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Top Management Team Attention To The Threats From Technological Disasters: Evidence From Polluters In The S&P 1500

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TOP MANAGEMENT TEAM ATTENTION TO THE THREATS FROM TECHNOLOGICAL DISASTERS: EVIDENCE FROM POLLUTERS IN THE S&P 1500

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ABSTRACT

Increased public attention to environmental disasters is reducing the likelihood firms can ascribe the consequential damages of stakeholders to "acts of Nature". This phenomenon indicates that the absence of top management team (TMT) attention to natural environmental issues leads a firm to control-reducing and likely-loss threats, but less is known about whether firms engage in environmental actions in response to technological disasters and why some firms actively undertake environmental action, while others do not.

Drawing on the attention-based view, I propose that technological disasters that happen in a focal firm's affiliated industry cause a TMT to increase a firm's environmental action, as mediated by the increased concerns and confidence about natural environmental issues. Using 10-year panel data, I found that TMT attention to the environmental issues was a key cognitive instrument that links technological disasters and a firm's protective environmental actions. Furthermore, family influence and outside directors play critical roles in influencing a TMT to reframe its sensitive cognitive map on a technological disaster, and thus, to sense the signals from technological disasters in a strategic perspective.

My findings contribute to research on the attention-based view by applying the view to the natural environmental context, exploring a possible mediating effect of TMT attention between technological disasters and a firm's environmental actions, and empirically testing conditional effects that will enhance TMT attention and environmental actions. Providing the framework of how firms become environmentally responsible, I will discuss some insights into how firms adjust themselves to fit stakeholders' expectations.

DEDICATION

This dissertation is dedicated to my family, especially to my father and mother who encouraged me during this challenging journey by keeping saying “I am sure you can do it”; to my father-in-law and mother-in-law who allowed me to pursue my childhood dream;; and to Eugene and Minjun who always stood by me and offered me unconditional supports and affection.

LIST OF ABBREVIATONS

ABV	Attention-Based View
BTOF	Behavioral Theory of Firm
CEO	Chief Executive Officer
chi^2	Chi-Squared
CSR	Corporate Social Responsibility
DV	Dependent Variable
EM-DAT	Emergency Events Database
PA	Environmental Protection Agency
CC	Intraclass Correlation Coefficient
HTP	Human Toxicity Potential
ISO	International Organization for Standardization
LIWC	Linguistic Inquiry and Word Count
LTS	Letter to Shareholders
MD&A	Management Discussion and Analysis
NASIC	North American Industry Classification
NTSB	National Transportation Safety Board
PCLOSE	*P* of Close Fit
RMSEA	Rootmean Square Error of Approximation
RQ	Reportable Quantity
SEM	Structural Equation Modeling
SIC	Standard Industrial Classification
SWOT	Strength Weakness Opportunity Threat
TEP	Tokyo Electricity Power
TMT	Top Management Team
TRI	Toxic Release Inventory

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Finally, I attribute the successful completion of my doctoral program to my son Minjun. I am very proud that you have grown into a fine young boy without causing any trouble during the years of hardship. I love you Minjun.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE:
SCOPE AND PURPOSE OF THE DISSERTATION

The critical role of top management team (TMT) attention to industrial events and changes such as deregulation and the introduction to technology has been studied by strategy researchers for decades (e.g., Cho & Hambrick, 2006; Nadkarni & Barr, 2008). Indeed, TMT attention has provided a pivotal consensus about the direction of organizational actions (Ocasio, 1997). Recently, natural environmental issues have been increasingly a focused point for TMTs, as environmental disasters that damage stakeholders and communities are being vividly captured and reported by individuals who carry digital recording devices.

For instance, pictures and videos of the collapse of the Fukushima nuclear power plant hit by a tsunami and the BP oil spill that polluted a massive swath of the Gulf of Mexico in 2010 quickly spread out through social networking services, and then public criticisms against the firms were heightened. Due to the technology development, a natural environment segment that TMTs are facing has radically changed and charges overwhelming clean-up and follow-up protection costs to corresponding firms (de Villiers, Naiker, & van Staden, 2011).

Unlike competitive pressures that present both opportunities and threats (Sharma, 2000), environmental disasters that are characterized by sudden and devastating threats to organizations and stakeholders may require a TMT to experience a different decision-making process than the normal decision-making process that focuses on competitive events. However, there is little empirical research on determinants of TMT attention to natural environmental issues that

possibly lead a firm to be committed to environmentally responsible actions for the prevention of the occurrence of technological disasters.

Research Objectives

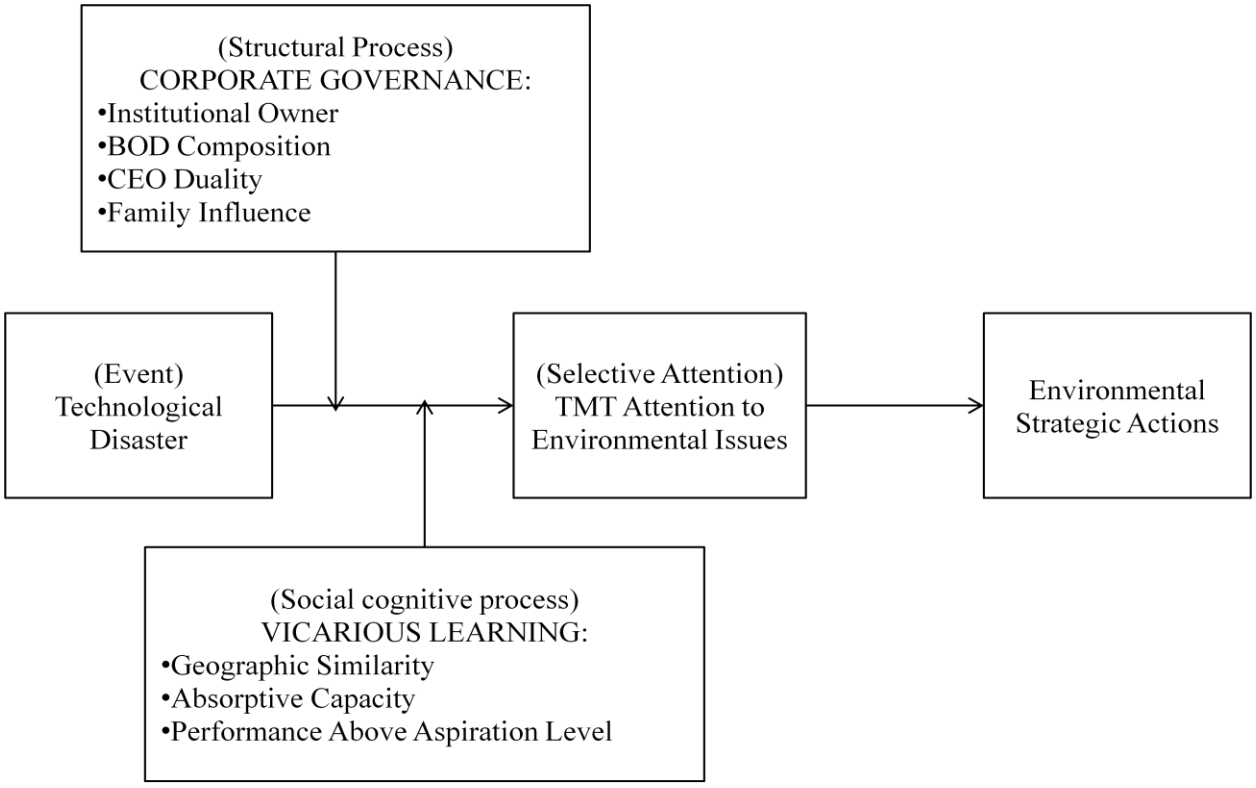
Because a technological disaster is an industry-level phenomenon that influences all firms within an industry directly or indirectly through a shared reputation and a common fate (Barnett & King, 2008), a study on a firm-level internal process by which disastrous events are attended to by managers will be able to advance our understanding of the impact of unusual events that have been away from the primary domain where firms usually focus (e.g., industry) (Rerup, 2009), but are increasingly influential so that firms' continuity could be threatened when environmental issues are less attended to(e.g., Freedom Industries filing for Chapter 11).

Researchers have examined why and how some events in relation to the natural environment generate the public attention inside and outside of an accident industry (Hoffman & Ocasio, 2001; Nigam & Ocasio, 2010). Regarding a disaster as an event, Maitlis and Sonenshein (2010) examine how an accident firm enacts its environment and goes through sensemaking process, but few studies have investigated and empirically tested how other firms operating in the same industry with an accident firm respond to a disaster by attending to and taking actions against relevant issues to the natural environment. Furthermore, little is known about why managers are encouraged to integrate environmental issues with a strategic planning process, how a technological disaster affects managerial attention, and under what conditions the level of impact gets stronger enough to activate a firm's action responding to disasters.

A better understanding of why TMTs pay more attention to environmental issues in a decision-making process motivates me to develop a hypothesized model (See Figure 1) and to address the following four research questions; 1) Do firms respond to industry-wide

technological disasters caused by an accident firm operating in the same industry? 2) Why and how do firms respond to technological disasters in different manners? 3) Does TMT attention mediate a technological disaster and a firm's environmental action as a response? And 4) Under what conditions is the mediating effect of TMT attention on the relationship stronger or weaker?

Figure 1 – Theoretical Model



Drawing on the attention-based view (Ocasio, 1997), I theorize and empirically test the impact of a technological disaster on TMT attention to natural environmental issues and how a TMT is motivated to adopt preventive strategic actions. Particularly, social and cognitive processes constituting the attention-based view could provide better explanations and insights into the effects of interactions among multiple managers in TMT or TMT managers on attention

to environments (Cho & Hambrick, 2006) I argue that attention plays a crucial role in promoting an organization-wide support for the development of environmental competency and protection. Considering the importance of TMT attention, I propose that attention to natural environmental issues fully mediates the relationship between the occurrence of technological disasters and a firm's environmental actions. This implies that the TMT attention that acts not only as firm-level motivation but also a champion for highly risky environmental initiatives is a necessary condition for the development of environmental actions for a firm's continuity (Andersson & Bateman, 2000; Ren & Guo, 2011).

My work will contribute to conceptualizing TMT attention to the natural environment and to establishing its mediating role between a technological disaster and a choice of environmental actions. Ultimately, it will contribute to extending the attention-based view by incorporating the view into the environmental management literature. Using panel data, I will test the net effect of a technological disaster and examine a significant different in TMT attention between firms influenced by the disaster and those not. Furthermore, I will also explore the boundary conditions of TMT attention by analyzing the conditional effect of corporate governance and vicarious learning on environmental actions, as mediated by TMT attention. Lastly, by highlighting the distinguishable effects of technological disasters from these of other types of disasters, this study advances our understanding of why firms actively but selectively respond to an environmental disaster.

I begin by defining a technological disaster and reviewing the attention-based view literature to examine why a TMT attends to a limited number of issues while forgoing others. I discuss how corporate governance and vicarious learning moderate the impact of technological disasters on TMT attention to natural environmental issues. I next describe methods and samples

to be utilized in this research, and conclude with the implication for future research in the environmental management literature.

CHAPTER TWO:
REVIEW OF THE LITERATURE REVIEW AND HYPOTHESES

Environmental Disaster

Environmental disasters have been studied with different labels, including massive discontinuous change (Winn et al., 2011), socio-technological disaster (Richardson, 1994), large-scale organizational crisis (Pearson & Clair, 1998), and technological hazard (Appendix A). A majority of definitions indicate that an environmental disaster is a cause of perceived crisis and characterized by low probability of occurrence but high impact on communal environments and stakeholders as well as a responsible firm for the disaster (Pearson & Clair, 1998). Therefore, the occurrences of environmental disasters do necessarily involve considerable stakeholders' perceptions on crisis, which are assumed to vary across the types of disaster, as well as lead to the sensemaking process of accident firms (Maitlis & Sonenshein, 2010; Weick, 2010)

While various definitions of an environmental disaster have been made in both management and non-management literatures, as shown in Appendix A, few studies have defined a technological disaster, particularly in the management literature and the border between a technological disaster and other types of disasters has been blurred (Shaluf, Ahmadun, & Said, 2003). Distinguishing a technological disaster from others by definition and developing its construct is fundamental to advancing our understanding of the impact, mechanism, and role of a technological disaster caused by technical failures of a firm. For the purpose, it is worthwhile to note that a common effect observed across various types of environmental

disasters is damages of organizations and communities in the three typical patterns of environmental disaster – natural, sequential, and technological.

Natural Disaster

The first type of environmental disasters is natural disasters, caused by a force of nature (i.e., flood, earthquake, etc.). Natural disasters directly damage visible assets such as properties, plants, and equipment of organizations. For example, tsunamis engulf an industrial complex as well as residential areas, tornados and typhoons sweep inventory storages and manufacturing facilities, and landslides bury plants and groups of people. The economic and non-economic damages occurred due to a natural disaster do not involve health problems that could remain for a long-term period due to oil and chemical spills and air contamination following the disasters (Boin, Van Duin, & Heyse, 2001). Natural disasters are considered uncontrollable acts of Nature and may directly generate massive damages to environments (Strömberg, 2007).

Sequential Disaster

The second type of environmental disasters includes the disasters that initially hit and destroy properties, plants, and equipment of firms and then create second-order larger impacts on communities in various manners that toxic chemicals leaked from the destroyed facilities are spread throughout broad geographical areas. One example of the damages of second-order impacts is the radioactive leakage from destroyed Fukushima nuclear plants by the tsunami that hit the Eastern ocean of Japan in 2011 (Dauer et al., 2011). The boundary of second-order impacts extends to the distribution of secondary stakeholders who do not have "a formal contractual bond with the firm or direct legal authority over the firm" (Eesley & Lenox, 2006). The second-order impacts of a disastrous event trigger indirect turmoil into the quality of lives

for secondary stakeholders due to low attention to issues related to environment concerns (Walls, Berrone, & Phan, 2012).

When natural disasters directly hit facilities, they often inflict second-order impacts upon local communities by releasing environmentally hazardous substances into the natural environment, such as chemical release from plants in Louisiana damaged by Hurricane Katrina in 2005 and Hurricane Gustav in 2008. The problem with second-order impacts can be found in a societal phenomenon that a sequential disaster resulting from a natural disaster often brings about debates as to whether firms are responsible for the economic and environmental damages that initiated by natural disasters. For example, on March 11, 2011, the Fukushima Daiichi nuclear power plant was hard hit by an earthquake and ensuing Tsunami. The first-order impacts of the Japanese Tsunami gave rise to a series of collapses of power facilities at the Fukushima Nuclear Power Plant (Aldrich, 2012). As a result, the cooling system was disabled, causing the reactors to overheat and significant radiation leaks to spread out into the surrounding Fukushima area and eventually far off into the Pacific Ocean (Dauer et al., 2011).

The case brought by the earthquake and an ensuing Tsunami in Fukushima, Japan, demonstrates the seriousness of second-order impacts of a natural disaster - radiation leakage. It is notable that low identifiability of the direct association between acts of Nature and the consequential damage may lead the TMT members of the Tokyo Electricity Power (TEP) to perceive the second-order impacts that leave economic and environmental damages unavoidable. The concept of identifiability has been mainly explored in the micro-level management studies focusing on the social loafing in organizations (e.g., Liden et al., 2004). When tasks assigned to individuals are identifiable, individuals tend to reduce social loafing because their effort is recognizable so that they could be more responsible for assigned tasks. In the macro-level

management studies, an identifiable state refers to "assignment of identity that differentiates it (a current state) from what existed before" (Ford & Ford, 1994: p.767). Shrivastava (1987) suggests that in order for an event to cause a crisis, a specific event should be "identifiable in time and place and traceable to specific man-made causes" (p.8).

When an event is not highly associated with damages, stakeholders who cannot differentiate the specific association from others tend to incorrectly ascribe the cause of damages to any firm in the same category or industry (Zavyalova et al., 2012). In that sense, a firm's active engagement in internal investigation with regard to environmental disasters could leave stakeholders an imprecise clue that the firm engaged has at least a partial responsibility for the disaster when a low identifiable disaster happens. Thus, the low identifiability tends to make firms less responsive to an environmental disaster and does not lead them to adopt proactive environmental actions.

Technological Disaster

The last type of environmental disasters represents the case that an environmental disaster takes place due to technological mistakes and causes massive damages to communal environments (Roberts, 1990; Reed & Fitzgerald, 2011). For the most part, human, organizational, and technical factors are identified as factors that cause a technological disaster (Shrivastava, Mitroff, & Miller, 1988). The BP Deepwater Horizon Oil spill that contaminated the Gulf of Mexico in 2010 and the chemical spill into West Virginia's Elk River by Freedom Industries in 2014 are classified into this category.

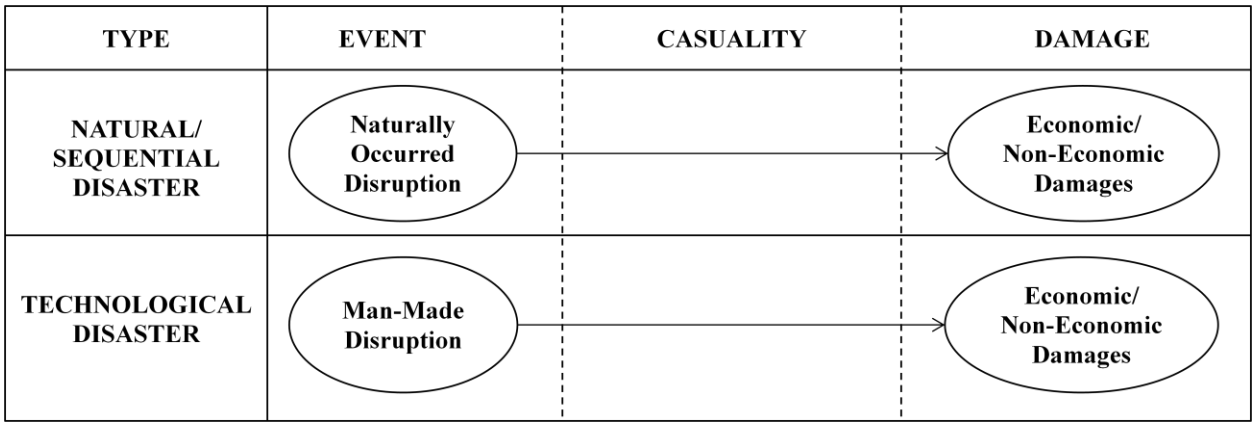
The Deepwater Horizon was a semisubmersible offshore drilling rig that was contracted to BP by Transocean. The rig was capable of drilling wells in excess of 35,000 feet while operating in water depths up to 10,000 feet. It was operating in 5,000 feet of water on an oil well

(Baiocchi & Welser, 2010). On April 20, 2010, Deepwater Horizon exploded and sank, as a remote switch failed to activate a blowout preventer. By late May, the destroyed well was estimated to leak 30,000 to 60,000 barrels of crude oil a day (Reed & Fitzgerald, 2011). Given that if the blowout preventer had properly functioned, the massive leakage from the Deepwater Horizon must not have occurred. Therefore, the BP oil spill case can be classified as a technological disaster caused by an identifiable malfunction of a remote switch that ultimately led to marine pollution in the Gulf of Mexico (Reed & Fitzgerald, 2011).

Similarly, the Freedom industries case also illustrates that a technological failure to prevent a one-inch hole in the bottom of a storage tank from which hazardous chemicals were released into the Elk River ultimately left more than a hundred residents who were damaged from contaminated drinking water and experienced related diseases such as nausea, headaches, burning skin, rash, etc. (The Washington Post, Jan 10, 2014). Therefore, the common attribute of both cases was what the public could understand and identify the link between the explosion of the Deepwater Horizon for BP and the one-inch hole at Freedom Industries and resulting massive oil and chemical spills. According to Hoffman and Ocasio (2001), social salience of an event is created when outsiders of an accident industry can attribute direct accountability to the industry (i.e., identifiability) or when insiders of the industry can examine an accident as a threat to the industry's image (i.e., damage) The direct association between a man-made error and environmental and non-environmental damages heightened public attention to an accident firm and its industry (Barnett & King, 2008), thus igniting TMTs operating in the same industry to perceive the possibility of receiving greater penalty from the public if similar technological disasters are repeated, thus damaging its industry image and identity (Hoffman & Ocasio, 2001). As illustrated in Figure 2, the identifiable causality between a man-made cause and massive

damages is the attribute of a technological disaster, distinguishable from the attributes of a natural disaster and a sequential disaster.

