. Drawing upon cue utilization and signaling theories, this study develops a theoretical framework that describes how consumers process information in evaluating product quality and developing purchasing intentions based on the firm's environmental strategy. Our research contributes to a deeper understanding of *how* and *when* a firm's corrective actions might dampen the effect of suppliers' environmental wrongdoing on consumer judgments of product quality. The findings of this research converge on the idea that consumer willingness to purchase becomes affected by consumer perceptions of product quality. To test our predictions, a series of three vignette-based experiments was performed. We begin our general discussion with an overview of Study 1.

Study 1 enables us to leverage the cue diagnostic literature to develop a theory on how consumers might perceive product quality based on extrinsic and intrinsic cues of a firm's environmental management practices. The study examined the relationships among a firm's switching to environmentally irresponsible suppliers, suppliers' location and environmentally non-compliant materials, perceived product quality, and willingness to purchase. Specifically, drawing upon cue utilization theory, this study contends that consumers' perceptions of product quality are influenced by a firm's environmental sourcing practices (extrinsic cues), suppliers' location (extrinsic cues) and environmentally non-compliant materials (intrinsic cue). We found initial support for our proposed hypothesis that consumers are more likely to perceive poor product quality when a firm switches from eco-friendly to environmentally irresponsible suppliers. The findings of this study reinforce the importance of the idea that firms should carefully select their suppliers based on environmental performance (Carter and Carter 1998; Ehrgott et al. 2013).

Supplier location was the only factor in Study 1 that was not significant. A possible explanation for this result is that consumers may take for granted the assumption that it has become common practice for U.S.-based (and other Western) companies to take advantage of low-cost sourcing (Ruamsook et al. 2007). Indeed, many Western companies now have globally distributed supply, manufacturing, and distribution facilities, and this has an impact on the growing presence of manufacturing occurring outside a company's country of origin (Kusaba et al. 2011). Collectively, these arguments suggest that supplier location (cue) may be subdued within the broad dimension of manufacturers' country-of-origin.

As we speculated, environmentally non-compliant materials negatively affect perceived product quality. Drawing upon signaling theory, we posited that eco-friendly material

compliance conducted by third-party auditors could be a valuable source of trust. These findings have a significant implication on the firm's eco-friendly product strategy (Katsikeas et al. 2016). We suggest that firms could adopt eco-labeling to facilitate easily interpretable information to consumers about a product's eco-material compliance.

We now turn to the discussion of the results from Study 2. Our findings indicate that consumers are more likely to perceive poor product quality in situations when suppliers' environmental violations pose a higher risk to public health and the environment. This result suggests that a firm's poor environmental sourcing practices might influence consumers' confidence in its products. This logic also suggests that consumer willingness to purchase certain products associated with environmental misconduct would decline, especially when risks to public health are involved.

Our next main finding is that consumers favorably perceive a voluntary product recall when a product-harm crisis related to supplier's environmental offense occurs. We posited that consumers might generally be skeptical about a firm's ability to deliver high-quality products should they learn about suppliers' environmental misconduct. Our study shows that consumers are more likely to give favorable product evaluations for a voluntary product recall as compared with denying a recall. Prior research also suggests that, during a product-harm crisis, it is important for firms to respond quickly and engage in two-sided communication with consumers (Borah and Tellis 2016; Hora et al. 2011). One effective way to engage in two-sided communication with the target audience is to use social media outlets (such as Facebook, Twitter, and other online forums). In so doing, firms can signal their willingness to resolve issues, which in turn, can lead to consumers' favorable perceptions about product quality.

We also considered the possibility that environmental risk type might moderate the impact of a voluntary product recall on the perceived quality. We studied the moderation effect of environmental risk type (high risk vs. low risk) on the relationship between a voluntary product recall and consumers' perceptions of quality. We theorized that the positive effect of a voluntary product recall might be reduced when the environmental risk is high. Our results support this prediction. This suggests that a voluntary product recall may not always be perceived as an effective corrective action, especially when environmental misconduct involves risks to public health.

Study 3 examines how consumers' negative appraisals of product quality can be mitigated by a firm's corrective actions. This study further identifies two corrective actions that seem well suited for attenuating the effect of high-risk environmental violations on consumers' perceptions of product quality. The two corrective actions in a high-risk situation examined are 1) self-disclosing negative information and 2) announcing the termination of supplier relationships. The key premise in this study is that high-risk environmental violations erode consumers' trust in product quality. Drawing upon signaling theory, the study builds on the idea that self-disclosing negative information can help a firm in repairing consumers' lost trust and could thus affect their perceptions of product quality. We show that consumers are more likely to give favorable product quality ratings when a firm self-discloses negative information about suppliers' serious environmental offenses. The findings also help advance knowledge with respect to the impact of self-disclosing negative information (Fennis and Stroebe 2014).

Finally, we show that consumers are more likely to judge product quality more positively if a firm announces the termination of relationships with suppliers who have engaged in serious environmental offenses. The managerial implication is that firms may be forced to undertake

such actions. It is also plausible that some firms may even turn a blind eye, assuming that suppliers' environmental offenses will not affect consumers. Therefore, our study findings represent an important step toward mitigating suppliers' sustainability risk, a key concern for supply chain managers (Hajmohammad and Vachon 2016).