Figure 2 – Classification of Environmental Disasters by Event



Following previous disaster studies in the crisis management literature (e.g., Richardson, 1994; Robert, 1990; Weick, 1988), I define a technological disaster as an extensive and low-probability disruption to stakeholders and the natural environment made by controllable organizational and technological failure. The definition indicates that organizational and technological failure (e.g., oil spill occurred by man-made mistake) alone does not fulfill the conditions of being classified as a disaster. Instead, when a technological failure causes economic and non-economic damages massive enough to trigger the public attention from stakeholders, the catastrophic event is classified as a disaster (Roberts, 1990; Richardson, 1994) and is critical to shaping organizational attention to relevant issues (Gavetti et al. 2012; Ocasio, 2011). Furthermore, regarding the disruption shown in the definition of a technological disaster, this study adopts an operational definition suggested by the Center for Research on the Epidemiology of Disaster at the Universite Catholique de Louvain in Belgium. By definition, an

extensive disruption to stakeholders includes at least one of the following criteria: "10 or more people are reported killed; 100 or more people are reported affected, injured, and/or homeless; the government declares a state of emergency; the government requests international assistance."

With regard to a similar construct, a technological disaster is conceptually different from wrongdoing, which is defined as a firm's behaviors that "place a firm's stakeholders at risk and violates their expectation of societal norms and general standards of conduct" (Zavyalova et al., 2012: p. 1080). Industry wrongdoing is related to quality that exists when a firm's offerings meet or exceed stakeholder's expectation. When a firm intentionally or unintentionally violates customer expectation by providing defective products, wrongdoing happens. When that happens, an accident firm makes compensation to stakeholders in a way of product recall (Zavyalova et al., 2012). Meanwhile, a technological disaster is disruptive and unprecedented so that the violation of social contract cannot be applied to an accident firm which may or may not have fulfilled stakeholders' expectations. When a technological disaster happens, a responsible firm ends up transferring damages to stakeholders in a way of social cost.

Technological Disasters and Environmental Actions

As the primary purpose of this study is to explore the mediating effect of TMT attention to natural environmental issues in the environmental decision-making process, the first thing to be done is to establish a theoretical association between a technological disaster and a firm's environmental action. That is, if no theoretical relationship exists between a technological disaster and a firm's environmental action, TMT attention has nothing to mediate (Mathieu & Taylor, 2006)[1].

[1] Mathieu & Taylor (2006) distinguish indirect and mediating relationships. Unlike a mediation relationship, an indirect relationship does not necessarily demonstrate the direct effect of an independent variable and a dependent variable. As indirect effect includes a chain of events such that technological disaster affects TMT attention, which,

Research in the environmental management literature has seen a preventive environmental action as a firm's effort to nurture capabilities for environmental competency (Hart, 1995; Hart & Dowell, 2011). The anticipated outcomes of the action include organizational efficiency/productivity and increased financial performance. Meanwhile, a protective environmental action mainly seeks environmental legitimacy, which is achieved when stakeholders believe that a focal firm's business objectives and practices at least fulfill their expectations (Suchman, 1995). According to Chattopadhyay, Glick, and Huber (2001), organizational actions are made depending on whether managers perceive an event as a threat. Specifically speaking, when TMTs perceive events as either a threat to market control or a firm's profitability, they actively take actions to avoid or reduce threats. Under the circumstances where the causes of a technological disasters are readily identified and attributed to a firm, a TMT perceives a technological failure that could cause economic and environmental damages as a salient threat and ascertains that a firm's intentional or unintentional involvement would result in the loss of firm's performance and market share (McMullen, Shepherd, & Patzelt, 2009), as well as the loss of legitimacy (Deephous & Carter, 2005). These unrealized threats motivate a TMT to seek either internal or external strategic actions, and the choice depends on the type of expected losses (Shinkle, 2012).

When a TMT perceives a threat to market share of its firm, it tends to take internally-oriented actions by strengthening the quality, productivity, and efficiency of its products and attempts to alleviate control-reducing threats (Chattopadhyay et al., 2001). To offset negative perception of control-reducing threat from the a technological disaster, a TMT enhances internally-oriented environmental actions in a way that a firm reduces wastes and defects by

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in turn, affects a firm's environmental action, the direct effect of the disaster on a firm's action is not prerequisite for an indirect effect.

integrating environmental management into a manufacturing process. This environmental action increases a firm's control in a manufacturing process by reducing defects, a competitive advantage in a competitive market by increasing productivity and efficiency, and a social responsibility in a general environment by stabilizing its organizational operation.

Similarly, a TMT can perceive likely-loss threats due to its firm's involvement in causing technological disaster. The likely-loss threat implies that causing a technological disaster could result in losses of customers, reputation, and performances. According to threat-rigidity hypothesis (Chattopadhyay et al., 2001; Ocasio, 1995), when likely-loss threats are perceived, a TMT tends to choose externally-oriented actions to keep its market power from uncertainties. To offset the negative perception from the likely-loss threat of a technological disaster, a TMT enhances externally-oriented environmental actions in a way that a firm nurtures environmental competency and develop environmental stewardship that requires experience and knowledge of preventive environmental actions (Hart, 1995).

Lastly, a TMT perceives legitimacy-loss threats due to environmental disaster caused by technological failure. Unlike reputation, which is based on a firm's competency, legitimacy is present only when a firm is "meeting and adhering to the expectations of a social system's norm, values, rules, and meanings" (Deephouse and Carter, 2005: p.331). This indicates that as long as a firm abides by desirable and appropriate value in a societal system, it can survive at least by getting favorable exchange conditions that delegitimized firms cannot obtain. A firm seeking environmental legitimacy rather than competency tends to exert their efforts to meet minimal requirements specified by stakeholders. This environmental action at least enables the firm to avoid being criticized for having been irresponsible for environmental issues when technological disaster happens, and the action is referred to as a protective environmental action.

Attention-Based View

Proposed by Simon (1976) and March and Simon (1958), individual level of attention in an organization has been long discussed. Assuming the bounded rationality of a decision-maker constituting three central concepts – satisficing, search, and routinization (Gavetti et al., 2012), behavioral theorists focus on how managers set organizational goals and how they behave to achieve those goals under uncertainty. In the behavioral theory of the firm, subjective salience plays a critical role in determining the level of organizational goals, and managerial attentions of decision-maker are based on the salience (Nadkarni & Barr, 2008; Shinkle, 2012).

As a complementary view to the behavioral theory of the firm, the attention-based view assumes an organization as systems of structurally distributed attention in which cognitions and actions of individuals are derived from organizational contexts and situations and define organization-level attention as "the noticing, encoding, interpreting, and focusing of time and effort by organizational decision-makers on both issues … and answers" (Ocasio, 1997; p.189). The attention is shaped by a firm's formal, informal structures, routines, procedures, communication channel, as well as organizational goals (Cho & Hambrick, 2006). The selective attention to organizational issues and initiatives leads to decision-making and, ultimately, a firm's competitive advantage (Ocasio & Joseph, 2005).

This view enlarges determinants of organizational attention to include social-cognitive and structural processes that encode, understand and focus efforts and time on external stimuli in different manners (Barreto, 2013; Ocasio, 1997). This view provides the lens that links events in general environments and strategic actions by explaining why organizations selectively pay attention to a few events, how organizational contexts create distinguishable internal situations

that facilitate communication and interactions among TMT managers, and how firms distribute that attention in response to external environments (Ocasio, 1997).

In the attention-based view, external environments are viewed as the source that provides an unlimited number of events (Ocasio 2011). Meanwhile firms are characterized by their limited ability to identify, understand and process all information from environments (Cyert & March, 1963). Thus, firms are assumed to selectively attend to a few events by coordinating structural, social, and cognitive processes of attention and adapt to the environment (Levinthal & Rerup, 2006; Ocasio, 1997; Rerup, 2009). It indicates that the attention-based view provides an alternative perspective of a firm's action to the theories that emphasize environmental determinism, since the action is driven by what issues and answers a TMT focuses its attention on, the focus of attention determined by the organizational context in which the firm is situated and the governance structure that influences a TMT's problem framing (Ocasio, 1997; Thomas, Clark, & Gioia, 1993). Ocasio (1997) conceptualizes the view by proposing three principles of organization-level attention.

Three Principles of Organization-Level Attention

Selective Attention as Manifestation of Individual Cognition

Following the assumption of the behavioral theory of the firm, Ocasio (2011) assumes that firms cannot equally distribute attention to all possible external events and proposes that they selectively attend to a limited number of strong cues and ignore others, the attention referred to as selective attention. The assumption behind the relationship between the presence of numerous external stimuli and selective attention is that a TMT, consisting of managers who have bounded rationality, focuses its attention on the limited stimuli based on salience (Cyert & March, 1963). It is notable that actual events are not necessarily influence a TMT turn its

attention to relevant issues unless a TMT perceives the events as salient (Lampel, Shamsie, & Shapira, 2009). When the event is perceived as salient (Elsbach, Barr, & Hargadon, 2005), a TMT labels and categorizes the event into its routinized cognitive framework through enactment in the process of sensemaking (Weick, 1988; Weick & Sutcliff, 2006; Weick, Sutcliff, & Obstfeld, 2005).

Sensemaking is "the process of social construction that occurs when discrepant cues interrupt individual ongoing activities, and involves the retrospective development of plausible meanings that rationalize what people are doing" (Maitlis & Sonenshein, 2010; p.551). When organization focuses a problematic situation that is interrupted by an unexpected event, people materialize this uncertain situation by giving a meaning and transform it to a problem by labeling and categorizing the situation (Weick, 1995), and the problem that was labeled and categorized places relevant issues on an agenda to attend to (Lüscher & Lewis, 2008).

From the perspective of sensemaking, a disastrous event such as a technological disaster is enacted, rather than encountered (Maitlis & Sorenshein, 2010; Weick, 1993). The term enactment describes the process by which people conceptualize an event that was not categorized in cognition by setting aside portions of cognitive repertoire and symbolize the conceptualized event to reinforce its meaning for further attention (Weick, 1988). As the result of the enactment process, people in an organization have the enacted environment where the symbolized event is assigned significance and meaning and is linked to future actions. Thus, enactment process enables people to commonly attend to an event by facilitating individuals to make more sense of it through categorization and symbolization (Fiske & Taylor, 1991). Weick (1993) used the disaster that 13 U.S. Forest Service Smokejumpers died in the process of extinguishing forest fire

in rugged mountain to examine why sensemaking of a highly trained team was collapsed and suggested that the emergent situation was not properly noticed and enacted.

Enactment is referred to as both a process and a product that are produced as people act upon a new threat in routinized activities (Weick, 1988). The discrepancy between changed environments due to a new threat and ongoing activities facilitates enactment that includes the activities of constructing, categorizing, and prioritizing a problematic event (Lampel, Shamsie, & Shapira, 2009), which are the foundation for the selection of meanings (Gephart, 1993; Weick et al., 2005) and for organizational change (Lüscher & Lewis, 2008). According to Lüscher & Lewis (2008), the whole process of sensemaking by which people enact, interpret, and select is differentially shaped by organizational identity – who we are, as identity determines what we enact, how we understand and interpret, and what we act (Ocasio, 1997). In sum, a disruptive event that provides TMT managers with a salient signal leads a TMT to go through enactment process and then to have a selective attention to a few issues that were prioritized through enactment.

Situated Attention as Manifestation of Contextual Influence

Secondly, Ocasio (1997) proposes situated attention. What a TMT focuses on and how it behaves is shaped by its external and internal contexts of organizations (Barnett, 2008; Ocasio, 2011). According to Cialdini, Reno, and Kallgreen (1990), the impact of signals from an event on attention and action of signal recipients varies depending on the situation where the recipient and the event are commonly located. If the situation is supportive of what the event intends to imply, the event could draw recipient attention via supportive situations. For organizations influenced by different types of internal and external situations including competitive dynamics (Dess and Beard, 1994), absorptive capacity (Cohen and Levinthal, 1990), slack resources

(Greve, 2008), and geographic distance from an event (Baum, Li, & Usher, 2000), the intensity of situated attention could vary across organizations.

The extent to which a TMT focuses its attention on an issue varies depending on the contextual determinants such as firm performance (Tuggle et al., 2010) and growth (Greve, 2008), which play a crucial role in strengthening situated attention by facilitating insiders to discuss the situation they are located in (Ocasio, 1997), and the speed at which an industry changes (Nardkarni & Barr, 2009). Nardkarni and Barr suggested that high velocity environments lead to attention to competitive and market environments. Plourde, Parker, and Schaan (2013) examine the circumstances where expatriates helps overseas subsidiary to attract headquarters' attention. The context influences participants in a discussion in concert with the symbol of language that represents meaning or substance (Geertz, 1973), and the integration of an issue with symbolism facilitates them to categorize it in a communication channel (Gioia et al., 1994).

The more TMT managers perceive to be situated together, the more they tend to intensively share and communicate what they focus time and efforts on, then forming an attention emerged from a communication channel (Ocasio, 1997; 2012). In this process, they interact, engage in communication, and influence one another (Ocasio 1997) and tend to have homogenous attention to events in the channel. The emerged, situated attention is reflected through the internal communication channel in which some forms of cognitive schema and contexts surrounding an organization interact and elicit participants to experience sensemaking processes (Elsbach, Barr, & Hargadon, 2005) and to determine what individual behave (Cialdini, Kallgreen, & Reno, 1991) In sum, internal and external environments determines the intensity of signals from an event that will be shared and discussed in communication channels. While

interacting and communicating among insider, situated attention is emerged from the channel. The intensity of situated attention to a specific event and relevant issues could vary according to the extent to which signals from an event are relayed.

Structural Distribution of Attention as Manifestation of Structural Process

The third principle is a structural distribution of attention, which suggests that the rules, resources, and players of a firm govern social, economic and cultural mechanisms that vary across firms (Barnett, 2008; Ocasio, 1997). The mechanisms distribute and control the channels of decision making through which TMT managers interact (Ocasio 1997). As forms of communicative exchange, governance channels shape the attention of decision makers and thus lead to change in strategic direction, and the formal channels generate informal channels, and the interconnection across formal and informal channels guides strategy formulation (Ocasio & Joseph, 2005). According to the authors, as channels are embedded in organizational social and economic structure consists of rules, resources, and people, attentions of TMT managers surrounded by governance channels are socially structured and thus focused on selective issues enacted by people who allocate rules and resources.

A TMT, standing in the middle of the mechanisms, evaluates and legitimizes issues that are rushed in from both inside and outside of its organization by being influenced by communication channels embedded in those mechanisms (Ren & Guo, 2011). This attention process is closely related to issue selling, which is referred to as "the process by which individuals affect others' attention to and understanding of the events, developments, and trends that have implications for organizational performance" (Dutton et al., 2001: p. 716). As interests and identities are structured through the network of formal and informal channels, the structures of TMT attention is determined by how organizational players control and distribute the

allocation of interests and identities. As a result, the allocation of identities and interest of TMT managers is an underlying determinant to their enactment, understanding, and interpreting environments and, furthermore, strategic directions.

From the perspective of bounded rationality of managers, a TMT relies on logic (Thornton & Ocasio, 1999), embeddeness in institution (Hung, 2005), structure and structure (Kabanoff & Brown, 2008), identity and image (Hoffman & Ocasio, 2001), players (Maula, Keil, & Zahra, 2013), procedures, rules, resources and processes when it selects issues initiated by both inside and outside stakeholders (Dutton et al., 2001). Thornton and Ocasio (1999) posit that an editorial logic as an institutional logic influences executives to focus their attention on author-editor relationships, whereas market logic influences them to focus more on issues of resource competition and organizational growth. Observing organizational attention of Taiwanese IT firms, Hung (2005) found the extent to which firms are embedded in institutional environments influence the firm to pay more attention to institutional environment when entering into a new market. Hoffman and Ocasio (2001) posit that public attention is shaped when an event damages industrial identity and image. Kabanoff and Brown (2008) suggest that strategic configuration of clusters of strategic elements determines organizational attention. Regarding players, Maula et al. (2013) suggest that corporate venture capital leads to TMT attention to technological discontinuity. These examples implies that top-down or schema driven TMT attention that is influenced by the individuals or groups who are eligible to distribute routines, procedures, and rules by governing resources and processes. In this process, a TMT dissolves its existing problem framing on issues and reframes it to interpret issues and the whole process is based on its organizational interests and identities (Gioia & Thomas, 1996; Ocasio, 1997).

Technological Disasters Affecting TMT Attention:

Hypotheses Development

In the process of framing a TMT's cognitive framework, managers subjectively prioritize issues and answers in accordance with the salience of events (Daft & Weick, 1984; Weick, Sutcliff, & Obstfeld, 2005). Despite their affiliation with the same organization, the degree to which managers view natural environmental issues as salient varies from individual to individual before a technological disaster happens. After a salient event is noticed, TMT managers reconstruct homogeneous and consistent cognitive repertoires of categories and make more sense of issues relevant to the noticed event (Ocasio, 1997; Weick, 1995). The more disruptive an event is, the more likely a TMT is to enact its environment and adjust a cognitive framework with new priorities and implications for future actions (Arrfelt, Wiseman, & Hult, 2013), rather than to rely on routinized framework (Weick & Sutcliff, 2006).

Causing economic, human, and environmental damages and characterized by identifiable causality, a technological disaster gives rise to social salience in an accident industry (Hoffman & Ocasio, 2001) and facilitates the enactment process of TMT managers (Ocasio, 1997), as the disaster causes crises and "a collective breakdown in sense making" (Pearson & Clair, 1998: p. 64). Hoffman & Ocasio (2001) define social salience as "the prominence or importance of a stimulus to a particular context" (p.429). The attribution of accountability and the pressures from insiders and outsiders of an affiliated industry who condemn an accident firm create social salience that serves as an implicit rule that possibly regulates the firms operating in the same industry with an accident firm (Hoffman & Ocasio, 2001; Zavyalova et al., 2012).

When a salient event is noticed, organizations, at least, "consider the type of request being made and the type of problem being faced… and what role they are playing in a particular

context" (Levinthal & Rerup, 2006: p. 507) and encode issues ingenerated by a technological disaster into cognitive repertoire of categories. When existing routinized processes and ongoing activities cannot effectively address the situation caused by the occurrence of a technological disaster, decision-makers go through mindful enactment (Levinthal & Rerup, 2006). According to Weick, Sutcliff, and Obstfeld (2005), categorizing and labeling the problematic situation enables managers to be more oriented and closer to possible signals created by an event for close attention and deploy cognitive repertoire of categories that is amenable to functional activities. Therefore, a sensemaking process triggered by a technological disaster has a TMT differentiate a natural environment segment from other segments and materializes a problematic situation as an issue.

I suggest that the salience of a technological disaster elicits TMTs who work in the same industry where a technological disaster occurs to go through enactment process by which issues that are relevant to technological disasters are prioritized and focused in accordance with the salience (Weick, 1995). By definition, a technological disaster means an extensive and low-probability disruption to the natural environment and stakeholders, leaving environmental and economic damages. In a narrow sense, environmental issues include only problematic situations surrounding business classified by Anderson and Bateman (2002) such as air pollution, solid waste disposal, topsoil erosion, ozone depletion, pollution growth, marine and fresh water pollution, toxic waste accumulation and disposal, reduction in biodiversity, wetland destruction, deforestation, and climate modification. Meanwhile, drawing on the definition of Ocaiso's (1997) organizational attention could enlarge the range of natural environmental issues by including the answers to corresponding environmental problematic situation such as proprietary

environmental programs and technologies, business practices of treating wastes, environmental regulations, and so on.

As a central entity of triggering technological disasters, organizations have been criticized for transferring social costs to the natural environment and experienced negative spillover that happens when a firm do harm to the reputation intertwined with other firms in the same industry (Barnett & King, 2008; Yu, Sengul, & Lester, 2008). Furthermore, the negative spillover effect is more intensified, as outsiders of an industry tend to ambiguously categorize and attribute the damages of an accident to an industry as a whole (Zavyalova et al., 2012).

Given that an issue is "a development, event, or trend perceived as potentially having an impact on the organization" (Bansal, 2003: p.511) and organization's problems and opportunities (Ocasio & Joseph, 2005), the occurrence of a technological disaster could lead other firms operating in the same industry to attend to the issues that are adversely affected by a technological disaster as a negative, potential impact on organizations through stakeholders (Hoffman & Ocasio, 2001; Nigam & Ocasio, 2010). Therefore, salience of a technological disaster leads a TMT to focus time and efforts on natural environmental issues. Therefore,

Hypothesis 1: Technological disaster is positively associated with TMT attention to natural environmental issues

A Contingency Framework of TMT Attention to Natural Environmental Issues

Corporate Governance

The underlying concept of a structural distribution of attention is how a TMT attends to depends on how the organization distributes and controls the allocation of communications and procedures (Ocasio, 1997). The distribution of communication channel structured by organizational rules, resources, and players shapes TMT attention to issues (Barnett, 2008;

Ocasio, 1997). According to Ocasio (1997), the structure of attention facilitates TMT managers to go through the enactment of the environment by structurally distributing interests and identities of TMT managers (Ocasio, 1997). It suggests that TMTs vary in the extent that they attended to an issue, and the degree of TMT attention to an issue is determined by attentional structure, and the structure shapes a problem framing of TMT managers by distributing and controlling the allocation of communication channel along with personal identities and interests of TMT managers (Kahneman & Tversky, 1979; Ocasio, 1997).