Theoretical Contribution

Our study makes several theoretical contributions to the supply chain, consumer behavior, and environmental sourcing literatures. First, our study extends the work of Bregman et al. (2015) and Hartmann and Moeller (2014) by taking a step toward further understanding how consumers interpret environmental-sourcing practices and the associated impact on product quality. Second, and, more importantly, despite significant enthusiasm for the idea that firms should adopt environmental-sourcing practices, scant attention has been paid to theorizing about the specific ways in which consumers express concern about a firm's environmental sourcing practices. Our study fills this important gap in the literature by demonstrating that consumers' perceptions of product quality can become affected by a firm's environmentally irresponsible sourcing practices.

Third, our study expands our understanding on a firm's corrective actions influence consumers perceptions of product quality. For example, existing research on product recalls (corrective action) has commonly focused on the effect of product recalls on firm performance but has not examined the impact on consumers (Borah and Tellis 2016). Our findings provide new theoretical insights into the influence of a firm's voluntary product recall on consumers' perceptions of product quality. Our research also suggests that it is important to investigate the role of corrective actions on the adverse effects of suppliers' environmental violations.

Finally, our research also has implications for research on product-harm crisis. We contribute to this body of literature by showing how consumers' perceptions of product quality can be influenced with a firm's decisions about whether or not to self-disclose the negative information or terminate relationships with suppliers who commit environmental offenses. In sum, our study findings contribute to a better understanding of a firm's environmental sourcing strategy and its impact on consumers' perceptions of product quality and purchasing intentions. We next turn to discuss the managerial implications.

Managerial Implications

This study offers several practical suggestions for managers. Our findings suggest that purchasing managers should evaluate suppliers based not only on traditional factors such as cost, quality, delivery, and flexibility but also on environmental sustainability. Our study provides evidence that managers can use environmental sourcing practices to influence consumer perceptions of product quality and in this way provide consumers with a strong quality appeal for products that are free from hazardous substances or contamination. The managerial implication for marketing professionals is that they should consider promoting a firm's use of eco-friendly suppliers. This information could convey higher images of the focal firm's products. Additionally, marketing professionals should consider evaluating their brand-alliance partners (suppliers) from an environmental perspective.

Our study also offers important advice to senior-level executives who often face media embarrassment resulting from supply-chain environmental misconduct. Senior-level managers should be prepared for negative news because this information can travel faster than positive news (Borah and Tellis 2016; Hewett et al. 2016). Likewise, because suppliers' environmental offenses can evoke negative media publicity, senior-level executives need an effective response

strategy focusing on the handling of supply-chain environmental misconduct. Our key implication for senior-level executives is that, when supply chain environmental wrongdoings surface, consumers will tend to react favorably to a voluntary product recall, while refusing to initiate a product recall can lead to adverse consumer reactions about product quality. Our findings further suggest that senior-level executives can consider self-disclosure of negative information as a strategy to calm consumer sentiments toward perceptions of product quality. Finally, our results suggest that announcing the termination of relationships with suppliers who commit environmental misconduct can be effective with respect to regaining consumer trust in product quality.

Limitations and Suggestions for Future Research

As with any study, this study has limitations in its scope and methodology. First, our measure of consumers' willingness to make a purchase is a self-reported measure, a type often associated with individuals' nonconsequential behavior, implying that such a measure does not have real-world trade-offs (Lonati et al. 2018). Future studies should consider designing experiments that elicit actual (real) behaviors. For example, future researchers can conduct controlled lab experiments to deploy the Becker–DeGroot–Marschak (BDM) procedure in which individuals get incentivized for providing accurate valuations on commodities (Abbey et al. 2019; Becker et al. 1964; Grewal et al. 2019). Second, in the domain of moderating situations, more studies are needed to examine factors that interact with effects of sourcing practices. For example, price, a well-recognized determinant factor for perceived quality (Pauwels and D'Aveni 2016; Zeithaml 1988) can create the differential impact of environmentally irresponsible sourcing practices on perceived quality. We also believe that an elevated corporate reputation might moderate the relationship between irresponsible sourcing practices and

perceived quality. A relevant question can be further explored, i.e., do lesser-reputed firms have greater likelihood of negative product evaluations from the consumers when supply chain environmental misconducts occur? While these factors go beyond the scope of our study, future research can go forward by demonstrating the moderating effects of price and corporate reputation on eliciting consumers' reactions to irresponsible sourcing practices.

Next, while our study did not conceptualize the interplay between corrective signals and environmental sourcing cues, future research should consider whether the effects of corrective signals (e.g., terminating the relationship with wrongdoer suppliers) transfer across cues (e.g., eco-friendly materials). Therefore, it would be worthwhile to explore the effects of the interplay of corrective signals and quality cues on consumer product evaluations. Furthermore, while we were able to test how consumers react to a firm's risk avoidance strategy (response strategy), in which a buying firm terminates a relationship with wrongdoers' suppliers, our study did not consider other risk-management strategies such as risk acceptance (Hajmohammad and Vachon 2016). For instance, future researchers can examine how consumers react to the conditions under which a buying firm announces to work closely with a wrongdoer supplier (e.g., supplier auditing) to ensure such mistakes will not occur in the future. This opens a new theoretical area of research in the supply chain risk domain in which future researchers can test how consumers react to a firm's accepting responsibility for suppliers' environmental misconduct and a firm's decision to help suppliers with audits for enhancing environmental performance. Finally, while our research makes important contributions to the literature using a vignette-based experiment, future researchers can use secondary data to operationalize eco-friendly products (e.g., www.ecolabelindex.org, the global forest stewardship council [FSC] certificate database) in

studies examining how consumers perceive eco-friendly products pertaining to perceptions of product quality.

Conclusion

The purpose of this study was to investigate how consumers' perceptions of product quality are affected by a firm's environmental sourcing practices as well as the firm's subsequent corrective actions. Drawing upon cue utilization and signaling theories, it developed a theoretical framework that describes how consumers process information pertaining to a firm's environmental strategy in evaluating product quality and building purchasing intentions. The study also demonstrates that consumer perceptions of product quality can be affected by a firm's environmentally irresponsible sourcing practices. Finally, we show in this research that consumers' negative appraisals of product quality can be mitigated through a firm's corrective actions.

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Figures and Tables

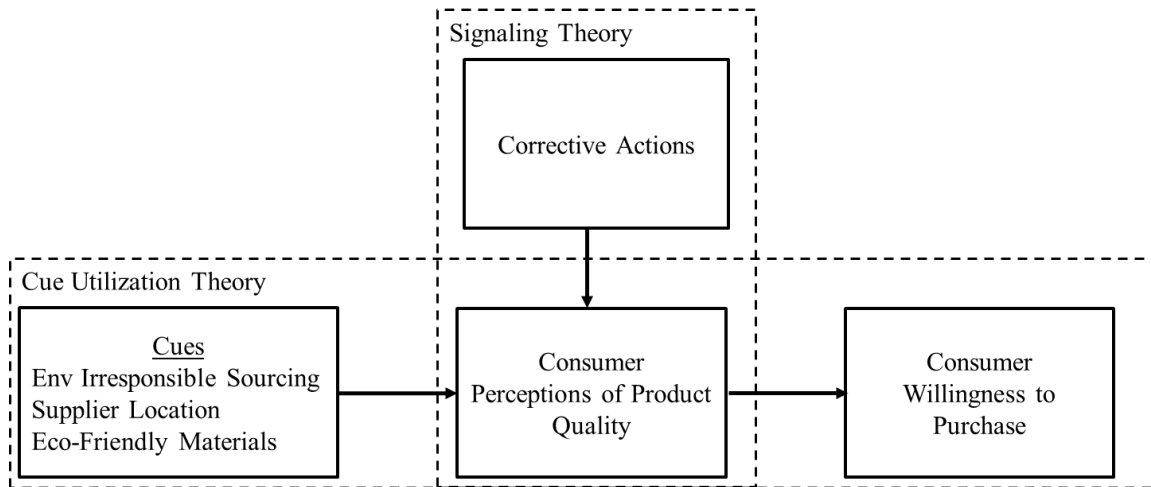
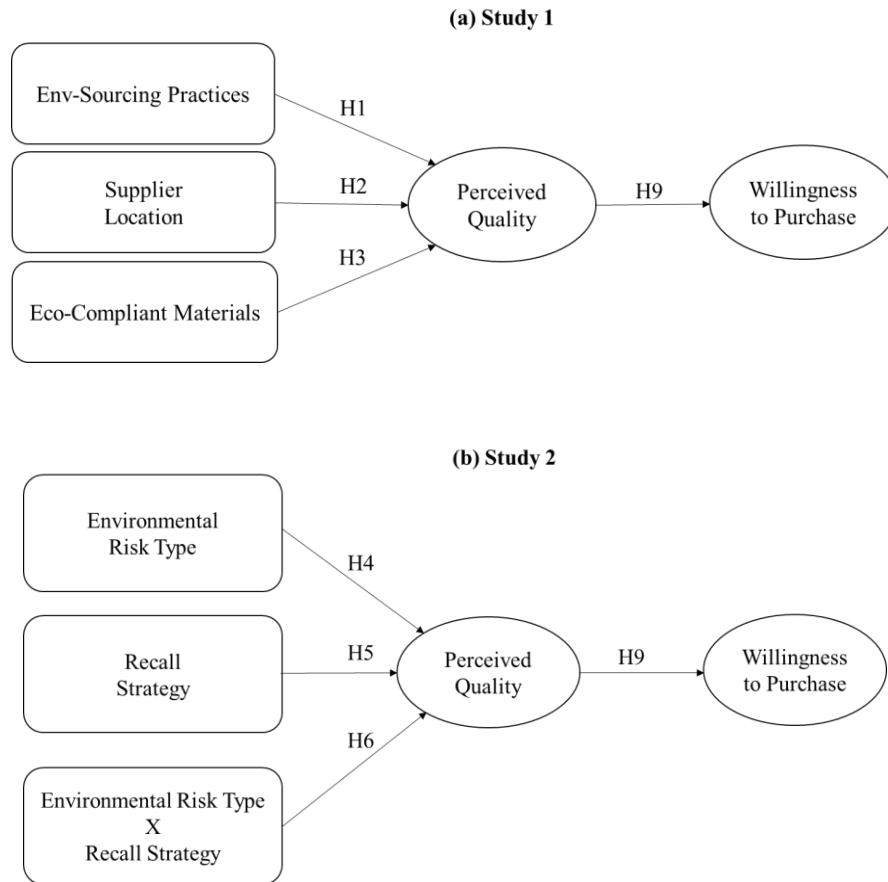