Corporate governance including influences of a founder's family and controlling shareholders, composition of directors, and effective controls of CEO renders some events more salient to TMT managers. The salience, in turn, serves as an implicit rule within an organization that enforces TMT managers to be more attentive to related issues and answers (Hoffman & Ocasio, 2001). When TMT managers perceive threats from a technological disaster as greater due to its organizational governance, they enact their own cognitive framework and reprioritize relevant issues to the disaster in response to an low-probability and sudden disruptive threat (Chattopadhyay et al., 2001; Weick & Sutcliff, 2006).

Throughout the process by which a TMT notices a technological disaster and focuses its attention on natural environmental issues, a firm-specific structural distribution of attention formed by governance characteristics substantially influences TMT managers to build a negative problem framing on technological disasters and to be highly sensitive to technological disasters. Therefore, it is reasonable to assume that a TMT has different level of attention to natural environmental issues depending on corporate governance. I propose that ownership dispersal, family influence, outside directors, and non CEO duality build a negative problem prospect on a technological threat, thus eliciting a TMT to be more attentive to natural environmental issues.

Ownership Concentration

Ownership concentration refers to the extent to which outstanding shares are concentrated in the hands of blockholders who can effectively monitor management and affect the overall direction of strategy (Dam & Scholtens, 2013). High ownership concentration that effectively eliminates information asymmetry between shareholders and management was found to discourage the agency behaviors of managers who could otherwise prioritize their personal interests over a firm's interest by monitoring management (Demsetz & Lehn, 1985). For another attribute, controlling shareholders own significant amount of equity positions in their invested firms, which constrains them from flexibly disposing their equity positions at the desirable price.

Alternatively, they tend to tolerate short-term unprofitability as long as long-term payouts are expected. When controlling shareholders as a provider of a valuable resource identify strategic decisions of invested firms is conflicting to their long-term investment intention, they increase stakeholder salience to a TMT and influence a direction of managerial decision by exercising their powerful, legitimate, and urgent claims (Mitchell, Agle, & Wood, 1997) rather than withdrawing their ownership positions from the firm. A TMT under controlling shareholders or blockholders holding a majority of ownership may have a negative problem framing on a technological disaster and attend it as adversely affecting long-term performances. Therefore, when ownership is highly concentrated to blockholders, a TMT is more likely to facilitate enactment by which natural environmental issues are prioritized (Weick, 1995).

Hypothesis 2: *Ownership concentration will positively moderate the technological disaster and TMT attention relationship.*

Outside Director

The primary role of the board of directors is to effectively fulfill their control over and service tasks for management, which includes offering advice and counsel to a TMT (Forbes & Milliken, 1999). I suggest these two roles have a significant implication for TMT attention to natural environmental issues. Inside directors are identified as being dependent of a TMT due to an inconvenient position to monitor TMT performance regularly, a loyalty they have long exhibited to TMT managers, and possible losses of personal interest (Johnson, Daily, and Ellstrand, 1996). For outside directors, however, their independence makes it possible to freely suggest adjusting strategic orientations and to propose alternatives to the existing policies maintained by a TMT (Forbes & Milliken, 1999). This indicates that the more outside directors engage in the governance, the more diversified interests, perspective, and professional knowledge are (Johnson & Greening, 1999).

The presence of outside directors who bring in various perspectives and knowledge increase the possibility that a firm notices and encodes possible threats that had been unrecognized before outside directors were present in the board. Further, it gives more weights to managing threats that are ultimately directed to stakeholders who have a wide range of the needs (Johnson et al., 1996). For a TMT whose decisions and performances are monitored and influenced by outside directors, its internally oriented attention to pursue self-interests is discouraged, while its externally oriented attention tends to be encouraged due to a established problem frame that encodes and interprets environmental concerns as salient to be able to adversely affect the relationship with stakeholders and to result in deteriorated quality of environments (Walls et al., 2012). A TMT under outside directors evaluates a technological

disaster as a risk that adversely affects its interests and identities and is more likely to facilitate enactment by which natural environmental issues are prioritized.

Hypothesis 3: *Outside directors will positively moderate the technological disaster and TMT attention relationship.*

CEO Duality

CEO duality is referred to as the situation where "the same person holds the titles of CEO and chairperson of the board of directors in a corporation" (Tuggle et al., 2010: p. 951). This situation reduces monitoring of board of directors (BOD) toward management by engaging in both management and control (Tuggle et al., 2010). Lowering the intensity of BOD monitoring over managerial decisions through the duality, CEO can take actions opposed to shareholders' interests by taking advantage of his/her enhanced discretion (Zhang & Rajagopalan, 2004). Since CEO is internally oriented and focuses on the performances that could improve its compensation (Mallette & Fowler, 1992), it possibly promotes CEO entrenchment that occurs when CEO is so powerful as to earn more personal interests by compromising on shareholders' interest (Finkelstein & D'Aveni, 1994).

A CEO who is internally focused due to duality tends to seek, for instance, unrelated diversification strategy to reduce his/her employment risk by sacrificing the interests of shareholders (Hoskinsson & Hitt, 1990). CEO's individual motivation to lower employment ends up with leaving risks to shareholders (Gomez-Mejia, Nunez-Nickel, & Gutierrez, 2001). In the same logic, CEO reduces the attention to external environments and becomes more attentive to internal environments such as entrenchment (Finkelstein & D'Aveni, 1994). This indicates that a TMT under the CEO duality evaluates a technological disaster as a risk that would not harm its interests and identities and is less likely to facilitate enactment by which natural environmental issues are prioritized.

Hypothesis 4: *CEO duality will negatively moderate the technological disaster and TMT attention relationships.*

Family Influence

Aiming at inter-generational succession, family firms tend to maintain family identity and influence in an organization for a long-term period time. The family goal induces a firm to allocate more efforts and resources to managing its social reputation and the ties with stakeholders (Duh, Belak, & Milfelner, 2010) and to adopt policies that demands a long-term commitment (Gomez-Mejia et al., 2007). Although the policies need substantial capital investment that reduces financial slacks (Hart & Ahuja, 1996) and undermines a short-term profitability (Chrisman, Mernili, & Misra, 2013), family firms often assume the risks, as they believe environmentally irresponsible actions could adversely affect family affective wealth such as the loss of family influence that could discontinue their long-term succession planning (Gomez-Mejia et al., 2007).

Family influence increases commitment (Zahra et al., 2008) and empowerment (Eddleston, Kellermanns, & Zellweger, 2012), thus enabling managers to consider taking more risks for affective needs of families (Gomez-Mejia et al., 2007). Hernandez (2012) proposes that the effect of family influence on managers' cognitive process is enhanced when a mental model for family value is shared between managers and families. This is, the mental model promotes managers to act for and think like owners by prioritizing family affective needs. Similarly, a TMT under family influence will have a negatively framed perspective on the possibility of being involved in a technological disaster, which will harm the reputation of a founder's family. Therefore, TMT under family influence evaluates a technological disaster as a risk that adversely

affects its interests and identities and is more likely to facilitate enactment by which natural environmental issues are prioritized.

Hypothesis 5: Family influence will positively moderate the technological disaster and TMT attention relationship.

Vicarious Learning

The underlying concept of situated attention is what a TMT focuses on and behaves depends on the particular context its organization is located in (Ocasio, 1997). As TMT managers affiliated with an organization are exposed to the same environments, within-group variance in selective attention is smaller than between-group variance. It indicates that an organizational cognitive framework has been built through social cognitive process (Levinthal & Rerup, 2006; Weick & Sutcliffe, 2006) by which individual cognitive frameworks influence one another among TMT managers. This process is referred to as situated cognition (Elsbach, Barr, & Hargadon, 2005).

Similarly, attentions of individual TMT managers are shared in the decision-making process and the focusing of attention emerges from the social interaction among TMT members who participate in communication channel (Ocasio, 1997). The emergent attention in the communication channel is referred to as situated attention (Ocasio, 1997; Schilling et al., 2003), which is the product of communication through which TMT managers share and discuss what they noticed and interpreted about the situation that organization is located in. The situated attention is stronger when TMT managers can make temporal (i.e., frequency) and spatial (i.e., scope) commitment to communication (Ocasio, 1997). Therefore, the context that could motivate them to actively participate in communication channels will moderate the impact of a technological disaster on TMT attention to natural environmental issues.

Given that a disaster triggers uncertainties (Pearson & Clair, 1998), firms are motivated to learn other firms' environmental practices and strategies to reduce uncertainties, thus facilitating situated attention to natural environmental issues in a way that communication among TMT managers is more frequent and intensive. This is, it is notable that organizational characteristics such as performance relative to aspiration level (Greve, 2003), a firm's ability to absorb external knowledge (Cohen & Levinthal, 1990), and similarity to an accident firm (Baum et al., 2000) increase the likelihood that TMT managers are motivated to learn environmental strategies and practices from others.

Vicarious learning is distinguishable from experiential learning that firms obtain knowledge by doing something new (Huber, 1991). Vicarious learning is referred to as "an attempt to learn the strategies, management practices, and especially technologies possessed by other organizations" (Tsang, 2002: p. 836). According to Tsang (2002), the attempt to learn from others increases as managers highly perceive the needs for the knowledge and are exposed to more information than they immediately need. Thus, I propose that organizational conditions under which TMT managers are broadly exposed to and feel more needs for knowledge related to a technological disaster enhances situated attention to natural environmental issues.

Geographic Similarity to an Accident Firm

Disasters increase uncertainties to firms (Weick, 1988). When firms identify highly uncertain events, they tend to imitate the actions of other firms having similar organizational characteristics to reduce uncertainties (Gentry, Dalziel, & Jamison, 2013; Peng, Tan, & Tong, 2004). As technological disasters that are characterized by low-probability and sudden disruptions to external environments create uncertainties, firms relying on limited experiences

and knowledge observe how other firms operating in the same industry address the consequences to reduce uncertainties and acquire new knowledge (Baum et al., 2000).

Following the logic above, when the accident firm has similar characteristics to those of a focal firm, the focal firm will make more sense of a technological disaster and intensively focus its attention on possible spillover effect that would adversely affect itself due to geographical similarity. Geographic similarity is referred to as the extent to which a focal firm is proximately located with other firms (Lee & Pennings, 2002). Geographic similarity is characterized by the situation where clienteles are commonly shared and firms directly and symbolically interact one another (Lee & Pennings, 2002). Furthermore, the similarity provides a crucial reference that a TMT socially compares its capabilities of addressing threats in a similar context to, and the intensity of learning by observing others firms' actions against an event increases organizational attention (Greve, 2003). As a result, high degree of geographical similarity increases the likelihood that a firm observes and learns from mistakes of an accident firm (Csaszar & Siggelkow, 2010).

More specifically, motivation of a focal firm to vicariously learn and attention to the relevant issues are stronger when information on the firm is observable and relevant so that a focal firm could compare and infer possible scenario (Greve, 1998). It is reasonable to anticipate that firms have similar strategic profile such as the location proximity of a focal firm and an accident firm (Baum et al. 2000). In the context, TMT managers are more motivated to actively communicate one another to share what they attended to and to predict the possibility that its firm is involved in causing a technological disaster. The increased communication and interactions will create higher TMT attention to natural environmental issues in the communication channel.

Hypothesis 6: Similarity to an accident firm will positively moderate the technological disaster and TMT attention relationship.

Absorptive Capacity

Zahra and George (2002) define absorptive capacity as a dynamic capability to acquire, assimilate, and apply knowledge in external environments. The capacity has been identified as a critical property of a receiver who is better able to receive knowledge (Csaszar & Siggelkow, 2010; Cohen & Levinthal, 1990). When absorptive capacity is high, firms are better able to understand external environments, transform what they understand into knowledge, and increase commercial outputs, thus contributing to a firm's performance in a highly uncertain industry.

According to Lane, Koka, and Pathak (2006), insiders' mental model and knowledge making process is a major predictor of absorptive capacity. The author posits that insiders share a mental model by influencing one another in the process by which knowledge is actively transferred, shared, integrated, and created. In other words, a higher level of absorptive capacity enables firms to readily note and understand the occurrence of a technological disaster and to effectively share and integrate what they learned from the environments through transferring tacit knowledge and experiences across business units of a firm (Baum & Ingram, 1998), facilitating situated attention to natural environmental issues in the decision making process. Therefore, the perceived impact of a technological disaster on TMT attention to natural environmental issues is amplified when absorptive capacity facilitates received knowledge to be transferred across business units within a firm.

Hypothesis 7: Absorptive capacity will positively moderate the technological disaster and TMT attention relationship.

Aspiration Level

The primary goal of a firm is to create and sustain its profits and maintain its attractiveness relative to aspiration level (Greve, 2008). Aspiration is referred to as

organizational goals that create strategic change and risk taking (Shinkle, 2012). When firms achieve a higher performance that exceeds a given goal, a TMT will find slacks resources are available and support slack-driven distant search for non-core activities assuming risks (Baum & Dahlin, 2007; Levinthal & March, 1981; Ren & Gou, 2011). Meanwhile, the failure to achieve the aspiration leads a TMT to seek a problemistic search for the solution to the lower performance relative to aspiration level (Greve, 2008) by focusing the specific problem.

During the process of strategic change, a TMT has been found to shape its selective attention by both examining a firm's historic performances and comparing competitors' current performance (Washburn & Bromiley, 2012) and, when a firm's profitability is above its aspiration level, to shift its attention from survival-necessitated performances (e.g., profitability) to growth-oriented practices (e.g., organizational size) particularly (Greve, 2008). Therefore, a high performance above aspiration level enables a TMT to communicate with a broad range of insiders about growth-oriented environmental practices and strategies away from the issues on performance and profitability, and thus increase situated attention to natural environmental issues.

Hypothesis 8: Performance above aspiration will positively moderate the technological disaster and TMT attention relationship.

Attention as a Limited Resource

Attention is a valuable but limited resource within organizations (Laursen & Salter, 2006; Rerup, 2009). Given that TMT attention is made after managers go through social-cognitive and structural processes, the attention is an intangible resource that remains following competition among issues in the firm's decision-making channels (Ocasio & Joseph, 2005). As a limited resource, TMT attention has been identified as fundamental to the exploration of environmental

opportunities and active reactions against environmental threats (Hart & Dowell, 2011). It indicates that managers assume risks and allocate resources to the extent that they believe the presence of opportunities to explore and of threats to neutralize (King & Lenox, 2002).

In early studies, Daft and Weick (1984) posit that a firm's strategic action depends on how managers notice the existence of opportunities and threats and interpret their impacts on their organization. This logic explains why some firms respond to radical changes such as a technological disaster or deregulation (Cho & Hambrick, 2006) in environmental actions while a majority of firms do not in a highly uncertain and complicated context where a huge amount of information is created but equivocal (Delmas & Toffel, 2008; Kaplan, 2008).

Following previous studies, I suggest the allocation of resources and efforts into environmental actions for the purposes of achieving legitimacy and competency depends on the extent to which a TMT is concerned about and confident in natural environmental issues. The more TMT is attentive to the natural environmental issues, the better it is able to understand, interpret, and perceive the issues as threats that a firm can neutralize by maintaining controllability over environmental issues (Sharma & Vredenburg, 1998; Sharma, 2000). A high level of TMT attention to environmental issues is complete when managers are structurally encouraged to pursue natural environmental issues and actively involved in sharing and learning one another in the communication channel. At the moment, the TMT attention has ability to control information to flow into a few selective directions and the controllability of information flow leads to an organizational movement (Ocasio, 1997).

As an organization movement, a TMT will illustrate its attention in different ways to neutralize the threats from a technological disaster. In this study, I theorize and examine a preventive environmental action and a protective environmental action as the manifestation of

TMT attention to environmental issues. For the preventive action, a TMT focuses on engaging in developing an environmental competency by controlling information flow (Bansal, 2003; King & Lenox, 2002). For the protective action, TMT focuses on achieving or maintaining environmental legitimacy by relying environmental expertise of the third party (Russo & Fouts, 1997).

TMT Attention to the Natural Environment and Environmental Competency

Berrone and Gomez-Mejia (2009) define a preventive environmental action as an organizational effort to "minimize or eliminate the creation of toxic chemical agents during the various stages of production" (2009: p.106). When a TMT perceives an external event as a threat to its competitiveness and profitability, the firm is more motivated to choose a preventive action, in spite of its necessary risks of investment and required long-term TMT commitment (Dutton & Jackson, 1987; Thomas & McDaniel, 1990).

Highly attentive TMT to environmental issues has been found to better identify expectations from stakeholders and try to actively figure out what they expect by leveraging cumulative tacit knowledge and experience of eliminating pollutants during the various stages of production (Hart, 1995; Hart & Dowell, 2011; Nardkani & Hermann, 2010). It means that high attention to environmental issues helps TMT focus its attention on relevant initiatives proposed by middle managers (Dutton et al., 2001) and stakeholders (Bansal, 2003). In the process of focusing TMT attention to natural environmental issues, firms are better able to accumulate and develop tacit knowledge and experiences as unique advantages and consider preventive environmental actions that controls and eliminates pollutants of toxic chemicals and wastes that exist anywhere in the whole stages of production (Russo & Fouts, 1997). Furthermore, adopting the preventive environmental actions encourage a TMT to rethink and redesign the whole

process to actively fight against loss-likely threats and have stakeholders choose their products in both economic and environmentally responsible dimensions (Hart, 1995; Freeman, 1994).

Hart (1995) highlights a preventive environmental action as the function of making organizations environmentally competent and enabling them to accumulate knowledge and information through close relationship with stakeholders (Berrone & Gomez-Mejia, 2009). High attention to environmental issues that encourages a TMT to have a faith in the presence of a firm's controllability in the natural environment is a determinant for adopting a preventive environmental action in response to threats accompanied with the occurrence of a technological disaster.

Hypothesis 9: TMT attention to natural environmental issues is positively associated with preventive action

TMT Attention to the Natural Environment and Environmental Legitimacy

Following King & Lenox (2002) and Berrone & Gomez-Mejia (2009), I define a protective environmental action as organization efforts to treat, recover, and transfer waste at the end of a manufacturing process by complying with environmental regulations and expectations enacted by stakeholders. Unlike the preventive environmental action that aims to eliminate causes of environmental degradation or pollutants throughout the entire manufacturing process, a protective environmental action focuses on gaining and maintaining environmental legitimacy at a lower cost by outsourcing environmental protection activities to an independent, professional firm having an environmental expertise (Christmann, 2000; Deephouse & Carter, 2005). Adopting a protective environmental action enables firms to have favorable exchange conditions with stakeholders, as they can gain at least environmental legitimacy (Desai, 2008).

However, the underlying problem of the protective environmental action is that as firms rely on the 3rd party's environmental competency to address environmental concerns, the reliance

eliminates any opportunity to accumulate knowledge (Hart, 1995) and, thus, to develop natural environmental competency (Russo & Foute, 1997). The primary motivation to adopt this action was based on rational and economic decision, but it is worthwhile noting that the cost of maintaining environmental legitimacy may exceed the benefit from favorable exchange conditions, as a manufacturing process becomes more specific to the 3rd party's environmental competency that should be necessary when manufacturing lines are updated and redesigned (Hart, 1995)

A TMT having high attention to environmental issues perceives them as threats to avoid and thus seeks an economic way of having their firms look accountable for the natural environment at relatively lower costs and risks than a preventive action (Barreto, 2013) and thus to focus on the result, rather than process, of environmental actions. This protective environmental action tends to focus on the waste amount that a firm would transfer and recycle at the end of production lines (Berrone & Gomez-Mejia, 2009; Russo & Fouts, 1997), instead of removing pollutants in the entire manufacturing process. Therefore, adopting the actions release a firm from the concerns that the lack of environmental legitimacy could lead stakeholders to ascribe damages of a technological disaster at least partially to a focal firm when a technological disaster occurs. In sum, higher TMT attention leads to employing a protective environmental action with which firms can fulfill regulative institutions and stakeholders' expectations and environmental legitimacy.

Hypothesis 10: TMT attention to natural environmental issues is positively associated with protective actions.

Attention is an underlying mediating process in the strategy literature (Cho & Hambrick, 2006; Ocasio, 1997). In this study, TMT attention to natural environmental issues is the manifestation of extended concerns about a technological disaster and the conviction of needs for

environmental actions against threats from technological disasters. In the whole environmental decision-making process, TMT attention plays a critical role in noticing, interpreting, and selecting initiatives proposed from inside and outside of an organization (Ren & Guo, 2011) and enables an organization to accumulate knowledge fundamental to developing environmental actions and, more importantly, to champion organization-wide actions for uncertain capital investments (Andersson & Bateman, 2000). Thus, how much firms engage in environmental actions depends on the concerns that a TMT attends to as issues (Bansal, 2003) and the convictions that it has as answers (Ocasio, 1997).