Figure 4.1: The Conceptual Framework



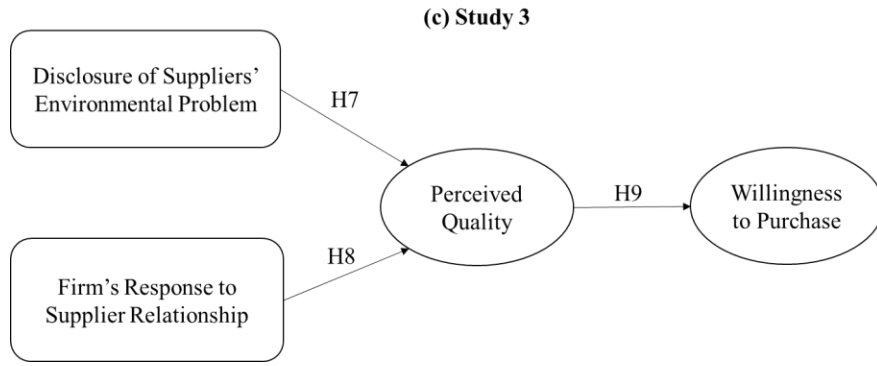


Figure 4.2: Theoretical Models (a) Study 1, (b) Study 2, and (c) Study3

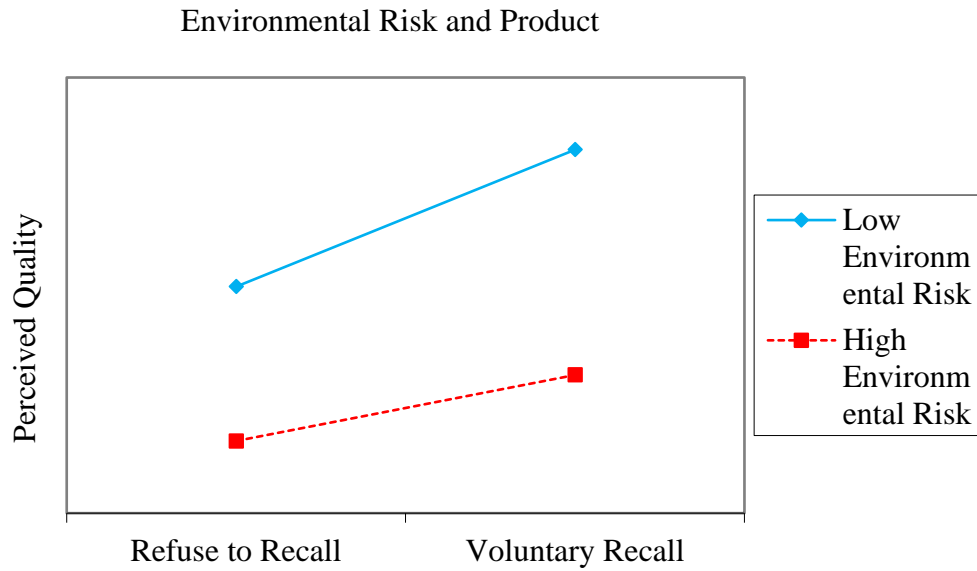


Figure 4.3: Study 2 Interaction Effects

Table 4.1: Key Elements of Theories

Cue Utilization Theory	Signaling Theory
1. Intrinsic Cues (Product-specific attributes)	1. Signalers (Insiders)
2. Extrinsic Cues (Non-product specific attributes)	2. Signals (Sent by signalers)
	3. Recipients (Outsiders)
	4. Feedback (Given by recipients)

Table 4.2: Theoretical Perspective on Factors

Factors	Hypothesis	Cue Utilization Theory	Signaling Theory
Env irresponsible sourcing practices	H1	x	
Supplier's location	H2	x	
Eco-compliant materials	H3	x	x
Environmental risk type	H4	x	
Product recall	H5		x
Env risk type X Product recall	H6		x
Self-disclosing negative information	H7		x
Terminating supplier relationships	H8		x

Table 4.3: Study 1 Participants by Treatment Condition: Means And Std Dev ()

Condition (2x2x2=8 conditions)			Cell	n	Pre-Perceived Quality	Post-Perceived Quality	Willingness to Purchase	Env-Values
Condition 1	Condition 2	Condition 3						
Eco-Friendly to Env - Irresponsible	Local Suppliers	Eco-Compliant Materials	# 1	24	5.67 (.97)	4.16 (1.44)	3.53 (1.61)	5.32 (1.55)
		Non-Eco Complaint Materials	# 2	25	3.25 (1.37)	2.81 (1.43)	1.93 (1.35)	5.01 (1.37)
	Global Suppliers	Eco-Compliant Materials	# 3	25	5.45 (1.18)	3.93 (1.44)	3.25 (1.78)	4.88 (1.13)
		Non-Eco Complaint Materials	# 4	24	4.00 (1.46)	2.81 (1.50)	2.18 (1.65)	4.94 (1.66)
Env Irresponsible to Eco-Friendly	Local Suppliers	Eco-Compliant Materials	# 5	25	4.61 (1.19)	5.28 (.79)	5.30 (1.16)	5.2 (1.25)
		Non-Eco Complaint Materials	# 6	22	2.49 (1.51)	3.4 (1.69)	2.75 (1.90)	5.66 (1.20)
	Global Suppliers	Eco-Compliant Materials	# 7	25	4.22 (1.21)	4.72 (.96)	4.4 (1.45)	4.72 (1.14)
		Non-Eco Complaint Materials	# 8	26	3.38 (1.46)	3.6 (1.23)	2.82 (1.63)	5.11 (1.17)
Total				196				

Table 4.4: Study 1 Demographic Information

Gender	
Female	93
Male	103
Age	
18-21	1
22-30	71
31-40	66
41-50	33
51-60	19
above 60	6
Employment Status	
Employed, working > 40 hours/week	144
Employed, working 1-39 hours/week	26
Not currently employed	26
Education	
High School	20
Associate degree	25
Bachelor's degree	97
Master's degree	15
Ph.D. or equivalent	2
Some college, no formal degree	37