Hypothesis 11: TMT attention will mediate the effect of technological disaster on an environmental action.

CHAPTER THREE:
METHODOLOGY AND RESEARCH DESIGN

Sample and Data

In this study, I offer a contingent model that describes how corporate governance and motivation to observe and learn about other firm's failure differentially affects the decision-making process for environmental actions. To test the conditional process by which a cognitive process that causally links a technological disaster and a firm's environmental actions, the boundary conditions of the causality should be considered simultaneously (Hayes, 2013). For testing these relationships, I chose industries where natural environmental issues were salient and secondary quantitative and qualitative data were publicly available.

Through reviewing the literature on organizations and the natural environment, I identified five industries that have been historically noted as heavy polluters because they generate a substantial amount of wastes and chemical substances in the manufacturing process. According to Reid and Toffel (2009), the firms that are affiliated with heavily polluting industries have long been challenged by environmental activist groups and governmental regulations. Those challenges have led the firms to be better able to capture the signals regarding their potential conflicts with environmental demands than firms in other industries.

Following Nadkani and Barr (2008)'s two-step process, I narrowed my investigation to five industries. First, based on Emergency Events Database (EM-DAT, 2008) provided by the Center for Research on the Epidemiology by Disaster at the Universite Catholique de Louvain in Belgium, I examined all industries that experienced a technological disaster at least once in a 10-

year research window from 1994 to 2003. The industries were collected in the basis of a 2-digit SIC and a 3-digit NASIC codes. For a 2-digit SIC code, 19 industries[2] experienced a technological disaster at least once during the study period, while, for a 3-digit SIC code, 53 industries went through any technological disaster.

Second, to narrow my research focus to methodologically and theoretically relevant industries, I reviewed existing literature on environmental actions and performances (e.g., Bansal & Clellend, 2004; Berrone & Gomez-Mejia, 2009; Christmann, 2000; Sarkis & Cordeiro, 2001; Walls et al., 2012). Among 19 SIC-classified industries filtered through the first process, I could reach the five industries that have been commonly addressed as heavy polluters that include pulp/paper and plastic manufacturing (NASIC 322, 326 or SIC 26), chemicals & iron/steel manufacturing (NASIC 325, 331 or SIC 28), petroleum (NASIC 324 or SIC 29), metal parts, semiconductor, machinery, automobile, ship, and aircraft manufacturing (NASIC 332, 333, 336 or SIC 37), and electric, gas and sanitary services (NASIC 221 or SIC 49) industries.

For SIC 28 (chemicals & iron/steel manufacturing), the scope of business characteristics are relatively broader than other industries in terms of the number of distinguishable SIC codes. Using the 4-digit SIC code for the sample firm's primary business (Table 1), I classified them into the businesses producing chemicals as a primary product and those processing chemicals to produce their products (e.g., pharmaceutical preparation, medical equipment, toilet and soap).

[2] The industries either directly or indirectly influenced by one or more technological disasters in an 10-year observational period are as follows;
SIC 12 (Coal surface or underground mining), 13 (Crude petroleum, natural gas, and oil exploration), 15 (Residential and industrial construction), 20 (Food and beverage processing), 22 (Fabric/knitting mills and textile goods), 26 (Pulp/paper products), 28 (Chemicals, plastics materials, synthetic rubber, paints and allied products, fertilizers, explosives), 29 (Petroleum refining, asphalt paving materials, Oils/Greases), 37(Motor, aircraft, & railroad manufacturing and transportation equipment) 40 (Railroads operating), 41 (Local passenger land transportation), 44 (Water transportation), 45 (Air transportation), 49 (Electric/natural gas services & utilities), 50 (Auto parts & industrial equipment), 51 (Stationery and drugs), 56 (Clothing and apparel stores), 59 (Retailers), 79(Entertainment)

Table 1
Classifying SIC-28 Sample Firms into Subgroups

Firms producing chemicals as a primary business

Segment (SIC)	Firms
Plastic Preparation (2821)	Rohm & Haas, Eastman Chemical, Dow Chemical
Biological Chemicals (2879)	Monsanto, Amgen
Alkalies and Chlorine (2812)	FMC, Olin
Industrial Inorganic Chemical (2819)	Du Pont (Shifted from SIC 29 in 1999)
Industrial Chemical (2819; 2869; 2813)	Praxair, International Flavors & Fragra, Air Product
Paint (2851)	PPG Industries, Akzo Nobel, Ferro

Firms treating chemical to produce primary products

Segment (SIC)	Firms
Pharmaceutical Preparations (2834)	J & J, Merck, Bristol-Myers Squibb, Pfizer, Schuring-Plough, Lilly (Eli), Abbott Laboratories, Baxter International
Toilet and Soap (2844)	Avon Products, Estee Lauder Cos, Colgate-Palmolive

This study uses quantitative and qualitative data collected from a variety of secondary sources, including TRI (Toxic Release Inventory) database released and administrated by the US Environmental Protection Agency, a sample firm's annual reports that provide letters to shareholders (LTSs), Compact Disclosure, proxy statement posted on the US Securities and Exchange Commission, and COMPUSTAT. Having had to use multiple databases, I also considered the availability of databases a critical factor in selecting the industries to examine for this study. For example, transportation industries including SIC 40 (railroad transportation), SIC 41 (bus & truck transportation), 44 (water transportation), and 45 (air transportation) caused the most technological disasters during the observation period due to oil and chemical spills from various collisions and mid-air crashes. Several examples include derailment of union pacific railroad train on May 27, 2000, crash of Comair Flight 3272 on January 9, 1997 due to inadequate standards for icing operations while in flight, and train collision near an Avondale Mills plant in Graniteville on January 6, 2005. In spite of a great number of technical disasters in the transportation industries, they have not been required to report their environmental

performance to the EPA. These EPA-reporting exemptions made it impossible to measure their environmental actions in my study.

Instead, I investigated all cases to find out whether the transportation accidents were closely related to supply chains of other EPA-reporting firms in the heavily polluting industries and reclassified the accidents into the corresponding industries, if related. For instance, the case where a train collision occurred in the supply chain process of a petrochemical firm was retained as a sample case for this study. Through this process, I identified five transportation accidents that were incurred in the process of supply chain for chemical manufacturers and reclassified those cases into corresponding industries: chlorine exposure from collided trains in 2005, hazardous materials exposed from a derailed train in 2000, sulfuric acid and sodium hydroxide spilled from a derailed train in 1998, sodium hydroxide spilled from a derailed train in 1998, and gas leak from a derailed train in 1996.

Time Frame and Sample Firm Selection

As I aimed to test for the relationships between an event and attention and between attention and action, endogeneity issues might arise from the fact that a firm's environmental action could motivate a TMT to be more attentive to natural environmental issues and furthermore high TMT attention might reduce the possibility that technological disasters occur in an industry. This reversed causality is possible unless a cause is manipulated to precede its effect (Shadish, Cook, & Campbell, 2002).

For a hypothesized causality to remain valid, I aligned a technological disaster, TMT attention, and a firm's environmental actions in chronological order. As described in Table 2, the independent variable, a technological disaster lagged the dependent variable, environmental actions, by one year. For moderating and control variables, I used the same year data with an

independent variable. Specifically, the beginning year of an independent variable, technological disaster, was March 1994 through February 1995 before shareholder's letters were published in annual report around March to May 1995. For a dependent variable, a firm's environmental action, the beginning year was 1995. It is notable that there is a two-year time lag in the release of TRI data, so the data release in 1997 is for a firm's environmental performance of year 1995 (Lee, 2000). By using the secondary data on technological disasters that happened from March 1994 to Feb 1995, letters to shareholder published from March to May 1995, and Toxic Release Inventory reported in 1997, I focused on designing this research to clarify a temporal causality. With this research design, I again collected data for a 10-year observational window, and the last year of IV was March 2003 to Feb 2004. To measure a firm's environmental actions for year 2004, I used the TRI database of 2006.

Table 2
Databases and Time Period of Study

	Technological Event	**TMT Attention**	**Environmental Action**	**Vicarious Learning**	**Corporate Governance**	**Industry Conditions**
Period	1994-2003	1995-2004	1995-2004	1994-2004	1994-2004	1994-2004
Data Source	EMDAT	COMPACT DISCLOSURE	TRI	COMPUSTAT	COMPACT DISCLOSURE	COMPUSTAT
Variables	Independent	Mediator	Dependent	Moderator	Moderator	Control

Given that prior works in the environmental management literature have examined their sample's environmental performance and actions for 4 to 7 years (e.g., Bansal & Clellend, 2004; Berrone & Gomez-Mejia, 2009; Berrone et al, 2013), I assume that 10-year period of observation is a sufficient number of period to reflect the other possible events than technological disaster that potentially affect TMT attention for both the firms influenced by a technological disaster and

those not influenced (Chatterji & Toffel, 2010) as well as to test for serial correlation (Arellano & Bond, 1991).

Initially, I selected 15 firms in each of the five industries on the basis of sales in a fiscal year of 1995, which is the beginning year of DV. However, the numbers were adjusted based on the availability of database. Some firms which were publicly traded in the US stock market but did not reach a minimum TRI-reporting threshold[3] were not required to disclose toxic emissions, and I dropped the firms who did not report the annual toxic emissions for the reason. Appendix B lists the sample firms and provides basic demographics on each. I have constructed an unbalanced panel comprising 99 firms: 17 firms in SIC 26 (Paper/Pulp manufacturing), 25 firms in SIC 28 (Chemicals), 16 firms in SIC 29 (Oil & Gas), 24 firms in SIC 37 (Transportation manufacturing), and 17 firms in SIC 49 (Utilities). As shown in Appendix B, I have 970 observations.

Measurements

Dependent Variables

Following Berrone and Gomez-Mejia (2009), I classified environmental performance into a preventive environmental action that contributes to a firm's unique advantage and a protective environmental action that focuses on complying with regulative and normative pressures for environmental legitimacy (Hart, 1995). Targeting at eliminating underlying sources of environmental pollutions existing in the manufacturing process, a preventive environmental action were operationalized by the difference in generated hazardous chemicals and wastes between a prior and current year. Meanwhile, a protective environmental action was measured by released chemicals that were recycled, treated, or transferred to other sites.

[3] Individual facilities are required to disclose their annual toxic emissions to EPA when they have 10 or more full-time employees and emit any listed toxic substances in excess of the minimum level (Berrone & Gomez-Mejia, 2009)

Preventive Environmental Action Following Berrone and Gomez-Mejia (2009), Sarkis and Cordeiro (2001) and Hart (1995), I define a preventive environmental action as a firm's effort to eliminates pollutants of hazardous chemicals and wastes that will cause environmental concerns by coordinating a manufacturing process with environmental management. The environmental preventive action necessitates the understanding of an underlying mechanism whereby polluting factors such as toxic chemicals and wastes are generated and thus needs capabilities of process management as well as the nature-environment-related knowledge (Hart, 1995). Prior studies measured preventive environmental action by summing up annual emissions of chemicals reported to EPA and dividing the outcome by previous year's emission (e.g., Chatterji & Toffel, 2010; Sarkis & Cordeiro, 2001).

Given that each chemical has different levels of toxicity, King and Myles-Shaver (2001) applied a reportable quantities (RQ) measure to the calculation of chemical emission and toxicity. For more advanced weighting schema, Berrone & Gomez-Mejia (2009) weighted the quantity of each chemical emitted in a given year by its correspondent value of "human toxicity potential (HTP) factor" (Hertwich et at., 2001), which associates the TRI reporting chemicals with actual risks to human health by measuring toxicity in terms of cancer-causing vs. non-cancer causing materials and the media through which chemicals are released (Berrone & Gomez-Mejia, 2009). Although HTP is the most advanced weighting method in measuring toxicity, the following three approaches have been commonly used, since the methods have some strengths and weaknesses, as demonstrated in Table 3.

Table 3
Comparison of Methods for Environmental Performance

	Simple Aggregation	RQ	HTP
Functions	The total pounds each firm reported to the TRI as production waste, transfers offsite, and emissions	Applying the weighting scheme developed by EPA to serve as a threshold for reporting accidental spills – "Reportable Quantities (RQ)" database in the CERCLA	Applying "human toxicity potential factor" to assign different values to chemicals in terms of media (e.g., water & air) and carcinogens or non-carcinogens.
Strengths	Simple Calculation; commonly used by the media, non-profit organizations, government; examining institutional pressure (Dosh, Dowell, & Toffel, 2013)	Reflecting the fact that chemicals differ widely in their impacts by weighting each chemical by its toxicity	Associating the results with actual risks to human health by measuring toxicity in terms of benzene equivalence or toluene equivalence and the medium in which chemical is released (air & water)
Criticism	Low precision (chemical toxicity and medium not considered)	Less precision (chemical toxicity and medium less considered) (Toffel & Marshall, 2004)	Hart to match between the media in TRI and Human Toxicity Potential (HTP), particularly, land
Studies in the management literature	Chatterji & Toffel, 2010 (SMJ); Dooley & Fryxell, 1999 (JBE); Dosh, Dowell, & Toffel, 2013 (SMJ)	King & Lenox, 2000 (AMJ); Russo & Harrison, 2005 (SMJ)	Berrone & Gomez (2009)

To have a more realistic measurement for a proactive environmental action, I embedded a HTP weighting into data (Berrone & Gomez-Mejia, 2009) and additionally used a simple method to increase the validity of my measurement. First, considering that the actual risks of emitted chemicals to human health vary across the sources of toxic chemicals such as water and air and the levels of toxicity such as cancer-causing and non-cancer-causing substances (Hertwich et al., 2001), I weighted each of emitted chemicals by HTP index. Berrone and Gomez-Mejia (2009) suggest calculating the ratio of actual pollution to the predicted pollution based on the difference in production volume between time *t-1* and time *t*. The firms responsible for submitting TRI reports should report the change rate in production volume at t in comparison to production volume at time *t-1*. The ratio serves as a critical threshold of estimating whether the volume of

emitted chemicals at t is excessive to the expected volume of chemical wastes at t in a facility level.

$PreEA_{it}$ = *Expected chemical release* $_{t}$ – *Actual chemical release* $_{it}$ **[Formula-1]**
ECR_{it} = *Volume of released chemical* $_{it-1}$ *x (Changed ratio in production volume* $_{it}$*)* **[Formula-2]**

Where $PreEA_{it}$ denotes a preventive environmental action at year t for an individual facility (*i*); ECR_{t} denotes expected chemical release at year t for an individual facility (*i*). To find the current year actual emitted volume of sample firms at a firm level, I transformed two different units (e.g., pound, gram) of weight for emitted chemicals into a standardized unit, pound. I also multiplied HTP index by each of corresponding emitted chemicals to find standardized HTP-weighted chemical release at a facility level. I used VLOOKUP function of an excel software program to match individual chemicals released from the same facility at both current (*t*) and prior years (*t-1*). This matching at a facility level was critical since TRI database provided a facility-level changed rate in production volume [Formula 2] so that I could calculate a facility-level PEA, demonstrated in [Formula 1]. A poor match would result in an unrelated changed ratio in production volume, which would be applied and multiplied by prior year individual chemical release [Formula 1], thus misleading a current year expected chemical release (ECR). Lastly, as firms have various numbers of facilities, I calculated a firm-level environmental preventive action by summing up all facility-level PEAs [Formula-3].

Environmental Preventive Action = $\sum$ *[(HTP-weighted prior year's individual chemical release at t-1* x *the ratio of current year's production to prior year's production volume) – {Reported individual chemical release at t –* (*Non adjusted individual chemical release – HTP adjusted individual chemical release)}]* ***[Formula-3]***

The positive and greater value from Formula-3 indicates a firm's active involvement in reducing chemical release before the end of manufacturing pipelines. Meanwhile, the lower and even negative value indicates a firm's low involvement in preventing chemical release at a corresponding period, as actual chemical release exceeds expected chemical release (ECR) at a corresponding year.

Protective Environmental Action Following Berrone and Gomez-Mejia (2009) and Sarkis and Cordeiro (2001), I operationalize a protective environmental action as the ratio of reduced chemical release by recycling, treating on-site and transferring to other location for further treatment to total chemical release of a corresponding year [Fomula-4]. This environmental action focuses on achieving legitimacy from stakeholders through less active environmental actions (Barreto, 2013; Hart, 1995).

For the numerator of a protective environmental action, I included items that represented a firm's effort to reduce chemical release such as recycling on-site, recycling off-site, treatment on-site, and treatment off-site, which were all obtained from TRI database. As there was no information on the media (e.g., land, water, or air) through which recycled chemicals were originally generated, I followed the Berrone & Gomez-Mejia (2009) approach which adopted an average HTP value of water and air media for individual chemicals [Formula-5]. For the denominator, I used total chemicals generated by a firm (Sarkis & Coreiro, 2001). Regarding total release, it is notable that HTP-weighted measure can more precisely capture the differential toxicity of cancer and non-cancer causing chemicals on human health that come through water and air media. As shown in Formula-6, I included reported individual chemical release and other wastes at year *t* such as total release, production wastes, and one-time release. As these items were not weighted by HTP index, I deducted non-adjusted individual chemical release such as

fugitive air, stack air and water and then added HTP-weighted fugitive air, stack air and water [Formula-6]

$$ProEA_{it} = TCRE_{it} / HAP_{it} \quad \textbf{[Formula-4]}$$

$$TCRE_{it} = (\text{Energy recovery on-site} + \text{Energy recovery off-site} + \text{Recycling on-site} + \text{Reclying off-site} + \text{Treatment on-site} + \text{Treatment off-site}) \times \{HTP(air)+HTP(water)\}/2 \quad \textbf{[Formula-5]}$$

$$HAP_{it} = (\text{Total release} + \text{Production waste} + \text{One-time release} - (\text{Fugitive Air1} + \text{Stack Air2} + \text{Water}) + (\text{HTP-weighted air1} + \text{HTP-weighted air2} + \text{HTP-weighted water}) \quad \textbf{[Formula-6]}$$

Lastly, I calculated a firm-level chemical release by aggregating a current year's total release and wastes from a facility level. The formula of a protective environmental action at a firm level is as follows **[Formula-7]**:

> ***End-of-Pipe Protection*** $= \sum \{($*Current year's chemical release recycled, recovered, treated, and transferred to other sites* x *average value of corresponding HTP factors for air and water media for an individual chemicals*$) / \{$*Reported individual chemical release at t* $-$ (*Non adjusted individual chemical release – HTP adjusted individual chemical release)* $\}$ **[Formula-7]**

As a protective environmental action was operationalized as the ratio [Formula-4], higher ratio of end-of-pipe protection indicates that the firms intensively focus on minimizing released chemical wastes and pollutions through recycling, recovering, and transferring to other sites, whereas lower ratio means they engage less in the environmental activities. If a protective environmental action is equal to zero, a firm does not make any efforts to reduce chemical release and wastes by either recycling or transferring to third places. Meanwhile, if the action is equal to one, a firm recycles all released chemicals and wastes for a fiscal year.

For the measurement of a protective environmental action, there should be no score above one, since firms cannot recycle more than they released. However, it is notable that firms

being scored greater than 1 are often found in this measurement. This is because I used the averaged HTP index of two media following Berrone & Gomez-Mejia (2009), as TRI data do not provide information on which medium a recycled chemical were originally produced through. For example, when a firm releases chemicals only through air medium, the use of averaged value that includes both air and water media may inflate or deflate the nominator. Although the limitation in HTP-weighted measurement is present, the use of a simple method that does not consider different levels of toxicity across chemicals may provide more rough estimation of a firm's environmental protective actions.

Independent Variables

To measure the occurrence of a technological disaster, I constructed the independent variable as a binary variable using the Emergency Events Database (EM-DAT, 2008). The EM-DAT, provided by the Center for Research on the Epidemiology of Disaster at the Universite Catholique de Louvain in Belgium, is widely used for academic purposes across multiple disciplines including geology, environmental science, coastal ocean engineering, finance (Coleman, 2006) and management (Oh & Oetzel, 2012). The EM-DAT database classifies an external disruptive event into a disaster when the event falls under at least one of the following criteria: "10 or more people are reported killed; 100 or more people are reported affected, injured, and/or homeless; the government declares a state of emergency; the government requests international assistance." Among the reported disasters, I excluded the cases falling under sequential disaster that acts of Nature such as hurricanes and floods directly harmed technological capability of firms and thus resulted in human, financial, and environmental damages, as previously mentioned.

Following the DM-DAT classification, I selected the cases corresponding to technological disasters that were directly or indirectly associated with the value chain and manufacturing activities of the firms in my sample industries such as paper and pulp (SIC 26), chemical (SIC 28), oil and gas (SIC 29), transportation manufacturers (SIC 37), and utilities (SIC 49). It is notable that a dozen reported disasters arose from transportation accidents such as plane crashes, derailment of trains, and vessel crashes into bridges and harbors in the DM-DAT. When a disaster's cause was linked to employees who made a technological mismanagement (e.g., a pilot's poor decision making as a determinant of a plane crash), the case was excluded since this study examined the acts of the firms only in the most polluting US industries where TRI data are available.

However, given that shipping chemicals, oils and gases through railroad and vessels is a crucial part of the supply chain for manufacturers, stakeholders tend to ambiguously categorize them into a guilty group (Zavyalova et al., 2012). Thus, I included the cases that transportation accidents occurred in supply chain activities in my sample industries. To identify the cases, I collected information on accident locations, dates, and involved organizations reported by the DM-DAT and investigated news articles and accident reports announced by NTSB (National Transportation Safety Board) and narrowed down my selection to 24 technological disasters that occurred in the five different industries during the observation period from 1994 to 2003 (Appendix C). Based on the operational definition of a technological disaster, 10 or more people died or 100 or more injured by a controllable and adjustable accident, I coded 1 for the industry that experienced one or more technological disasters in a given year. Otherwise, it will be coded as 0.

TMT Attention to the Natural Environment Ocasio (1997) defines it as "the noticing, encoding, understanding, and focusing of decision makers' effort and time on the issues and the answers." Following Ocasio's definition, I measured TMT attention to natural environmental issues by using content analysis of letters to shareholders (LTSs) that represent the focused attention of executive-level decision makers (Nadkarni & Barr, 2008). LTSs have been long used to identify and analyze the manifestation of top management team's primary attention and communication (D'Aveni & MacMillan, 1990; Homberg & Pflesser, 2000). More importantly, LTSs are one of the most frequently used narrative documents identified as having external validity by previous studies (e.g., Short et al., 2010).

There are some debates as to whether LTS represents TMT attention or CEO attention, but using LTS for this study is appropriate since the letters are published through the process of coordinating the attention, interests, and prediction of TMT members through communication and filtering them into the most salient issues in which members are commonly interested (Cho & Hambrick, 2006). In this study, the letters were collected from multiple archived databases to reduce missing observations and increase the reliability of data content. A majority of letters were collected from firms' annual reports posted on the website of U.S. Securities and Exchange Commission, Mergent Online, and Compact Disclosure. These three complimentary archival data enabled me to check whether LTS was reported in a corresponding year. Particularly, as the letters were not a mandatory document for publicly traded firms unlike other reports legally required by SEC, data collection was not smoothly made. As supplementary document, MD&A and corporate information from Lexis-Nexis were used as references (Cho & Hambrick, 2006).

The period of documentation was the decade between 1995 and 2004. Publicly traded firms issue an annual report that demonstrates a prior year's performance and business

environments during the first half of the following year. Firms publish an annual report of 2002, for instance, which is published from March to June of 2003. The LTS published in 2003 is supposed to reflect TMT attention in 2002 and early 2003 including January and February. In order to capture the extent to which a TMT is attentive to the issues of the natural environment for each year during the observational window, I reviewed the environmental management literature to choose some seed words that are most frequently used in the top-tier management journals[4] and represent the natural environmental issues.

Although a few studies measure and empirically test the consciousness about natural environmental issues, most of them relied on cross-sectional data using questionnaires and thus could not account for possible analytical issues such as the possible influence of omitted missing variable on TMT attention (endogeneity), the serial correlation of prior year's attention to current attention (autocorrelation), and inconstant variance across firms (heteroskedasiticity). Additionally, few studies suggested an exhaustive list of words that indicate natural environmental issues. As the dictionary representing the natural environmental issues has yet to be developed, I employed an inductive approach to developing a word list, as suggested by Short et al. (2010).

First, I collected 838 LTSs from 98 firms during the 10-year observation period. Second, I examined all letters to identify the words and phrases that represent TMT attention to natural

[4] Instead of referencing all articles, I list here alphabetically the authors and published year of the articles that I read for the purpose of identifying the seed words: Aragon Correa & Sharma (2003), Bansal & Roth (2000), Bansal (2004), Bansal & Clelland (2004), Bansal & Hunt (2003), Barnett (2007), Barnett & King (2008), Berchicci, Dowell, & King (2012), Berron & Gomez-Mejia (2009), Berrone, Fosfuri, & Gelabert (2013), Bigley & Roberts (2001), Chatterji & Toffel (2010), Christmann (2000), Coleman (2006), Darnall (2003; 2006), Demas & Toffel (2004), Dibrell, Craig, Kim, and Aaron (2014), Dosh, Dowell, & Toffel (2013), Eesley & Lenox (2006), Etzion (2007), Flammer (2013), Gill (2007), Hart (1995; 2011), King (2007), King & Lenox (2000), King, Lenox, & Terlaak (2005), King & Shaver (2001), Knock, Santalo, & Diestre (2012), Majchrzak, Jarvenpaa, & Hollingshead (2007), Marguis & Toffel (2012), Oh & Oetzel (2011), Prakash & Kollman (2004), Roberts (1990), Russo & Fouts (1997), Russo & Harrison (2005), Sarkis & Cordeiro (2001), Sharfman (1996), Sharma (2000), Sharma & Vredenburg (1998), Walls, Berrone, & Phan (2012), Wang & Choi (2013)

environmental issues and answers and assessed whether the words were aligned with the concept of natural environmental issues considering the context for each letter. Judge and Douglas (1998) posit the issues are not limited to the ideas of compliance with stakeholder expectation manifested through environmental regulations and concerns and also include proactive considerations going beyond compliance that are explicitly addressed in TMT strategic planning process and are recorded within the firm's official statement such as mission statements and annual reports. Andersson and Bateman (2000) classify environment issues that businesses face into air pollution, solid waste disposal, topsoil erosion, ozone layer depletion, population growth, marine and fresh water pollution, toxic waste accumulation and disposal, reduction in biodiversity, wetlands destruction, deforestation, and climate modification. Similarly, Carroll & Buchholtz (2002) suggests eight key global natural environmental issues that include ozone depleting, global warming, sold and hazardous wastes, fresh water quantity and quality, degradation of marine environments, deforestation, land degradation, endangerment of biological diversity. By definition, attention embraces not only problems or concerns but also the answers to corresponding problems (Ocasio, 1997), I included TMT consideration of how to ameliorate opportunities and reduce threats from the natural environments as answers in the category of TMT attention to natural environmental issues.

Third, four experts who had expertise in the organization and the natural environment literature assessed how closely the collected words were associated with the attention to natural environmental issues and rated the association by using a scale ranging from 1 (not associated) to 7 (definitely associated). Following Cho & Hambrick (2006), I calculated inter-rater reliability using Intraclass Correlation Coefficient (ICC), which was 0.76. In the social science, when ICC is larger than 0.72, it is considered that adequate reliability is present. Based on the scale, I

retained any words that were rated 5 or more from the four raters. The raters and I discussed some words that were dropped in the validation process, but were potentially associated with natural environmental issues, and reselected some words on which we agreed.

Lastly, after going through the process, I compared the number of the words mentioned in each of the letters to the total number of letter written in LTS in order to standardize TMT attention to natural environmental issues. Among the three content analysis programs that are accepted to management research, I used the Mac-version of LIWC that captures phrases as well as words and provides text-highlighting functions to increase between-reviewer reliability of selected words.

Moderating Variables

Concentration Ownership is operationalized by the percentage of a firm's outstanding shares held by shareholders who owne at least 5% of the equity or blockholders (Bethel & Liebeskind, 1993; Fidrmuc, Georgen, & Renneboog, 2006). As my sample firms are publicly traded firms, their ratio of the number of blockholder to the number of small shareholder is smaller than the ratio for non-publicly traded firms. Also, the position of blockholders within an organization is distinguishable and they draw more TMT attention than do small shareholders (Earle, Kucsera, & Telegdy, 2005). For the measurement, I employed a continuous variable, while some prior studies used a dummy variable with a threshold of 5% ownership held by a shareholder (e.g., Li, 1994). Therefore, 5% ownership is widely used to identify whether ownership is concentrated to shareholders.

Outside Director As this study aims to examine the influence of outside directors having heterogeneous background, experience, and insight on business, I used the number of outside board members with no personal or professional relationship with the firm (Arthaud-day et al.,

2006), as opposed to inside board members who have former and current employment relationships and work for an affiliated organization.

Instead of using the proportion of independent directors to board size, using the actual number of independent directors as a proxy helps researchers to better understand heterogeneity in expertise and the possibility that various issues and answers are identified (Anderson, Mansi, & Reeb, 2004). These benefits are particularly important in predicting its conditional effect on TMT attention that is manifested through focusing time and effort on issues and answers.

CEO Duality a dichotomous variable was used to measure whether CEO serves as a chairperson for the board of directors (Boyd, 1994). To identify CEO duality, I consulted def (14) or proxy statement for publicly traded firm collected through corporate filings. When duality is identified, the focal will be coded as 1. Otherwise, it will be coded as 0 (Tuggle et al., 2010).

Family Influence In order to examine the influence of family members on TMT attention, I operationalized it as a firm in which at least one or more family members serve as either one of TMT members or chairperson of boards (Gomez-Mejia et al., 2001). As family members are those who are related by either marriage or blood to founding and owing family (Chrisman & Patel, 2012), I will match the last name of current directors and officers to that of founding family (Chrisman & Patel, 2012; Cruz, Gomez-Mejia, & Becerra, 2010). The information on the founding family's last name will be collected from Lexis-Nexis, web searches and company websites and the information on the name of current directors and officers will be collected from Compact Disclosure of 2005.

Similarity to an Accident Firm The variable indicates the degree of similarity between an accident firm and a focal firm. For the measurement of similarity in organizational size, Baum,

Li, & Usher (2000) adopted context similarity operationalized by geographical similarity in located latitude between a firm's prior acquisition and a target firm. Similarly, I employed the concept of geographical distance between the state that a focal firm's headquarter was located and the state an accident happened for the corresponding observation period. I used a dummy variable coding 1 if a focal firm's headquarter and an accident facility are in the same or regionally neighboring state, and 0 otherwise (Tsai, 2000).

Absorptive Capacity Cohen and Levinthal (1990) conceptualize it as a firm's ability to "recognize the value of new information, assimilate it, and apply it to commercial ends" (p. 128). The knowledge accumulated through investment enables firms to learn technology-based new capabilities and information promptly (Nelson & Winter, 1982), thus increasing responsiveness of R&D to value-creating or threat-neutralizing opportunities (Cohen & Levinthal, 1990). Thus, such learning incentives are increased when R&D intensity is high.

A few studies have empirically tested corporate-level absorptive capacity: Stock, Greis, & Fisher (2001) who operationalize it as R&D intensity and measure it by dividing R&D expenditure by annual sales; Zahra & Hayton (2008) use R&D expense for the measurement. Following Cohen and Levinthal (1990), I will draw on R&D intensity operationalized as R&D expense divided by sales to measure absorptive capacity of publicly traded firms. As the target firms are all publicly traded S&P 1500 firms, the financial data are available.

Performance relative to aspiration Levels is defined as a mixture of social performance level and historical performance level (Wiseman & Bromiley, 1996; Park, 2007). Following Bromiley and Harris (2014) and Greve (2003), I used weighted average model that combine historical and social aspiration in the same model [Formula-8].

$$A_{ti} = a_i SA_{ti} + (1 - a_1)\, HA_{ti} \qquad \textbf{[Formula-8]}$$

Where A denotes aspiration level; SA denotes social aspiration level; HA represents historical aspiration; a_i represents a weight. For social aspiration (SA), I calculated the industry average ROA, and ROS, as suggested by Greve (2003) and ROI during a current year. For historical aspiration (HA), I used a prior year performance (ROA, ROS, and ROI) of a focal firm. In the weighted average model, the weights for social and historical aspirations can be differentially allocated in accordance with how each of social and historical performances looks salient to TMT members

Among three values for the weight 25, 50, and 75 (Baum, Rowley, & Shipilov, 2005), I put equal weights between the two aspirations by selecting the value of 0.5. For the robustness of measurement, I also applied 0.25 and 0.5 to the model as well. I used a dummy variable coding 1 if a focal firm's performance (e.g., ROI) is above the calculated aspiration level and 0 otherwise

Control Variables

For the analysis, I included several control variables that influence TMT attention and a firm's environmental actions. To control for financial capacity that possibly affect TMT attention and propensity (Devers et al., 2013), net income was included. Assuming that large firms in my sample may have more possibility of being attentive to natural environmental issues than small firms due to their manufacturing capacity, I include firm size operationalized by assets of a focal firm in a fiscal year (Zavyalova et al., 2012).

As industry munificence is characterized by industry-based stabilized environments due to growth, and opportunities (Dess & Beard, 1984), abundant industries might lead a TMT to be less attentive to its financial performance than scare industries (Shepherd, Patzelt, & Baron, 2013). For the measurement of munificence, I used a standardized measure of industry sales

growth to measure munificence over its recent 5-year period. For the measurement of complexity, I took into consideration the number of firms in an industry and their market shares based on sales. Following the logic of Herfindahl index, I summed up the squared market shares of all firms in an industry. The outcome, 1, indicates a monopolistic market while 0 means perfect competition of the industry.

All of these industry-level data were acquired from COMPUSTATE in the basis of the primary two-digit standard industrial classification (SIC) code (Lester et al., 2006) and I calculated 5-year industry sales growth, its standard deviation, and the sum of the squared market shares of all firm in each industry for 11 years from 1993 to 2003. These industry conditions are necessarily considered since a firm's environmental performance is anticipated to be associated with the threats of competitors, the degree of demands for a firm's primary products and services, and the changes in technology.

CHAPTER FOUR:
RESULTS

Following Baron and Kenny (1986) and Edward and Lambert (2007), I focused on combining moderation and mediation to test for the conditional indirect effect of corporate governance and vicarious learning (Preacher, Rucker, & Hayes, 2007). This moderated causal step approach is distinguishable from a testing for mediation and moderation separately and a subgroup approach, which tests for the conditional effect of corporate governance and vicarious separately (Edward & Lambert, 2007).

Considering all hypothesized moderators in the same equation, a moderated casual step approach appropriately suppresses possible inflated relationships among variables that should otherwise have occurred. More importantly, the aforementioned approach has limited ability to provide the direct evidence for the causality of a technological disaster to a focal firm's environmental actions, as mediated by TMT attention, with theoretically important boundary conditions considered.

To test the conditional indirect effects of seven different moderators on a firm's environmental actions through TMT attention as a mediator simultaneously, I employed a structural equation modeling (SEM) that identified the significance of path estimation among these theoretical constructs and provided a holistic approach so that I could appropriately bond attention-based view with conditional indirect process (Bagozzi & Yi, 2011). Within the overall framework of a structural equation modeling, three different regression equations having a demeaned first-difference estimation were placed to test for the causality of a technological

disaster and a firm's environmental actions, as mediated by TMT attention (Baron & Kenny, 1986; Edward & Lambert, 2007; Mathieu & Taylor, 2006).

To examine how firms were involved in environmental actions in response to a technological disaster, I compared the levels of attention and actions that were hypothesized to be different between a group exposed to a technological disaster and the other not exposed to them by examining the coefficient for a technological disaster. I also investigated the effect of a technological disaster on TMT attention, the interactional effect between the disaster and variables for corporate governance/vicarious learning on the attention, and furthermore the mediating effect of the TMT attention.

Empirical Model

To estimate the coefficient of a technological disaster, I chose to use a demeaned first-differencing estimation, which allows researchers to test for the effect of the change in internal and external events such as the change in governmental policy (Card and Kreuge, 1994), change in industrial practices (Chatterji & Toffel, 2010), and the change in board independence (Anderson et al., 2004). I used a demeaned first-differencing estimation in the SEM and examined the difference between TMT attention of *i* at time *t* and a group-mean of TMT attention of *i*, assuming that there is no effect of difference in between-group estimation (e.g., no effect of unobserved time-invarying distinctions between Ford and Boeing on TMT attention). The assumption is possible because an individual firm's fixed effect is eliminated when a group mean of individual effect is cancelled out with a fixed effect at time *t* that is assumed to be consistent across the window of observation period. This is, controlling for unobserved time-invarying effects of an individual firm, this demeaned first-differencing estimation makes the covariance between change in technological disaster (IV) and change in error term equal to zero,

thus correcting for endogeneity (Wooldridge, 2009). In the case that data to measure the unobservable variable in error term are not available, a demeaned first-differencing estimation can provide a solution to the omitted variable bias. Additionally, the first-differencing can correct for serial correlation by calculating differences among pairs of observations and thus making a non-stationary series stationary.

As data were randomly collected from various sources, it might be reasonable to assume no covariance between idiosyncratic errors (u_i) across different time points and no heteroskedasiticity/ serial correlation. However, the results of Breusch-Pagan/Cook-Weisberg test for heteroskedasticity demonstrated that variance was not constant ($chi^2 = 47.86$; $Prob > chi^2 < 0.05$), whereas the results of Wooldridge test for autocorrelation in panel data indicated no first-order autocorrelation (*F-statistic* = 2.16; $Prob > F = 0.15$). As previously demonstrated, the first-differencing made a non-stationary series stationary by calculating differences among pairs of observations and thus eliminated auto correlations. To correct for heteroskedasiticity, I used robust standard errors.

Given that I used a binary variable coding 0 if a sample firm is affiliated with the industry experiencing a technological disaster at time *t* and otherwise coding 1, the panel data for this study and the use of a demeaned first-differencing estimation made it possible for me to identify whether the occurrence of a technological disaster leads to distinguishable difference in TMT attention between two groups. After dummy coding, I calculated the deviation of TMT attention to natural environmental issues at a specific year from the group-mean of TMT attention, as previously described.

The effect of a public policy, which is characterized by a single occurrence such as deregulation (Cho & Hambrick, 2006) and environmental rating (Chatterji & Toeffle, 2010),

tends to have a clear distinction in period between pre- and post-occurrence, meanwhile unprecedented but possibly repeatable technological disasters do not provide a clear post-disaster period, since, unlike the duration of institutionalized governmental policies and industrial practices, the duration of a technological disaster tends to vary across cases as they are not institutionalized. Therefore, it is reasonable to assume that a technological disaster affects TMT attention for a short-term period time such as up to 1 year following the occurrence and TMT attention manifested in letters to shareholders (LTSs) does not reflect a technological disaster that happened more than a year ago. This approach is different from the measures adopted by other studies that examine the effect of an external event on a firm by focusing on difference in TMT attention between pre and posttest tests.

Empirical Results

Path analysis using SEM was conducted with the statistical software package STATA 12.0. Table 4 shows correlations among constructs and Table 5 presents the number of observation, means, and standard deviation for the variables in the regressions. In table 6, there were low correlation (range of relationships = |.0| to |0.14|) among family influence, CEO duality, ownership concentration, and outsider directors falling under the same construct of corporate governance. There were also low correlation (range of relationships =|.0| to |.06|) among similarity to accident firms, aspiration relative to aspiration, and absorptive capacity falling under the same construct of vicarious learning.