Table 4.5: Study 1 Reliability and Item-Statistics

Construct/Item	Cronbach Alpha for Scale	CR	AVE	Factor Loading
Pre-Perceived Quality (<i>Global Measure</i>)	.94	.94	.76	
1. I perceive this product to be of high quality.				.91
2. I perceive that I will be able to use this product over time.				.86
3. I perceive this product would meet the highest standards related to safety.				.93
4. I perceive this product to be appealing to physical characteristics.				.78
5. I perceive that this product has not been contaminated.				.89
Post-Perceived Quality (<i>Product-Specific Measure</i>)	.95	.95	.81	
1. My overall impression of HDC Computer Display is that the product is of high quality.				.91
2. I perceive the HDC Computer Display to be durable (e.g., largely immune to impacts, breakage resistant)				.86
3. I think that HDC Computer Display is likely to be reliable.				.92
4. I perceive the picture quality (e.g., resolution) of HDC Computer Display to remain of high quality over time.				.92
5. I perceive the energy saving feature (power consumption) of HDC Computer Display to be of high quality over time.				.89
Willingness to Purchase (WTP)	.98	.97	.94	
1. If I were going to buy a computer display, the probability of buying HDC Computer Display is high.				.96
2. The probability that I would consider buying this HDC Computer Display is high.				.97
3. My willingness to buy this product is high.				.98
Environmental Values	.90	.90	.65	
1. I would pay more to buy products from an environmentally responsible company.				.91
2. I consider the environmental reputation of business when I shop.				.77
3. I avoid buying products from companies that have engaged in environmentally harmful actions.				.76
4. I would pay more to buy products from companies that show care for the well-being of our environment.				.90
5. If the price and quality of the two products are the same, I would buy from a firm that has an environmentally responsible reputation.				.70

Notes: Factors extracted using principal axis factoring with varimax rotation.

Table 4.6: Study 1 Descriptive Statistics and Correlations

Variables	Mean	SD	1	2	3	4	5	6
1. Post-Perceived Quality	3.88	1.57						
2. Pre-Perceived Quality	4.18	1.61	.51**					
3. WTP	3.28	1.88	.82**	.42**				
4. Environmental Values	5.10	1.33	-.03	-.08	-.07			
5. Age	-	-	.12	.08	.07	.06		
6. Gender	-	-	-.13*	-.12	-.09	.15*	-.03	
7. Income	-	-	.07	.01	.01	.09	-.04	-0.00

N = 196. SD = standard deviation.

Notes: † p < .10; * p < .05; ** p < .01

Table 4.7: Summary Results from Structural Model (Study 1)

Structural Path	Coef.	z-value	p <	Supported
H1: Environmental Sourcing (Poor) → Post-Perceived Quality	-1.42	-8.48	.01	Yes
H2: Supplier Location (Overseas) → Post-Perceived Quality	-.17	-1.12	n.s	No
H3: Env-Compliant Materials (Non-compliant) → Post-Perceived Quality	-.52	-2.82	.01	Yes
H9: Post-Perceived Quality → Willingness to Purchase	.98	19.87	.01	Yes

Table 4.8: Mediation Results from Study 1

Independent Variable	Mediating Variable	Dependent Variable	Effects of IV on Mediating Variable	Effect of Perceived Quality on DV	Direct Effects	Indirect Effects	Total Effects	95% CI for Mean Indirect Effects
Environmental Sourcing (Poor)	Perceived Quality	WTP	-.90**	1.67**	-.57**	-1.50**	-2.07**	-2.25 — -.76
Supplier Location (Overseas)	Perceived Quality	WTP	-.10	1.72**	-.12	-.18	-.31	-.97 — .56
Eco-Compliant Materials (Non-compliant)	Perceived Quality	WTP	-1.42**	1.64**	-.58 ⁺	-2.34**	-2.92**	-3.07 — -1.65

Notes: † p < .10; * p < .05; ** p < .01

Table 4.9: Study 2 Participants by Treatment Condition

	High Risk	Low Risk	Total
Voluntary Recall	48	47	95
Refuse to Recall	47	47	94
	95	94	189

Table 4.10: Summary Results from the Structural Model (Study 2)

Structural Path	Coef.	z-value	p <	Supported
H4: Environmental Risk (High Risk) → Perceived Quality	-1.24	-5.08	.01	Yes
H5: Product Recall (Voluntarily) → Perceived Quality	1.10	4.55	.01	Yes
H6: Environmental Risk X Product Recall → Perceived Quality	-.57	-1.67	.10	Yes
H9: Perceived Quality → Willingness to Purchase	.73	12.98	.01	Yes

Table 4.11: Mediation Results from Study 2

Independent Variable	Mediating Variable	Dependent Variable	Effects of IV on Mediating Variable	Effect of Perceived Quality on DV	Direct Effects	Indirect Effects	Total Effects	95% CI for Mean Indirect Effects
Environmental Risk (High Risk)	Perceived Quality	WTP	-.15**	.74**	-.22	-1.14**	-1.37**	-1.57 — -.77
Product Recall (Voluntary)	Perceived Quality	WTP	.76**	.79**	-.09	.60**	.50*	-.24 — .96
Environmental Risk X Product Recall	Perceived Quality	WTP	-.73**	.76**	-.25	-.56**	-.81**	-1.01 — -1.14

Notes: † p < .10; * p < .05; ** p < .01

Table 4.12: Study 3 Participants by Treatment Condition

	Terminate of Relationship	Continuation of Relationship	Total
Self-Disclosure	48	51	99
Exposed by Media	48	46	94
	96	97	193