Table 4
Correlation Matrix

`Var	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Pro	1.00														
2. Pre	0.01	1.00													
3. TA	0.07	-0.03	1.00												
4. TD	-0.01	0.06	0.10	1.00											
5. FI	0.08	0.05	0.05	-0.06	1.00										
6. CD	0.07	0.09	0.00	-0.06	-0.01	1.00									
7. AC	-0.03	0.00	-0.05	-0.08	-0.04	-0.00	1.00								
8. OD	0.01	0.04	0.04	-0.04	-0.12	-0.03	-0.05	1.00							
9. OC	-0.07	-0.00	-0.06	-0.07	-0.14	-0.06	-0.01	-0.03	1.00						
10. GS	0.01	0.02	0.03	0.25	0.11	0.01	-0.05	-0.13	-0.03	1.00					
11. PA	0.01	-0.01	-0.05	0.09	0.04	0.02	-0.04	-0.02	0.06	0.10	1.00				
12. MU	-0.07	0.04	0.03	-0.13	-0.11	-0.06	-0.11	0.06	0.00	0.06	0.10	1.00			
13. CO	-0.03	-0.04	0.04	0.01	-0.08	0.02	0.10	-0.03	0.09	-0.07	-0.08	-0.08	-1.00		
14. AS	-0.02	-0.10	-0.06	0.04	0.04	-0.08	-0.15	0.07	-0.08	0.14	0.13	-0.08	-0.08	1.00	
15. RE	0.01	0.07	0.01	0.05	0.00	0.04	0.05	0.11	0.05	0.03	0.05	0.01	0.07	0.05	1.00

*Legends: Pro = Protective environmental action; Pre = Preventive environmental action; TA = TMT attention; TD = Technological disaster; FI = Family influence; CD = CEO duality; AC = Absorptive capacity; OD = Outside directors; OC = Ownership concentration; GS = Geographic similarity; PA = Performance above aspiration; MU = Munificence; CO = Complexity; AS = Asset; RE = Revenue

Table 5
Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.
TMT attention to natural environmental issues	838	0.17	0.36
ln_ Protective environmental action	875	5.14	4.37
ln_ Preventive environmental action	874	23.29	0.15
Technological disaster	970	0.20	0.40
Family influence	970	0.17	0.37
Duality	954	0.81	0.40
Outside directors	951	9.22	2.68
Ownership Concentration	915	25.55	24.37
Similarity to accident firm	969	0.17	0.38
Absorptive capacity	628	0.04	0.41
Aspiration	968	0.67	0.47
Munificence	955	0.07	0.04
Complexity	955	0.04	0.02
No. of employee	934	36811.96	73493.96
Asset	970	17517.93	41597.25

The structural model I tested fits the data well. First of all, I compared my hypothesized model with a saturated model, which used all of variances, covariance, and means of the observed variables. As the saturated model becomes a reference, a small difference between two models (chi^2) indicates a good fit of the hypothesized model. The results were $Chi^2 = 0.116$; $P>Chi^2= 0.99$, indicating that the hypothesized model fits a saturated model. Additionally, I examined standardized root mean square residual that represents the standardized difference between the observed correlation and the predicted correlation. Given that the value less than 0.08 is considered a good fit (Hu & Bentler, 1999), this absolute measure of fit was 0.001, which indicates a good fit. Also, RMSEA (root mean square error of approximation) indicate good fit (RMSEA =0.00), since its value of 0.05 or less indicate there is a good model fit. PCLOSE, which tests the null hypothesis that RMSEA is no greater than 0.05, was 0.99, indicating that RMSEA is less than 0.05 and supporting that the SEM model has a good fit.

Table 6 shows the results from SEM for hypothesis 1, the effect of a technological disaster on TMT attention to natural environmental issues. The coefficient of the change in a

technological disaster was s positive and statistically significant (*b= 0.05; p<0.05 two-tailed*). As a demeaned first-differencing estimation was used, the coefficient for a technological disaster suggests the extent to which TMT attention of *i* at time *t* was deviated from the group-mean of TMT attention of *i* by one-unit change in technological disaster. The change in a technological disaster by one unit is estimated to increase by 0.05 units in how much TMT is attentive to natural environment issues (*p<0.05 two-tailed*). As the variable, a technological disaster, is dichotomous, it might be more appropriate to interpret that when a technological disaster happens, TMT attention for firms influenced by a technological disaster is estimated to be higher than those not influenced.

Table 6
Parameter Estimates for Hypothesized Model using SEM

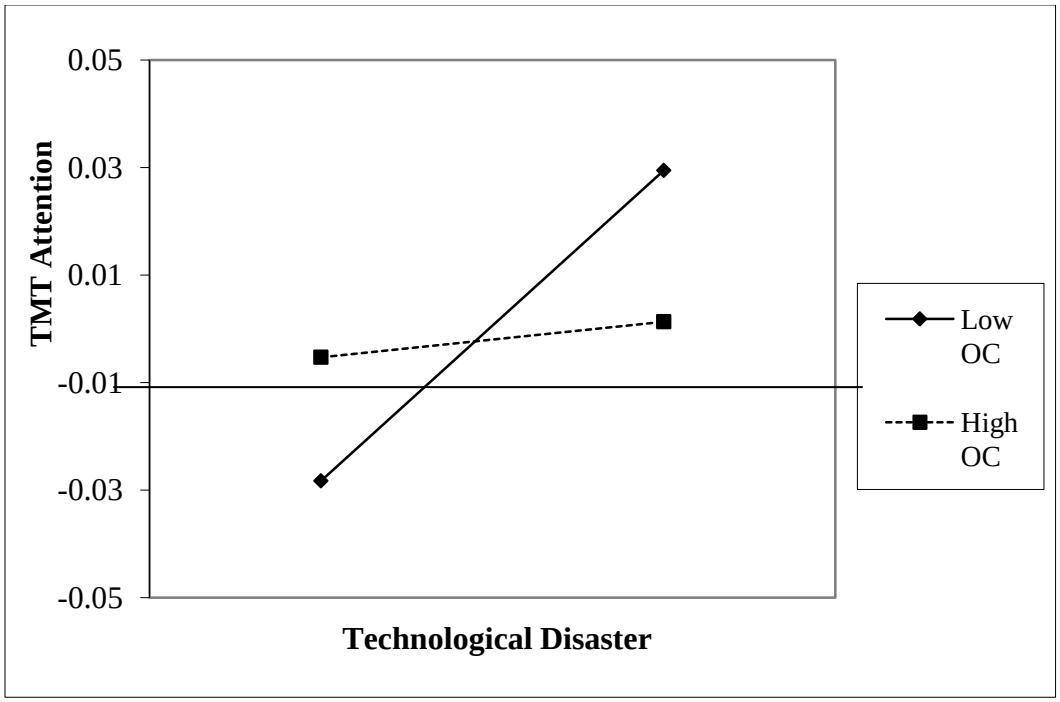
Path	Path Coefficient	z
Technological disaster → TMT attention	0.05**	2.09
TD*Ownership Concentration → TMT attention	-0.004**	2.10
TD*Outside directors → TMT attention	0.03**	2.19
TD*CEO duality → TMT attention	-0.01	0.09
TD*Family → TMT attention	0.29*	1.34
TD*Similarity to accident firm → TMT attention	-0.1**	2.45
TD*Absorptive capacity → TMT attention	-3.25*	1.78
TD*Aspiration → TMT attention	0.01	0.09
TMT attention → Protective Action	1.12*	1.82
TMT attention → Preventive Action	-0.02	0.36

Note. Model fit statistics: LR test of model vs. Saturated: $chi^2(3) = 0.13$, $prob>chi^2 = 0.99$
Obs.: 476
***: P<0.01 (one-tailed)
**: P<0.05 (one-tailed)
*: p<0.1 (one-tailed)

Hypothesis 2, which states that ownership concentration positively moderates the relationship between technological disaster and TMT attention, was supported (*b= -0.004; p<0.05 one-tailed*). To interpret the results from the moderation analysis, I followed the guidance provided by Aiken and West (1991) and Hayes (2013). Figure 3 demonstrated that

when ownership was concentrated, the effect of a technological disaster made a TMT more attentive to natural environmental issues.

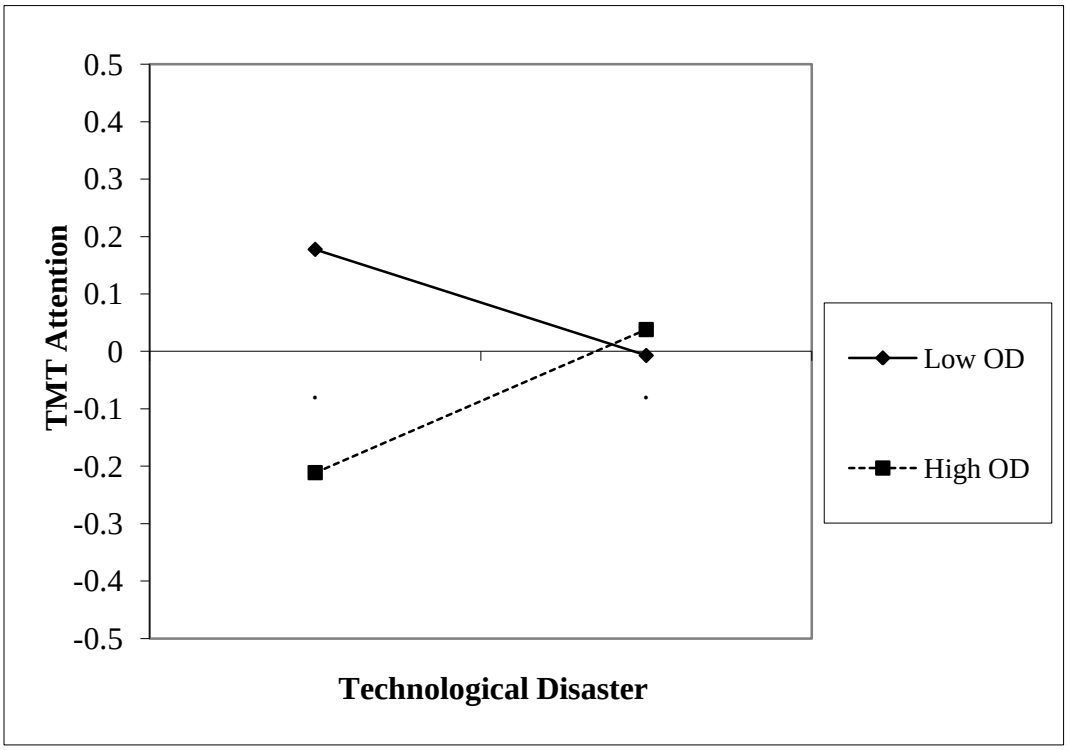
Figure 3
Interaction of Technological Disaster and Ownership Concentration on TMT Attention to Natural Environmental Issues



Hypothesis 3 that outside directors positively moderates the relationship between technological disaster and TMT attention was supported (*b=0.03; p<0.05 one-tailed*). It indicates that the effect of a technological disaster on TMT attention depends on the extent to which outside directors are involved. In Figure 4, the slopes of the lines correspond to the conditional effects of a technological disaster on TMT attention for outside director. As shown, the effect of a technological disaster about TMT attention was positive when the presence of outside directors was high, while the effect was negative when their presence was low. That is,

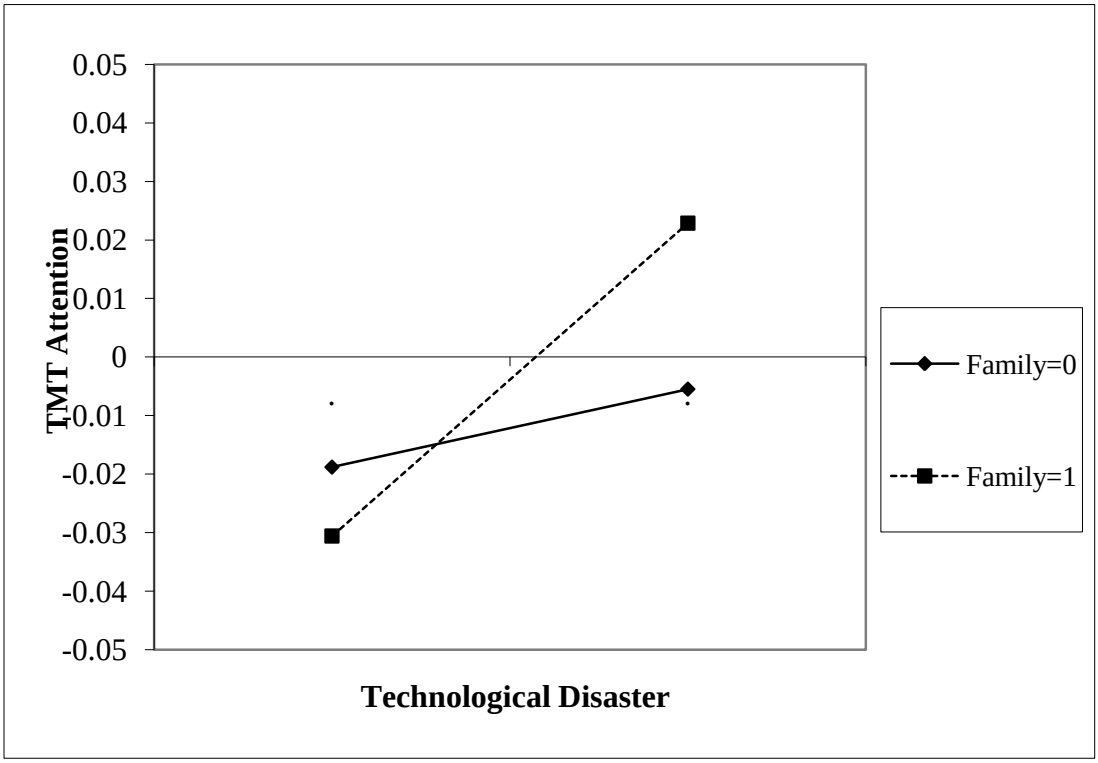
the effect of a technological disaster appears to be larger among the firms having high involvement of outside directors than among the firms having low involvement of outside directors, thus supporting hypothesis 3.

Figure 4
Interaction of Technological Disaster and Outside Director on TMT Attention to Natural Environmental Issues



Hypothesis 4 that CEO duality negatively moderates the relationship between technological disaster and TMT attention was not supported (*b=-0.01; p>0.1 one-tailed*). Although it was not statistically significant, the directionality indicates its potential negative effect on the disaster and attention relationship.

Figure 5
Interaction of Technological Disaster and Family on TMT Attention to Natural Environmental Issues



Hypothesis 5 that family influence positively moderates the relationship between technological disaster and TMT attention was marginally supported (*b=0.29; p<0.1 one-tailed*). The result indicates that the effect of a technological disaster on TMT attention depends on family influence. Among the firms that are influenced by a founder's family, the occurrence of a technological disaster has more positive effects on TMT attention than among those not influenced by a founder's family. Figure 5 illustrates the slopes of the lines correspond to the conditional effects of a technological disaster on TMT attention for the presence of family influence. The slopes were positive for both the firms being a family firm and those not.

However, it graphically shows that among the firms influenced by a founder's family, the effect of a technological disaster on TMT attention is larger than among the firms not influenced.

For vicarious learning, I investigated three different moderators including similarity to an accident firm, a firm's absorptive capacity, and a firm's achievement of aspiration level. None of hypothesis was found to be statistically significant. Particularly, hypothesis 6 that similarity to an accident firm positively moderates the disaster and attention relationship and hypothesis 7 that a firm's absorptive capacity positively moderates the disaster and attention relationship were found to be statistically significant but in an opposite direction.

Hypothesis 9 that TMT attention increase a firm's preventive environmental actions was not supported (*b=-0.02; p<0.37 one-tailed*). Meanwhile, the hypothesis 10 that TMT attention increases a firm's protective environmental actions was marginally supported (*b=1.13; p<0.1 one-tailed*). The result indicates firms having TMT attention higher by 1 point subsequently increased its protective environmental action by 1.13 point.

I tested hypotheses 1 to 10 using structural equation modeling. Although a demeaned first-differencing approach (within-estimator) controlled for endogenity and autocorrelation, it lacked the treatment for heteroskedasticity. For the robustness of the result, I ran a demeaned first-differencing regression model two times, one for hypotheses from 1 to 8 with TMT attention placed as a dependent variable and the other for hypotheses from 9 to 10 with a firm's environmental actions as dependent variables. Three regressions used standard errors that are robust to the presence of heteroskedasiticity. The results as seen in Table-10 were fairly consistent with those from structural equation modeling except that ownership concentration that was significant became marginally significant and family influence that was marginally significant turned significant.

Hypothesis 11 that TMT attention will mediate the effect of a technological disaster on a firm's environmental action was not supported (*Indirect Effect on a preventive environmental action: z=0.36; p>0.1; Indirect effect on a protective environmental action: z=1.37; p>0.1*).

In sum, the moderating effects of outside directors and family influence on the relationship between technological disaster and TMT attention to natural environmental issues was found significant, as illustrated in Figure 5 and 6. The findings indicate that when the two elements of corporate governance structurally distribute communication channels, the occurrence of a technological disaster becomes more salient to a TMT. It is more interesting to consider that neither of family influence (z=0.67; p>0.1) nor outside directors (z= 1.56; p>0.1) was significantly related to TMT attention.

The results do support family influence and outside directors serve as moderating the relationship between a technological disaster and TMT attention, while I did not found any support for the moderating effect of variables for vicarious learning (Table-6). A summary of the results for each hypothesis can be found in Table-7.

Table 7
Summary of Results

Hypothesis	Result
H 1: Technological disaster is positively associated with TMT attention to natural environmental (NE) issues.	Supported
H 2: Ownership Concentration will positively moderate the technological disaster and TMT attention relationship.	Supported
H 3: Outside directors will positively moderate the technological disaster and TMT attention relationship.	Supported
H 4: CEO duality will negatively moderate the technological disaster and TMT attention relationship.	Not supported
H 5: Family influence will positively moderate the technological disaster and TMT attention relationship.	Marginally Supported
H 6: Similarity to accident firm will positively moderate the technological disaster and TMT attention relationship.	Not supported
H 7: Absorptive capacity will positively moderate the technological disaster and TMT attention relationship.	Not supported
H 8: Performance above aspiration will positively moderate the technological disaster and TMT attention relationship.	Not supported
H 9: TMT attention is positively associated with preventive environmental action.	Not supported
H10: TMT attention is positively associated with protective environmental action.	Marginally supported
H11: TMT will mediate the effect of technological disaster on preventive environmental action	Not supported

CHAPTER FIVE:
DISCUSSION AND CONCLUSION

I began this study by noting the needs for understanding of how TMTs are sometimes committed to a risky and short-term unprofitable environmental action and why they often fail to be a key champion for the actions. Drawing on the attention-based view, I proposed that corporate governance and vicarious learning lead a TMT to attend to and engage in various levels of environmental actions across firms in ways that influence a TMT to reframe its perspective (i.e., structural process) on technological disasters and facilitate internal communication (i.e., social cognitive process), thus enhancing organization-level selective attention to environmental issues.

To explain this mechanism, I highlighted the role of TMT attention to natural environmental issues in achieving environmentally responsible actions as part of corporate social responsibility (CSR). Given that the primary group responsible for making CSR decisions and actions is a TMT, it should be challenging to advance our understanding of a theoretical mechanism of creating environmentally responsible actions without observing the social cognitive and structural process of developing TMT attention. It is worthwhile to note the ceaseless debates about the relationship between CSR and firm performance, which can be partially ascribed to the lack of observation of decision makers and their attention. Without that observation, researchers need to make some assumptions about the behaviors of managers in which there has long been a gap in perspectives on CSR between stakeholder theory and agency theory. The former theory assuming stakeholders as information and opportunity providers views CSR as instrumental to performance, whereas the latter theory assuming that CSR harms a

firm's performance posits that CSR should be made within performance (Jo & Harjoto, 2012). The gap has not been narrowed and the coexistence of the two dominant theoretical perspectives has continued to incur an ambiguous relationship.

Drawing on virtual ethic theory, Chun (2005) sees a firm's responsible behavior as originating from organizational virtue run by managers who have strong aspiration values for ethics. As an individual ethical value serves as an aspiration point, firms tend to engage in responsible actions and satisfy stakeholders' expectations. Having a more utilitarian perspective, I argued that TMT attention strengthened by organizational characteristics is a key antecedent to a firm's environmentally responsible actions. As part of corporate governance that facilitates a TMT to have a sensitive framework of natural environmental issues, ownership dispersal, a founder's family influence, outside directors, and separate functions of CEO and a chairman of the board were hypothesized to have positive moderating effects on the relationship between a technological disaster and TMT attention to natural environmental issues.

Using longitudinal data of S&P 1500 listed firms affiliated with heavily polluting industries (Bansal & Clellend, 2004), I tested for the indirect effect of technological disaster on a firm's environmental action, as mediated by TMT attention to natural environmental issues. Plus, I tested for the conditional indirect effect of corporate governance and vicarious learning on a firm's environmental action, as mediated by TMT attention. The 10-year period observation was effective in removing an individual firm's unique time-invarying unobservable effects so that I identified the net effect of a technological disaster on TMT attention, the moderating effect of a majority of the variables for corporate governance on the disaster-TMT attention relationship, and the effect of TMT attention on a firm's protective environmental action.

Whereas a chain of events between a technological disaster and TMT attention and between TMT attention and a protective environmental action were identified, the indirect effect of a technological disaster on the environmental action was not found in this study. Specifically speaking, I found the firms strongly attentive to the issues tend to marginally engage in protective actions but no significant relationship between TMT attention and preventive actions was found. This finding indicates that TMT attention might be a necessary condition, but not sufficient enough to drive a firm's environmental actions by taking risks. This suggests that considering the boundary condition of the relationship provides a good understanding of the following question: under what conditions does TMT increase its attention enough to take risks and implement what they are attending to?

In Ocasio's (1997) conceptual research, the relationship between TMT attention and organizational movement is explained by managers' identities and interests. Given that the attention-based view follows the assumption of the behavioral theory of the firm (BTOF), a dominant coalition's bounded rationality leads to uncertainty avoidance (Cyert & March, 1963). Unless there is managerial motivation to invest in environmental actions large enough to offset uncertainty, selective attention is less anticipated to be linked to a firm's environmental actions. The associations between TMT attention and a firm's environmental actions would be strongly significant, if a TMT is better able to predict that environmental actions will contribute to maintaining its identities and interests.