Table 4.13: Summary Results from the Structural Model (Study 3)

Structural Path	Coef.	z-value	p <	Supported
H7: Env Problem Disclosure (Self-Disclosure) → Perceived Quality	.28	1.66	.10	Yes
H8: Relationship Decision with Supplier (Termination) → Perceived Quality	.57	3.32	.01	Yes
H9: Perceived Quality → Willingness to Purchase	.95	21.08	.01	Yes

Table 4.14: Mediation Results from Study 3

Independent Variable	Mediating Variable	Dependent Variable	Effects of IV on Mediating Variable	Effect of Perceived Quality on DV	Direct Effects	Indirect Effects	Total Effects	95% CI for Mean Indirect Effects
Env Problem Disclosure (Self-Disclosure)	Perceived Quality	WTP	.33 [†]	.94**	-.03	.32 [†]	.29	-.06 — .69
Relationship Decision with Supplier (Termination)	Perceived Quality	WTP	.43*	.93**	.06	.40*	.46*	.03 — .79

Notes: † p < .10; * p < .05; ** p < .01

Appendix A. Study 1 Experimental Procedure

Common Module (Identical Across all Vignettes)

HDC Inc. is a multinational firm that manufactures computer monitors. The company provides a 1-year warranty (which is industry-standard) on all of its computer monitors. HDC spends a similar amount on advertising on its products as compared to its rival firms.

- Imagine that you are a consumer who is interested in purchasing a computer display monitor.
- You are looking to purchase a computer monitor within the next few days.
- There are multiple competitors that you can purchase a similar display screen from.
- There is not much price variation for computer displays among HDC's rival (competitors) firms (within similar categories, e.g. touchscreen, and 14", 15" 17" etc.)

To manufacture its electronics devices, HDC Inc currently sources components (or materials) and parts worth \$ 5 billion every year from multiple suppliers. These materials (or components) used inside the computer display play an influential role in functional performance, durability, and reliability of the product. For example, although all monitor display screens emit electromagnetic radiation to some extent, the extent to which computer display emits electro-magnetic radiation depends on installed components that are used inside the product. The components used inside the computer display also affect the energy-efficiency of the product. The components used inside the computer display also impact longevity (life expectancy) of a computer display, which is a key metric to measure the durability of the product. The ability of materials (components) to withstand heating during operation, and thermal/mechanical stress, thus, influence the longevity of the computer display.

Experimental Treatment Conditions

Switch in Environmental Sourcing

Level 1: You recently learned from the news media that HDC Inc has been accused by environmental advocacy groups that HDC is purchasing most of its key components from environmentally irresponsible suppliers (i.e., suppliers who are polluting the environment). These are prominent suppliers who provide components that will be used to manufacture the product that you would like to purchase. Several environmental advocacy groups have launched an attack campaign using #BeResponsibleHDC on social media. The attack campaigns report that most of HDC's most prominent suppliers are heavy polluters, release toxic/hazardous waste into the environment, and violate environmental regulations.

Imagine that it is 3 months later. The focal company, HDC, had a change in the leadership team in its purchasing department, which resulted in the use of a new group of suppliers. As part of its broader environmental sourcing efforts, the company has stated that it will only purchase key components from suppliers who do not engage in pollution and hazardous waste management

practices. These are prominent suppliers who provide components that will be used to manufacture the product that you would like to purchase. The advertising campaign highlights that HDC Inc has established working relationships with eco-friendly “green” suppliers who adopt good environmental sustainability practices throughout their business operations including the use of safe components and materials that do not create sustainability problems.

Supplier Location

Level 1: You also learned that HDC Inc’s most prominent suppliers are based locally to meet HDC’s procurement needs (i.e., these suppliers are located in the United States). These prominent suppliers are located within a two-hour drive of HDC Inc’s manufacturing facility. HDC’s manufacturing plants are also located in the United States.

Level 2: You also learned that HDC Inc’s most prominent suppliers are located in the Asia-Pacific region of the world to meet HDC’s procurement needs (i.e., these suppliers are based in a low cost-country). These prominent suppliers are located more than 15 hours via plane from HDC Inc’s manufacturing facility. HDC’s manufacturing plants are located in the United States.

Eco-Compliant Materials

Level 1: HDC Corporation is required to meet federal and state environmental emission requirements. On an annual basis, a third-party company conducts annual audits to ensure that HDC is meeting federal and state environmental rules. You learned from the media news that the third-party auditors found that HDC Inc's computer displays are fully compliant with environmental standards. For instance, it was found that HDC is using prohibited materials/chemicals (used as an ingredient) to manufacture the company’s computer displays.

Level 2: HDC Corporation is required to meet federal and state environmental emission requirements. On an annual basis, a third-party company conducts annual audits to ensure that HDC is meeting federal and state environmental rules. You learned from the media news that the third-party auditors found that HDC Inc's computer displays are NOT fully compliant with environmental standards. For instance, it was found that HDC is using prohibited materials/chemicals (used as an ingredient) to manufacture the company’s computer displays.

Appendix B. Study 2 Experimental Procedure

Common Module (Identical Across all Vignettes):

Kin Foods Inc. manufactures and markets branded consumer foods in the United States. The company manufactures ready-to-eat cereals, ice-cream, bottled water, processed snacks, meal kits, and nutrition bars. The company sells its products to consumers through grocery stores, membership club stores, and department stores. Kin Foods spends a similar amount on advertising on its products as compared to its rival firms. Kin Foods procures its food ingredients and related supplies from almost 250 direct suppliers; however, Kin Foods's most important suppliers are located in the Asia-Pacific region of the world to meet Kin Foods's procurement needs (i.e., these suppliers are based in a low cost-country). These suppliers are located more than 15 hours via plane from Kin Foods Inc's manufacturing facility. Kin Foods's manufacturing plants are located in the United States.

Kin Foods spends a similar amount on advertising on its products as compared to its rival firms. There are multiple competitors that you can purchase a similar product. There is not much price variation for the products sold by Kin Foods as compared to products sold by rival firms.

You recently learned from the news media that Kin Foods Inc has been accused by environmental advocacy groups that the company is purchasing most of its key ingredients for its ready-to-eat cereals products from environmentally irresponsible suppliers (i.e., suppliers who are causing air/water pollution, generating hazardous waste, causing potential health and/or environmental problems). These prominent suppliers provide the key ingredients that are used to manufacture the ready-to-eat cereals products that you would like to purchase.

Experimental Treatment Conditions

Detailed Report about Kin Foods' Supplier Environmental Issue

Level 1: A further report (prepared in consultation with a federal regulatory agency) was made available to public providing details that certain ingredients/raw materials purchased from company's major suppliers (who were found to be environmentally irresponsible) do not pose any serious health concerns to anyone.

Level 2: A further report (prepared in consultation with a federal regulatory agency) was made available to the public in regard to the details that certain ingredients/raw materials purchased from the company's major suppliers (who were found to be environmentally irresponsible) contain high levels of glyphosate, a widely used herbicide (chemical) to kill weeds. The report comes amid a longstanding debate about the safety of the weed killer "glyphosate" which many research studies suggest causes serious public health concerns. In fact, the report suggests that the company's cereal products are not fit for human consumption.

Kin Foods' Response

Level 1: The company has voluntarily recalled the ready-to-eat cereal product within two days after the suppliers' environmental problem was identified. The company contacted all of its retailers about the product recall. The retailers removed this product from their store shelves. Kin Foods Inc has replaced this product with a new product that is safe for human consumption.

Level 2: The company has denied to recall the product from the market after the suppliers' environmental problem (i.e. environmental violations) was identified. Moreover, the company has refused to comment further about whether or not raw materials/ingredients purchased from company's major suppliers cause any environmental and public health concerns. The ready-to-eat cereal products are still available in all retail stores to purchase.

Appendix C. Study 3 Experimental Procedure

Common Module (Identical Across all Vignettes):

Kin Foods Inc is a multinational firm that specializes in manufacturing and distributing a wide range of consumer food products such as breakfast cereals and other processed foods to consumers. The company sells its products to consumers through grocery stores, membership club stores, and department stores. Kin Foods Inc has an excellent reputation in the industry.

Kin Foods Inc purchases its food ingredients and related raw material supplies from almost 250 direct suppliers; however, Kin Foods Inc's most important suppliers are located in the Asia-Pacific region of the world to meet Kin Foods Inc's procurement needs (i.e., these suppliers are based in a low cost-country). These suppliers are located more than 15 hours via plane from Kin Foods Inc's manufacturing facility. Kin Foods Inc's manufacturing plants are located in the United States.

For the purpose of this study, please imagine that you are a consumer. You are ready to purchase ready-to-eat cereal product within the next one to two days at your local grocery store. The product is always available at the store. The product is manufactured by Kin Foods Inc. There are multiple competitors that you can purchase a similar product (ready-to-eat cereals) from. There is not much price variation for the products sold by Kin Foods as compared to products sold by rival firms. Kin Foods Inc spends a similar amount on advertising on its products (i.e. ready-to-eat cereal product) as compared to its rival firms.

Experimental Treatment Conditions

Voluntarily Self-Disclosure by Kin Foods Inc of their Supply Chain Problem

Level 1: You recently learned that Kin Foods Inc has voluntarily self-disclosed that their major suppliers have failed to adhere federally mandated health and environmental standards (i.e., some of its prominent suppliers have been polluting the environment, generating hazardous waste and/or using toxic chemicals which can create health and/or environmental concerns). These prominent suppliers provide the ingredients that are used to manufacture the ready-to-eat cereal product that you would like to purchase.

A report (prepared in consultation with a federal regulatory agency) was made available to the public. The report provides details that certain ingredients/raw materials purchased from the company's major suppliers contain high levels of glyphosate (a widely used herbicide to kill weeds), which many studies suggest can cause serious health concerns. However, the company has affirmed its commitment towards transparency by self-disclosing its supplier practices.

The media applauded Kin Foods Inc after they self-disclosed their supplier's problems. The environmental advocacy groups have welcomed the company's decision with appreciation using #Kin Foods Inc #environmental #leadership on social media as it would set a good example for other industry peers.

Level 2: You recently learned from the news media that Kin Foods Inc has been exposed by environmental advocacy groups that the company is purchasing most of its key ingredients for its products from environmentally irresponsible suppliers (i.e., suppliers who are polluting the environment, generating hazardous waste and/or using toxic chemicals which can create health and/or environmental concerns). These prominent suppliers provide the key ingredients that are used to manufacture the ready-to-eat cereal product that you would like to purchase.

A report (prepared in consultation with a federal regulatory agency) was made available to the public. The report provide details about certain ingredients/raw materials purchased from the company's major suppliers contain high levels of glyphosate, (a widely used herbicide to kill weeds), which many studies suggest can cause serious health concerns.