The underlying logic of behavioral perspectives in the environmental management literature is that TMT attention to environmental issues motivates a firm to engage in either developing environmental competency, achieving environmental legitimacy or both when a dominant coalition in an organization perceives threats to its position. The attention enables a

TMT to better understand and predict the extent to which technological disasters will bring about the loss of performances by insiders, and a dominant coalition will be threatened due to the loss and be replaced by a newly emerging coalition having an appropriate capability to be able to address environmental issues (Baum, Flemming, and Singer, 1983; Cyert & March, 1963). That is, high TMT attention functions as alerting the dominant coalition to the threats to continuity of its identities and interests before managerial competencies and tacit knowledge held by the dominant coalition are replaced by a group having a new cognitive framework (Gavetti & Levinthal, 2000).

Corporate Governance and Vicarious Learning

The results of testing for the moderating effect of corporate governance and vicarious learning on TMT attention indicated that ownership concentration, family influence and outside directors increase the impact of a technological disaster on TMT attention, but none of the variables for vicarious learning did. According to Ocasio (1997), rules and rule makers in an organization play a critical role in influencing the direction of communication, formulating organization-level attention, and strategic orientation (Thornton & Ocasio, 1999). In that sense, controlling shareholders, a founder's family influence, and outside directors were identified as critical players who effectively affect interests and identities of TMT by distributing the communication channels.

Under such a crisis condition as the impact of a technological disaster, long-term oriented goals influenced by controlling shareholders and family members were found to moderate the relationship between a technological disaster and TMT attention. Further, extensive concerns and interests ignited by outside directors were identified to distribute the communication channels that have TMT managers more responsive to events that could adversely affect a firm's

long-term performance for various reasons and communicate more about relevant issues and answer.

However, the findings that CEO duality did not support hypotheses led me to consider the possibility that CEO duality may serve differently in the period of crisis than in the normal business period. Unlike the traditional perspective of CEO duality that highlighted agency problems such as entrenchment and risk avoidance caused by leveraging on his/her power for his/her personal wealth, some new perspectives tend to view CEO duality as a driver of a strong transformative leadership, particularly in the period of crisis and uncertainty such as when a technological disaster and its negative spillover in an overall industry happen. I assume that non-significant results for CEO duality may represent its mixed effect on TMT attention. Therefore, there seems to be a decent possibility of being able to explore the boundary condition of CEO duality, particularly in relation to crisis management.

Unlike hypotheses related to corporate governance, none of three hypotheses for a firm's vicarious learning were supported in my study. They are conceptually important and meaningful in that social cognitive processes that occur among TMT members are facilitated when organizational characteristics provide decent conditions for learning other firms' actions and practices from a distance. A firm's absorptive capacity, achievement of its aspiration level, and similarity to an accident firm were hypothesized to motivate TMT members to communicate with one another to learn more about why technological disasters happened and how other firms addressed them.

I measured absorptive capacity calculating as R&D expenses divided by sales. About a third of my sample firms did not report R&D expenses or allocate capital budget into R&D activities during an observation period from 1993 to 2003. In the case that firms are strongly

expressing environmental concerns and strengths through letters to shareholders without budgeting R&D expenses, the moderating effect of absorptive capacity can be reversed, as opposed to hypothesis 7 that absorptive capacity will positively moderate the disaster and TMT attention relationship.

Furthermore, I also note the possibility that firms having high absorptive capacity may be internally oriented when they seek solutions to potential threats created by unprecedented disasters. This logic is possible when the attribute of absorptive capacity, path-dependency, is considered. Absorptive capacity is a firm's dynamic capability to absorb new knowledge relevant to a firm's existing knowledge system and thus enhance its routine and process (Cohen and Levinthal, 1990). High absorptive capacity tends to lead firms to be externally oriented and acquire and assimilate new knowledge and apply it to problems, but its relevance to existing knowledge systems or path-dependence facilitates a firm's routinization by selectively attending to what a firm has to know based on what it knows (Todorova & Durisin, 2007).

Based on the concept of path-dependence, there is the likelihood that when an event irrelevant to a firm's knowledge system, such as a technological disaster, it might be less attentive to natural environmental issues than a firm having low absorptive capacity. The path-dependence may have a TMT apply what it has acquired when noticing and encoding a technological disaster and interpret the threat by focusing on internally routinized knowledge, rather than focusing its attention on external cues for a solution (Gavetti, 2005). For the firms having high absorptive capacity, a technological disaster might be an event that has a TMT take its attention away from the issues encompassing the natural environment to the internal process, as suggested by statistical results (*$z = -3.25$; $p < 0.1$; one-tailed*).

This study also found that high TMT attention contributes to a firm's protective environmental actions, while the attention does not lead to a firm's preventive environmental actions. These findings are consistent with the explanation for the boundary condition for a firm's environmental action. High TMT attention to natural environmental issues seems to be sufficient conditions for achieving environmental legitimacy with low risks and costs, but a TMT with high attention does not necessarily have a firm engage in environmental actions for environmental competency that entails high risks and costs. The conditions that transformed attention into motivation to implement green actions will explain a substantial portion of total variance of a firm's environmental actions.

Lastly, this study, observing and testing the effect of a technological disaster, contributed to advancing our understandings of how firms engage differentially in environmental actions in periods of crisis by looking into the process of environmental decision-making of a firm. Walls, Berrone, and Phan (2012) examined the effect of corporate governance on environmental strengths, assessed by a firm's capability to improve environmental performance, and on environmental concerns, operationalized by pollution prevention that provides organizations with some advantages (Christamann, 2000; Klassen & Whybark, 1999). They found that board independence positively affects environmental concerns or problems. Meanwhile, CEO duality had no direct effect on pollution prevention.

Theoretical Implications

There are several important theoretical implications to this study. First, firms are taking two possible environmental strategic actions: developing environmental competency and keeping organizational legitimacy (Barreto, 2013). It is noteworthy to note that the fundamental reason behind this strategic choice lies in the assumption that attention to natural environmental issues is

a relatively limited resource compared to attention to competitive environmental issues. In this study, having this limited and selective attention, a TMT tends to engage in protective environmental actions rather than preventive environmental actions in response to threats from a technological disaster. The findings are consistent with Sharma, Pablo, and Vredenburg (1999) discussion that a firm's preventive actions are associated with opportunities while its protective actions are associated with threats.

Second, research into attention can bridge between organizations and general environments. External environments consist of general, industry, and competitor environments. These sub-external environments are conceptually aligned, and there are different dominant theories for each environment. Firms can identify threats and opportunities that are unequally distributed in the general environment. As the likelihood of effectively capturing opportunities and neutralizing threats depends on the extent to which firms are concerned about (Dibrell et al., 2014), learn about, and attend to the changes in general environment, attention should be a good cognitive instrument that links firms with opportunities to explore and threats to prevent. Therefore, the attention-based view can contribute to explaining why firms vary in responding to an unexpected event in the general environment using three principles of attention.

Third, attention-based view complements the limitations of formalized decision making process in a highly uncertain environment. The latter assumes that managers go through scanning, understanding, evaluating, and forecasting external and internal environments in a rational manner, and design and implement strategies with the results of the SWOT analysis. The formalized approach to strategy efficiently leads to a firm's actions and reactions against events (e.g., changes in forces from competitors, buyers, suppliers, and regulators) that happen in competitor and industry environments. Meanwhile, the formalized process of strategic decision

making is limited in focusing resources and efforts on a few issues in the highly uncertain environments driven by sudden and low-probability events from general environments including a technological disaster. The attention-based view that partially adopts a sensemaking process (Weick, 1995) suggests that social salience of a technological disaster elicit firms to enact their environment and to give meanings to prioritized issues by categorizing and labeling unequivocal issues, thus helping organizations make more sense of events that might not have been attended. Therefore, the attention-based view is anticipated to continue to provide a theoretical lens to look into the areas where strategies developed from a formalized decision-making process could not reach.

Managerial Implication

Management studies have been mainly conducted with micro-level management research into HR and macro-level management research into strategy divided. Meanwhile, businesses are moving forward with the two domains integrated by having a TMT rationally attend to the voices of employees (Bouquet & Birkinshaw, 2008) and to stakeholders (Hart, 1995). The failure to coordinate the integrative process of creating and attending issues is known to harm organizational change (Dutton et al., 2001).

It is notable that the a top-down attention-making process might bias an organizational attention to the issues that come from the bottom of its organization by providing a TMT with a firm's specific value, rules, and norms. It indicates the attention is focused not on the content of issues but on the source of attention. Internal powers tend to be concentrated to those who can promote issues in an organization, as insiders understand that their proposed issues are effectively attended by a TMT when they are endorsed by those having an internal power.

Given that a primary goal of a firm is to maintain a competitive advantage by nurturing competitiveness, the emergence of a powerful coalition that has no association with pursuing the organizational goal is referred to as organizational politics (Chang, Rosen, & Levy, 2009). When insiders are not aligned with strategy but follow those who can create issues in an organization, organizational politics often end up dominating an organizational strategy that is necessary for effective decision-making. In sum, this study implies that biased TMT attention by corporate governance is the manifestation of relying on the source of issues, instead of its content, thus harming a firm's capability to cope with external changes and identify opportunities

Second, although a number of governmental policies and regulations favorable to stakeholders have been enacted and try to improve communal environments, the key group which accepts and applies institutions to strategic management process is a TMT (Hiatt & Park, 2013) and its attention determines the level and type of environmental actions to implement, as hypothesized. I provided a framework for how to develop environmentally responsible firms considering corporate governance and vicarious learning. Understanding the mechanism by which TMT attention to natural environment is created and leads to the action will help regulatory agencies responsible for exercising environmental policies predict the possibility that firms faithfully comply with environmental regulations and practices.

Limitation & Future Study

First, limited data availability constrained me to select sample firms only from five different industries. Particularly, as a database for my dependent variable, TRI database, annually reported to the US EPA (Environmental Protection Agency), was available only for industries falling under the SIC first-two-digit codes from 20 to 50. This selection issue left limitation in external validity.

Second, following Cho & Hambrick (2006), I used 838 LTSs and analyzing its content was an appropriate approach to assessing and identifying TMT attention to natural environmental issues. As there was no systematic approach to studying and measuring organization-level attention to natural environmental issues, I assume that the construct is a unidimensional. However, given that its attention is the product of environmental concerns, conviction, and champion that encourage a firm to be environmentally responsible, it must be worthwhile to break down the construct further.

Although I developed the measurement of TMT attention in an inductive approach after assessing a sample firm's LTSs, I found some possibilities that the uni-dimensionality of TMT attention to natural environmental issues might be segmented into three components based on Scott's (2003) classification of institution: TMT attention to regulative environmental issues, TMT attention to normative environmental issues, and TMT attention to cultural environmental issues. TMT attention to regulative environmental issues indicates the noticing and encoding environmental regulations that look most salient in its business situation and interpreting them as the concerns that have coercively regulated and legally sanctioned. The words[5] for this category include, for instance, 'clean air act', 'clean air regulation', 'environmental law', 'environmental regulation', 'environmental protection agency', 'federal energy regulatory commission', 'wildlife conservation', 'toxic release inventory', 'national environmental policy', 'Kyoto treaty', 'ISO 14001', 'hydrocarbon law', 'environmental policy', 'coalition for environmentally responsible economies', etc.

TMT attention to normative environmental issues indicates the noticing and encoding environmental social expectation that look most salient in its business situation, interpreting

[5] The listed words are not exhaustive. Detailed explanations for the list of the words representing TMT attention to natural environmental issues are available from the author upon request.

them as the concerns that have normatively regulated and morally governed, and focusing its attention on the corresponding solutions. The words for this category include, for instance, 'accident prevention', 'air and fuel management', 'biodegradable', 'clean coal technology', 'clean energy', 'clean burning', 'community-based health program', 'cradle-to-cradle', 'environmental annual report', 'environmental practice', ' forest management', 'forest stewardship advisory', 'green diesel technology', 'groundwater treatment', 'pollution control', 'pollution prevention', 'recycle', 'renewable', 'sustainability report', 'sustainable forestry initiative', ' voluntary industrial toxics reduction', 'waste processing', 'water treatment', etc.

TMT attention to cultural-cognitive environmental issues indicates the noticing and encoding environmental taken-for-granted understandings that firms culturally support for communal environments. The words for this category include, for instance, 'a sense of stewardship', 'accountability', 'citizen's health', 'clean healthy environment', 'cleaner and healthier place', 'commitment to the environment', 'community support', 'corporate citizenship', 'corporate social responsibility', 'duties and obligations of stewardship', 'environmental and safety advance', 'environmental social performance', 'environmental benefit', 'environmental concern', 'environmental cost', 'environmental excellence', 'environmental impact', 'environmental leadership', 'environmental stewardship', 'global climate', 'impact on the environment', 'responsible public citizen', 'safety, health and environmental performance', 'sustainable development', 'value to their community', 'welling being of the community', etc.

The classification might provide an insight into how TMT attention to natural environmental issues did not mediate the relationship between the disaster and preventive /protective environmental actions, as indicated by the tests for hypotheses 11 and 12. The sample firms tend to use cultural-cognitive natural environmental issue in the most various forms

of words and phrases (n=326) followed by normative natural environmental issues (n=138) and regulative natural environmental issues (n=103). The results indicate that it might be more convenient for TMT to use cognitive natural environmental issues than normative and regulative ones, since TMT can exhibit its belief in the importance of nurturing communal environments that might positively impress stakeholders and express the priority of shareholder's interest by signaling that its environmental actions are too much to harm financial performance.

Meanwhile, normative and regulative natural environmental issues entail detailed information on the milestones of planned actions, relevant organizations, and expected outcomes. The details might be the manifestation of TMT's environmental concerns and confidence on the situations surrounding it firm, given that TMT is supposed to summary its primary attention only on 2 to 4 pages. It could imply that TMT attention to cognitive natural environmental issues focuses on how its firms look environmentally responsible by exhibiting its attention to natural environment, whereas TMT attention to regulative/normative natural environmental issues focuses on how its resources and capabilities address environmental concerns by doing so (Barreto, 2013). I anticipate that using segmented measures of TMT attention will improve the nomological validity on the relationship between TMT attention and protective/preventive actions in the future research. Additionally, the moderating effect of vicarious learning on TMT attention is also anticipated to be more effectively identified.

CONCLUSION

This study focused on how a technological disaster affects TMT attention to the natural environment, which, in turn, leads to environmental actions and what conditions differentially increase the effect of technological disaster on a firm's environmental action, as mediated by TMT attention. I found empirical support for the ideas that a firm's environmental actions

seeking legitimacy depends on the extent to which TMT concerns about environments are enhanced by corporate governance such as ownership dispersal, outside directors, and family influence. These factors effectively influence a TMT to make more sense of the adverse impact of a technological disaster on organizational legitimacy, and the structural attention leads to a firm's protective environmental actions. Meanwhile, the association between TMT attention and a firm's proactive environmental actions seeking environmental competency was not found in this study. The findings provide some insights into how environmentally responsible firms are nurtured and why a disastrous event leads to different environmental actions across firms.

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LIST OF APPENDICES

APPENDIX A

COMPARISON OF DEFINITIONS FOR TECHNOLOGICAL DISASTERS & NATURAL DISASTERS

Comparison of Definitions for Technological Disasters & Natural Disasters:
Technological Disaster

	Technological Disaster	
Domains	Source	Definitions
Non-Academic Areas	National Science and Technology Council's Subcommittee on Disaster Reduction (SDR)	"Technological hazards involve the release of hazardous substances that impact human health and safety, the environment, and/or the local Economy. Hazardous substances are chemicals, toxic substances, gasoline and oil, nuclear and radiological material, and flammable and explosive materials, in the form of gases, liquids, or solids" (Section for Technological Disaster, 2008: p. 1)
Non-Management Area	Pidgeon & O'Leary (2000, p.16)	"significant disruption or collapse of the existing cultural beliefs and norms about hazards"
	Gill & Picou (2008, p.796)	"… occur when breakdowns in technological and bureaucratic organization systems lead to destruction or contamination of the natural and built environment. Most technological disasters involve contamination of the environment that challenges individuals' fundamental expectations regarding their relationship with nature"
	Baum et al. (1983)	Malfunction of a vast technological network of power generating, production, and waste disposal system
Management Area	Robert (1990: p. 164)	Caused by "the technological failures that combined with human and organizational factors to produce the accident and were unanticipated interactions among multiple failures in the system, tight coupling, design flaws in the plant, the use of defective or malfunctioning equipment, the use of contaminated or sub standard supplies and raw material, and the use of incorrect operating procedures"
	Richardson (1994: p. 41)	"which cause extensive damage and social disruption, involve multiple stakeholders and unfold through complex technological, organizational and social processes"

Comparison of Definitions for Technological Disasters & Natural Disasters:
Natural Disaster

	Natural Disaster	
Domains	Source	Definitions
Non-Academic Areas	US EPA; Federal Emergency Management Agency (FEMA)	Classifying natural disaster into drought, earthquakes, extreme cold, extreme heat, fires, floods, hurricanes, landslides and debris flow, tornadoes, tsunamis, and volcanoes
	Center for Research on the Epidemiology of Disasters (CRED)	When an natural event fulfills at least one of following criteria, it qualifies as a disaster: 10 or more people are reported killed; 100 or more people are reported affected, injured, and/or homeless; the government declares a state of emergency; the government requests international assistance
	Department of Homeland Security (DHS)	"Disaster can strike people in any community at any time, building slowly, or striking suddenly without warning." DHS definition includes both natural disasters and acts of terrorism.
Non-Management Area	Kreps (1984, p. 312)	"events, observable in time and space, in which societies or their subunits (e.g., communities, regions) incur physical damages and losses and/or disruption of their routine functioning"
	Alcantara-Ayala (2002, p.112)	"some rapid, instantaneous or profound impact of the natural environment upon the socio-economic system, or as a suddenly disequilibrium of the balance between the forces released by the natural system and the counteracting forces of the social system"
Management Area	Winn et al., (2011: p. 161)	*Massive Discontinuous Change* "significant, sudden, disruptive change in the broader ecological or social systems of which organizations and economic systems are a part"
	Oh & Oetzel (2011: p. 660)	Significant and sudden disruptions ignited by an unprecedented and unpredictable natural event (i.e., act of God) including "drought, earthquakes, epidemics, extreme temperatures, floods, insect infestations, mudslides, volcanic eruptions, tsunamis, and wild fires"

APPENDIX B

LIST OF SAMPLE FIRMS

SIC 26: Pulp/Paper/Stationery Products[6]

Unit: Millions of Dollars

Name	Revenue (1995)	Ticker	Name	Revenue(1995)	Ticker
Int'l Paper co.	19797	IP	Domtar Inc.	2795	DTC
Kimberly-Clark Corp	13788	KMB	Sonoco Products co	2706	SON
3M	13460	MMM	Bowater Inc	2001	BOW
Weyerhaeuser co	11788	WY	Potlatch corp.	1605	PCH
Tenneco Inc.	8899	TEN	Bemis co	1523	BMS
Boise Cascade corp.	5074	BCC	Rayonier Inc	1260	RYN
W R Grace & co.	3665	GRA	Rock-Tenn co	902	RKT
Temple Inland Inc	3460	TIN	Caraustar Industries	544	CSARQ
Avery Dennison corp.	3113	AVY			

[6] As of 1995, the above 18 firms were primarily engaged in paper industry such as paper coated and laminated (2672), paperboard mills (2631), pulp mills (2611), and corrugated and solid fiber boxes (2653). Among them, six firms transformed their primary businesses during the observation period from 1995 to 2004; W R Grace shifted from 2671 to 2819 (Industrial Inorganic Chemicals) in 1998, 3M shifted from 2672 to 2891(Adhesives and sealants) in 2002, Weyerhaeuser shifted from 2621 to 0811 (Timber Tracts) in 2002, Tenneco from 2653 to 3714 (Motor Vehicle Parts and Accessories) in 2002, Potlatch from 2631 to 2435 (Hardwood Veneer and Plywood) in 1998 and back to 2611 (pulp mills) in 2002, and Rayonier from 2611 to 2823 (Cellulostic Manmade Fibers) in 2002 and to 6798 (real estate investment).