The media blamed Kin Foods Inc for hiding this information about its suppliers. The environmental advocacy groups launched an attack campaign using #Kin Foods Inc#environmental #scandal on social media.

Company's Recent Actions/Responses

Level 1: You also recently learned from the media about the company's decision to terminate its business relationships with suppliers who were using the glyphosate ingredient in its ready-to-eat cereal product.

Level 2: You recently learned from the media that the company is still conducting business with suppliers who were using the glyphosate ingredient in its ready-to-eat cereal product.

CHAPTER 5. GENERAL CONCLUSION

In this dissertation, I investigated environmental sourcing strategies from both inter-organizational and business-to-consumer (BTC) perspectives. While environmental sourcing has been at the core of a wide body of environmental supply chain management research, very little empirical work exists that considers how environmental sourcing impacts a buying firm's procurement spending and consumer behavior. The dissertation consists of three essays that shed insights into the dynamics of a firm's environmental sourcing strategies.

The first essay conducts a systematic review of the environmental supply chain management literature. This study yields important insight into key theoretical tenets described in prior literature that act as guiding principles for how firms develop internally and acquire external EM capabilities. The study's results also show that researchers studying supply chain EM capabilities have frequently drawn upon five theories: stakeholder theory, resource based-view (RBV), institutional theory, transaction cost economics theory, and natural resource-based view (NRBV). This study concludes that much of the existing body of empirical literature is centered around a theory-testing rather than a theory-building approach. Finally, this study identifies important research gaps and provides future research directions.

The second essay examines environmental sourcing strategies from an inter-organizational perspective and seeks to investigate why buying firms are willing to increase their overall business-volume with suppliers with strong environmental expertise. Drawing upon TCE and agency theory, this study provides new insight into understanding why and under what moderating conditions buyer firms either increase or decrease their overall procurement spend with suppliers that have strong environmental expertise. It was argued that buying firms seek to acquire external EM expertise efficiently (less expensively) by awarding more business to environmentally competent

suppliers and that allocating a greater proportion of procurement spend reflects a firm's commitment to relationship continuity with suppliers possessing strong EM expertise. The study extends our understanding of how a buying firm reduces suppliers' opportunistic behavior by allocating them a greater proportion of business volume.

This study tests proposed hypotheses using a multilevel model based on the dyadic buyer-supplier data derived from the Bloomberg, US Patent and Trademark Office, MSCI ESG STATS, and Compustat databases. The study concludes that buying firms can benefit from lower transaction costs arising from the uncertainty associated with acquiring external EM expertise by increasing their procurement spend with suppliers with stronger EM capabilities. The findings demonstrate that firms with greater profitability and research & development (R&D) experience tend to allocate a greater proportion of procurement spend to suppliers with environmental expertise. The study also shows that a firm's executives, when compensated for environmental, social, and governance (ESG) performance, are thereby motivated to strengthen internal EM capabilities rather than relying on external sources of EM capabilities. Finally, the findings indicate that firms with greater environmental concerns (poor environmental ratings) are less likely to allocate procurement spend among suppliers with strong environmental expertise.

The third essay takes a business-to-consumer (BTC) perspective and seeks to understand how consumers become affected by a firm's environmentally-irresponsible sourcing practices. Drawing upon cue utilization and signaling theories, this study develops a theoretical framework that describes how consumers process information in evaluating product quality and developing purchasing intentions based on a firm's environmental strategy. In this study, I argued that supplier environmental wrongdoing can represent an important extrinsic cue to consumers for evaluating product quality. I further argued that consumer assessment of product quality is affected by

spillover effects which initiate upon learning of supplier environmental wrongdoing. The study also adds to signaling theory literature by demonstrating that a firm's corrective actions (e.g., a voluntary product recall, self-disclosing of negative information, and announcing termination of the relationship with wrongdoer suppliers) can serve as trust-repairing signals that might dampen the negative effects of supplier environmental wrongdoing on consumer product evaluations. This essay employs a series of three vignette-based experiments to test its hypotheses, with all participants in the study recruited from Amazon's MTurk online subject pool.

From the study's findings, it can be noticed that both cue utilization and signaling theories support the idea that companies must align environmental sourcing strategies and associated corrective action strategies with respect to consumer perceptions of product quality. The study's findings demonstrate that consumers are more likely to perceive poor product quality when a firm switches from eco-friendly to environmentally-irresponsible suppliers. This study makes several theoretical contributions to the supply chain, consumer behavior, and environmental sourcing literatures. First, this study extends the work of Bregman et al. (2015) and Hartmann and Moeller (2014) by taking a step towards further understanding how consumers interpret environmental-sourcing practices and their associated impact on product quality. Second, the study contributes to product-harm crises literature by showing that negative consumer appraisals of product quality can be mitigated by corrective actions such as a voluntary product recall, self-disclosing negative information, or terminating relationships with suppliers committing environmental offenses.

Finally, the dissertation has laid a solid foundation for my future research work. The dissertation research has helped me identifying several specific areas where future research would be valuable. For example, I intend to explore questions related to how a buying firm's purchasing power can influence supplier engagement in reducing supply chain environmental impact. I am also

interested in examining the impact of suppliers' environmental expertise on a buying firm's environmental performance, and I would also like to use behavioral experiments related to understanding environmental attitudes and behaviors at the individual level. For example, I would like to explore how behavioral characteristics of purchasing managers and senior-level executives impact environmental sourcing (e.g., make vs. buy) decisions. Additionally, I would like to continue examining how environmental supply chain practices impact consumers.