SIC 28: Plastic Materials/Chemical Manufacturing/Pharmaceutical Preparation/Paint & Coating Manufacturing)

Unit: Millions of Dollars

Name	Revenue (1995)	Ticker	Name	Revenue (1995)	Ticker
Procter & Gamble Co.	33434	PG	Baxter International Inc	5048	BAX
Akzo Nobel NV.	21488	AKZOY	Eastman Chemical Co.	5040	EMN
Dow Chemical Co	20261	DOW	FMC Corp	4509	FMC
Johnson & Johnson	18842	JNJ	Avon Products Inc	4492	AVP
Merck & Co Inc	16681	MRK	Rohm & Haas Co.	3884	ROH
Bristol-Myers Squibb co.	13767	BMY	Air Products & Chemicals Inc.	3865	APD
Pfizer Inc.	10021	PFE	Olin Corp	3150	OLN
Abbott Laboratories	17685	ABT	Praxair Inc.	3146	PX
Monsanto Co	8962	MON	Estee Lauder Cos Inc	2899	EL
Colgate-Palmolive Co.	8358	CL	Amgen Inc	1818	AMGN
PPG industries inc	7057	PPG	International Flavors & Fragra	1439	IFF
Lilly (Eli) & co.	6763	LLY	Ferro Corp	1322	FOE
Schering Plough Corp.	5014	SGP			

SIC 29: Petroleum Refining/Asphalt Paving Mixtures/Lubricating Oils/Petroleum & Coal Products[7]

Unit: Millions of Dollars

Name	Revenue(1995)	Ticker	Name	Revenue(1995)	Ticker
Mobil Corp	73413	MOB	Valero Energy Corp	3019	VLO
Du Pont (EI) De Nemours	42163	DD	Pennzoil Co.	2385	PZL
British Petroleum Co	36106	BP	Lubrizol Corp.	1983	LZ
Conocophiliips	13368	COP	EMCO Ltd	1086	EMLTF
Ashland Inc	12167	ASH	Quaker State Corp	1035	KSF
Occidental Petroleum Corp	10423	OXY	Tesoro Petroleum Corp	7119	TSO
Unocal Crop	8133	UCL	Holly Frontier Corp.	613	HFC
Hess Corp	7302	HES	Quaker Chemical Corp	227	KWR

[7] For SIC 29 (Oil and Gas), mergers and acquisitions frequently occurred, particularly early in 2000s. Therefore, I briefly describe the history of the M&As related to sample firms in SIC 29.

Hess Corporation (HES)

In 1919, Amerada Corporation was formed by British oil entrepreneurs. In 1996, Hess Oil and Chemical acquired 10% of Amerada Corporation, and in May 2006, Amerada Hess Corp, changed its name to Hess Crop.

Exxon Mobile Corp (XOM)

It was formed in November, 1999, by the merger of Exxon (formerly Standard Oil) and Mobil (Formerly Standard Oil of New Jersey).

ChevronTexaco Corp (CVX)

In October, 2000, Chevron announced acquisition of Texaco and the new firm was named ChevronTexaco, which returned to the Chevron name in May, 2005. Therefore, the official name was Chevrontexaco Corp. from 2000 to 2005.

Conocophillips (COP)

It was created through the merger of Conoco inc., which was founded in 1875, and the Phillips Petroleum Co., founded in 1917, in August, 2002.

SIC 37: Motor Vehicles/Aircraft Engines & Parts/Shipbuilding & Railroad Equipment /Transportation Equipment

Unit: Millions of Dollars

Names	Revenue(1995)	Ticker	Names	Revenue(1995)	Ticker
General Motors co.	168828	GM	Gencorp inc	1772	GY
Ford Motor Co.	137137	F	A O Smith Corp	1544	AOS
United Technologies Corp	22802	UTX	Sequa Corp	1414	SQAB
Boeing Co.	19515	BA	Harley Davison Inc.	4090.9	HOG
Lockheed Corp.	13130	LMT	Alliant Techsystems Inc.	2172.1	ATK
Textron Inc.	9973	TXT	Polaris Industries inc	1113	PII
Dana corp.	7786	DAN	Terex Corp	1030	TEX
Navistar International Corp	6292	NAV	Teleflex Inc.	2076.2	TFX
Paccar inc.	4848	PCAR	Standard Motor Products Inc	663	SMP
Magna International Inc	4512	MGA	Thor Industries inc	562	THO
General Dynamics corp.	3067	GD	Winnebago Industries inc	484	WGO
Trinity Industries inc	2496	TRN	Oshkosh Truck Corp.	437	OSK

SIC 49: Electric Services/Gas Transmission/Utilities)[8]

Unit: Millions of Dollars

Names	Revenue (1995)	Ticker	Names	Revenue (1995)	Ticker
Southern Co.	9180	SO	DTE Energy Co.	3635	DTE
Edison International.	8405	EIX	Cinergy Corp.	3031	CIN
Entergy Corp.	6274	ETR	Wisconsin Energy Corp	1770	WEC
Public Service Enterprise group	6164	PEG	Pinnacle West Capital Corp	1669	PNW
American Electric Power Co.	5670	AEP	Teco Energy Inc	1392	TE
FPL Group, inc. (Formerly, Nextra Energy Resource)	5592	NEE	Hawaiian Electric Industries	1295	HE
Duke Energy Corp.	4676	DUK	Waste Management Inco.	1144	WM
Dominion Resources Inc.	4651	D	Portland General electric	983	POR
CMS Energy Corp	3890	CMS			

[8] Unlike other industries where a majority of firms were operating in the US, this industry includes many of large-cap firms which were publicly traded in the US but were being operated out of the US. So, I selected sample firms of this industry from top 150 firms in the basis of revenue as of 1995, which doubled 75 targeted firms for each of other industries.

APPENDIX C

LIST OF TECHNOLOGICAL DISASTER IN FIVE INDUSTRIES DURING OBSERVATION PERIOD FROM 1994 TO 2003

List of Technological Disaster in Five Industries
During Observation Period from 1994 to 2003

Type of Disaster: Industrial Accident (Explosion; Chemical Spill; Gas Leak; Fire) and Transport Accident (Chemical/Oil/Gas Spill)

Date	Location (Neighbor States)	Type	Relevant Organization	Damages	Related Industry	Disaster No.
Jan 29 2003	Kinston near Chapel Hill, North Carolina (Virginia, Tennessee, South Carolina, Georgia)	Explosion of Pharmaceutics Factory caused by an accumulation of combustible polyethelene powder	West Pharmaceutical Service (publicly traded firm): manufacturer of pharmaceutical packing (e.g., plastic packaging) and delivery	6 killed 36 injured	SIC 28	2003-0070
Sep 23 2001	Brookwood Alabama (Mississippi, Tennessee, Georgia, Florida)	Explosion of Coal Mine Blue Creek (i.e., gas explosion) caused by methane gas	Jim Walter Resource Blue Creek No. 5 Mine (Non publicly traded): Southernmost Appalachian coal producer for use in electric generating plants	13 Killed 3 injured	SIC 29;	2001-0569
Aug 19 2000	Fatal Carlsbad New Mexico (Arizona, Utah, Colorado, Kansas, Oklahoma, Texas)	Explosion of Natural gas pipeline explosion and a transmission pipeline ruptured; blamed on corrosion in a 50-year old pipe.	El Paso Natural gas (L.L.C)	12 Killed 2 injured; property and other damages or losses totaled $998.296; steel suspension bridges damaged	SIC 49	2000-0512
May 27 2000	Eunice, South-West Louisiana (Texas, Oklahoma, Arkansas, Mississippi)	Derailment of Union Pacific Railroad Train and oil spill due to poor track conditions of the Union Pacific	Union Pacific Railroad (Publicly Traded Firm; owner is unknown)	3500 evacuated; total damages exceeds $35 million areas polluted by hazardous materials and residue	SIC 29	2000-0319
Dec 8 1998	Saluda Western North Carolina (Virginia, Tennessee, South	Highly volatile and toxic Chemical Spill (Sodium Hydrosulfite)	A tractor-trailer (Non publicly traded firm)	100 affected;	SIC 28	1998-0412

	Carolina, Georgia)					
Oct 19 1998	Highland Pierron Illinois (Wisconsin, Iowa, Missouri, Kentucky, India, Michigan)	Chemical Spill (Sulfuric Acid) caused by derailment	Conrail (Non publicly traded corporation)	200 affected	SIC 28	1998-0318
Oct 7 1998	Portland Pennsylvania (New York, New Jersey, Delaware, Massachusetts, Connecticut, Maryland, Ohio, West Virginia, Virginia)	Chemical Spill (Sulfuric Acid; sodium hydroxide) to Clarion River	Genesee & Wyoming industries (publicly traded firm)	100 affected	SIC 28	1998-0305
Sep 2 1998	Harper County Texas (New Mexico, Colorado, Kansas, Oklahoma, Arkansas, Louisiana)	Chemical Spill (Nitric acid, sodium hydroxide)	Burlington Northern and Santa Fe (Publicly traded firm; owner is unknown)	350 affected	SIC 28	1998-0285
July 1 1998	North Carolina (Virginia, Tennessee, Georgia, South Carolina)	Mislocating 2-inch gas lines and the construction company later bit when digging	N.C. Natural Gas (Publicly Traded Firm)	400 affected	SIC 49	1998-0196
Jun 22 1998	Derailed at Cox Landing, West Virginia (Pennsylvania, Ohio, Kentucky, Virginia, Maryland, Delaware)	Chemical spill of 21,550 gallons of Formaldehyde	CSX Transportation (publicly traded firm; owner is unknown)	512 affected; total damages exceeded $2.6 millions	SIC 28	1998-0195
Feb 26 1998	Pocasset, Oklahoma (Texas, New Mexico, Colorado, Kansas, Missouri, Arkansas, Louisiana)	Fire of Baroid's metal building that contained caustic soda, potassium hydroxide, and highly corrosive compounds	Baroid's Drilling fluids inc. (a worldwide drilling fluids company, a division of Dresser Industries Inc; non public traded firm.)	500 affected	SIC 29	1998-0058
Sep 10 1997	Columbus Ohio (Michigan, Indiana, Kentucky, West Virginia, Pennsylvania, New York)	Explosion of Chemical factory, causing a phenol/formaldehyde resin mixture over the grounds	Georgia Pacific Corporation (publicly traded firm)	25 killed 8 injured; degradation of neighbors' health and property	SIC 28	1997-0370
July 19 1997	Flora Mississippi (Louisiana, Arkansas,	Crews used and destroy tanker cars carrying a flammable liquid	Dupont (Publicly Traded Firm)	6000 affected	SIC 28	1997-0198

	Tennessee, Alabama)	chemical and 6,000 residents were ordered out of their homes				
Apr 11 1996	Alberton Montana (Idaho, Wyoming, South Dakota, North Dakota, Washington)	Gas Leak (Chlorine gas) caused by the derailment and emitting poisonous chlorine gas	Burlington Northern and Santa Fe (Publicly traded firm, but owner unknown)	1092 affected	SIC 28	1996-0076
July 25 1995	Texas City Texas (New Mexico, Colorado, Kansas, Oklahoma, Arkansas, Louisiana)	Explosion of Refinery	BP (Amoco) Publicly traded firms	105 injured;	SIC 29	1995-0160
Feb 28 1995	Minneapolis Minnesota (North Dakota, South Dakota, Iowa, Wisconsin)	Fire of Chemical supply company causing a noxious cloud of chlorine fumes	Hawkins Chemical Co.: Non public firms	200 injured	SIC 28	1995-0039
Dec 6 1994	Samson Alabama (Mississippi, Tennessee, North Carolina, Georgia, Florida)	Fire of Plastic pipe factory causing toxins that irritate residents' lungs and eyes	Samson Plastic Pipe company using the chemical Azodicarbonamide to make PVC pipes: Non public firms	3000 affected	SIC 28	1994-0592
Oct 21 1994	Houston, Texas (New Mexico, Colorado, Kansas, Oklahoma, Arkansas, Louisiana)	Gas Leak of 8 Pipe Line due to lack of effective operational monitoring or pipeline and of automatic operated valves to allow for prompt detection of product release	Exxon Pipeline company; Colonial's (Publicly traded firm)	530 affected	SIC 28	1994-0544
Jun 13 1994	Allentown Pennsylvania (New York, New Jersey, Delaware, Massachusetts, Connecticut, Maryland, Ohio, West Virginia, Virginia)	Servicemen for a local gas utility arrived at the scene in response to gas odour reports, but without the correct tool to turn off the line.	UGI Utilities Inc., publicly traded firm	1 killed 379 injured	SIC 49	1994-0141
May 27 1994	Belpre Ohio (Michigan, Indiana, Kentucky, West Virginia, Pennsylvania, New York)	Explosion of Chemical Plant; causing cyclohexane & styrene monomers to release	Shell Chemical Co. producing a thermosplastic rubber, publicly traded firm	3 killed 1700 affected	SIC 29	1994-0136
APR 14 1994	Balch Springs Texas (New Mexico, Colorado,	Explosion of a truck loaded with pesticide crashed into a highway	Non publicly traded firm	4000 affected	SIC 28	1994-0109

	Kansas, Oklahoma, Arkansas, Louisiana)	sign, spewing a cloud of toxic smoke and causing respiratory problems				
Mar 24 1994	Edison area New Jersey (Connecticut, New York, Pennsylvania, Delaware, Maryland)	Explosion of a gas pipeline damaged by intense pressure from repeated use of construction equipment	Texas Eastern Transmission, owned by spectra energy, which is publicly traded firm	1 killed 58 injured	SIC 49	1994-0085

VITA

Jaemin Kim

EDUCATION

M.B.A. College of Business, Oregon State University, Corvallis, Oregon, USA
M.F.D.I. KDI School of Public Policy and Management, Seoul, Korea
B.S. Hankook University of Foreign Studies, Seoul, Korea

PROFESSIONAL INTERESTS

My research is at the intersection of strategy and entrepreneurship with a focus on the role of top management teams and families in business processes and the sustainability of the firm through corporate social responsibility. In particular, my research has examined how corporate governance, entrepreneurship, and stakeholder management lead to innovative and socially responsible actions in small- to medium-sized firms, as well as larger publicly-traded firms.

JOURNAL PUBLICATIONS

Dibrell, C., Craig, J. B., Kim, J., & Johnson, A. (2014) Establishing how natural environmental competency, organizational social consciousness and innovativeness relate, accepted at the *Journal of Business Ethics*.

Novicevic, M., Humphreys, J., Buckley, R., Hebdon, A., Roberts, F., & Kim, J. (2013) Teaching as constructive-developmental leadership: Insights from Mary Follett. *Journal of Management History*.

PAPERS UNDER REVIEW

Gentry, R., Dibrell, C., & Kim, J**.** The preservation of socioemotional wealth in publicly traded family businesses: A behavioral theory perspective, invited for third round resubmission to *Entrepreneurship Theory & Practice*.

MANUSCRIPTS IN PREPARATION FOR JOURNAL

Kim, J. & Johnson, A. Family culture, Stewardship, and Managerial intention to adopt an environmental policy: Evidence from small and medium sized family firms. Targeting at *Entrepreneurship Theory and Practice.*

Gentry, R., Dibrell, C., & Kim, J. Founding Family Influence on TMT Compensation and Earnings Expectations in Public Firms. Targeting at *Journal of Management Studies.*

Kim, J., & Dibrell, C. Will Overseas Mutual Funds Never Be a Good Stakeholder? Evidence from the US Energy-Sector Funds. Targeting at *Sustainability Accounting, Management and Policy Journal*.

Kim, J. & Jifri, A. When Corporate Social Responsibility Meets Reality: From Prospect Theory Perspective. Targeting at *Journal of Management*.

Kim, J. There Is More Than Meets the Eyes: Sequential Attention to Stakeholder Relationship. Targeting at *Strategic Management Journal*.

Juasrikul, S. & Kim, J. The Effect of Top Management Team Heterogeneity on Organizational Ambidexterity and the Moderating Role of Absorptive Capacity. Targeting at *Strategic Management Journal*.

CONFERENCE PRESENTATIONS

Gentry, R., Dibrell, C., & Kim, J. Founding family influence on TMT compensation and earnings expectations in public firms. Accepted for presentation at the 2013 *Southern Management Association*, New Orleans, LA.

Kim, J., & Dibrell, C. Will overseas mutual funds never be a good stakeholder? Evidence from the US energy-sector funds. The 2013 *Academy of Management Conference*, Lake Buena Vista (Orlando), FL.

Gentry, R., Dibrell, C., Kim, J., & Fairclough, S. Dominant logics in publicly traded family-controlled firms: A behavioral theory perspective. The 2013 *Babson College Entrepreneurship Research Conference*, Lyon, France.

Dibrell, C., Craig, J. B., Kim, J., & Johnson, A. Establishing how natural environmental competency, social consciousness and innovativeness relate. The 2012 *Southern Management Association Conference*, Fort Lauderdale, Florida.

Gentry, R., Dibrell, C., & Kim, J. The role of socioemotional wealth in publicly traded family businesses: A behavioral theory perspective. The 2012 United States Association for Small Business and Entrepreneurship Conference, New Orleans, LA. Winner of the Best Paper in Family Business Award, sponsored by the University of Wyoming and the Northeastern University Center for Family Business.

Kim, J., Dibrell, C., & Johnson, A. (2011). The moderating effects of social entrepreneurship intensity on the firm environmental competency and innovativeness relationship: Does it matter? The 5th *International Conference on Business and Sustainability*, Portland, OR. Winner of the Best Paper Award at the 5th International Conference on Business and Sustainability, Portland, OR.

Gentry, R., Dibrell, C., & Kim, J. Families as dominant coalitions: A study of family-controlled enterprises in the S&P 1500. The 2011 *Academy of Management Conference*, San Antonio, TX.

HONORS AND PROFESSIONAL AWARDS

Doctoral Consortium (Late Stage) Invited with Grant, *The 24th Annual Southern Management Association (SMA)*, New Orleans, Lousiana, US, 2013

Organizations and the Natural Environment (ONE) Doctoral Consortium Invited, *Academy of Management Conference*, Buena Vista, Florida, US, 2013

Doctoral Consortium Invited with Grant, *Western Academy of Management Conference*, Santa Fe, US, 2013

2012 Best Paper Award in Family Business for the USASBE Conference
Gentry, R., Dibrell, C., & Kim, J. The role of socioemotional wealth in publicly traded family businesses: A behavioral theory perspective. Winner of the Best Paper in Family Business Award, sponsored by the University of Wyoming and the Northeastern University Center for Family Business at the *2012 U.S. Association of Small Business and Entrepreneurship Conference*, New Orleans, LA.

2011 Best Paper Award at the 5th International Conference on Business and Sustainability
Kim, J., Dibrell, C., & Johnson, A. The moderating effects of social entrepreneurship intensity on the firm environmental competency and innovativeness relationship: Does it matter? Winner of the Best Paper Award at *the 5th International Conference on Business and Sustainability*, Portland, OR.

June 2009 MBA Integrated Business Project Award
Winner of Elevator Pictch, *Oregon State University*, Corvallis, OR.

June 2009 MBA Integrated Business Project Award
Winner of Overall Business Plan and First Place Winner for Technical Merit and Artistic Merit, *Oregon State University*, Corvallis, OR.

September 2008 TRSIS Scholarship ($3,000) for International Students with Excellent GPA
Oregon State University, Corvallis, OR

September 2008 Korean Alumni Award ($1,000) for Korean Student with Excellent GPA,
Oregon State University, Corvallis, OR.

Feburary 2005 Scholarship ($10,000) program of KDI School
Funded by *Korean Ministry of Commercial Information and Energy*

TEACHING & SERVICE EXPERIENCE

Teaching

Management of Strategic Planning (Undergraduate, MGMT 493)	Spring, 2014
Family Business Management (Undergraduate, MGMT 486)	Fall, 2013 (Co-Teaching)
Management of Strategic Planning (Undergraduate, MGMT 493)	Summer, 2013
Human Resource Management (Undergraduate, MGMT 383)	Spring, 2013
Human Resource Management (Undergraduate, MGMT 383)	Fall, 2012

Research Assistant to Dr. Clay Dibrell (September 2010 to Present); Dr.Samantha Fairclough (2011 to 2012); Dr.Richard Gentry (2010 to 2011)

Research Fellow (August 2009 to Present): Association for Asian Business Management, Center for Asia Entrepreneurship

Graduate Assistant to Dr. Zhaohui Wu (January 2008 to June 2009)

PROFESSIONAL AFFILIATIONS & SERVICE

Professional Associations: Academy of Management, Strategic Management Society, Southern Management Association, Western Academy of Management, United States Association for Small Business and Entrepreneurship

Ole Miss Gillespie Business Plan Competition, Judge Spring, 2011, 2012, 2013, and 2014

Ad-Hoc Reviewer: *Journal of Family Business Strategy*, *Journal of Environmental Management*, Academy of Management Conference, Southern Management Association, United States Association for Small Business and Entrepreneurship

Technical Assistant Volunteer for Beaverton City Library, OR, USA (November 2009 to May 2010)

GRADUATE STUDENT SERVICE

President of Korea Student Association at the University of Mississippi (September 2011 to August 2012)

WORK EXPERIENCE

Korea Exchange Bank, Seoul, Korea (January 2002 to July 2007)

- Corporate Analyst and Banking
- Foreign Direct Investment (FDI) consultation

Sergeant, Korean Army, Korea (October 1995 to December 1997)