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A Resource-Based Perspective on Green Supply Chain Management and Firm Performance

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I am submitting herewith a dissertation written by Jon Frederick Kirchoff entitled "A Resource-Based Perspective on Green Supply Chain Management and Firm Performance." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Business Administration.

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A Resource-Based Perspective on Green Supply Chain Management and Firm Performance

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DEDICATION

This dissertation is dedicated to my loving wife Amy, to my two beautiful children, Angela and Anders, and to my mom and dad. Thank you for all of your encouragement, advice, support and love. You are all a constant source of happiness in my life.

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ABSTRACT

Due to the perceived performance implications of green supply chain management, research in this area has grown in recent years. However, the literature is limited on the determinants of green supply chain management and its performance implications. Thus, the literature has yet to furnish an accepted explanation for why green practices are manifested in supply chain management and, whether a positive relationship exists between green supply chain management practices and firm performance.

This dissertation responded to these challenges through exploring the antecedents and consequences of green supply chain management. This dissertation built on the theoretical base of the resource-based view of the firm (RBV) and investigated two potentially important determinants of green supply chain management practices, and how such practices, in turn, shape firm performance. Specifically, a theoretical model was developed that offered hypothesized relationships among the resources of an environmental orientation, a supply chain orientation, and green supply chain management practices, and how these resources relate to firm performance.

Significant results and good fit indices tested with structural equation modeling generated a number of interesting theoretical implications for scholars and practical implications for supply chain managers. The results challenge the current theoretical and operationalization of the green supply chain management construct. The results also show the strategic implications of firm orientations. Finally, for executives and strategists who are concerned about better managing their supply chains, this study provides insights for how firms can develop a competitive edge through the implementation of green supply chain management practices.

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CHAPTER 1 – DEFINING THE RESEARCH

INTRODUCTION

The primary goal of most businesses is to create and maintain value via competitive advantage (Chaffee 1985; Conner 1991; Sirmon et al. 2007). Since the early 1990s, researchers have discovered that supply chain management plays an important role in helping firms improve performance (Mentzer et al. 2001). Supply chain management (SCM) is the strategic coordination of resource flows among members of the upstream and downstream supply chain (Mentzer et al. 2001). Ultimately, the goal of SCM is improving the long-term performance of firms in the chain (Crook and Combs 2007). To create value, supply chains need to be managed in a proactive way that creates processes and common goals among the supply chain members (Min et al. 2007). Indeed, research supports the idea that proactive supply chain management may represent an "inimitable competitive weapon" in the business environment, one that can deliver value for the firm (Ketchen and Hult 2007, p. 579)

Within SCM inquiry, researchers have begun to examine the impact of supply chain operations on the natural environment[1] (Klassen and Johnson 2004; Zhu and Sarkis 2004; Handfield et al. 2005; Rao and Holt 2005; Markley and Davis 2007; Vachon and Klassen 2008). Firms commit significant resources to environmental initiatives, and some research suggests that environmental practices in supply chain management shape firm performance. When firms use such practices, they can potentially improve performance via processes that involve controlling wastes, improving their reputation, and lowering overall costs (Hoffman 2000; Bowen et al.

[1] To avoid confusion when using the term 'environment', this dissertation delineates the difference between the meanings of the term environment by using 'external' or 'business' as a qualifier to define the operating environment that is external to a firm or network of firms. All other uses of the word environment or environmental refer to the natural environment.

2001; Klassen and Johnson 2004; Handfield et al. 2005; Markley and Davis 2007; Vachon and Klassen 2008; Zhu et al. 2008b).

Environmental or green practices in supply chain management are generally comprised of actions that reduce or eliminate waste and pollution, eliminate hazardous materials, consider product life-cycles, review supplier environmental performance, emphasize compliance, minimize the environmental impact of the firm's operations, and remediate environmental problems (Rao 2002; Klassen and Johnson 2004; Handfield et al. 2005; Zhu et al. 2008a; Stock et al. 2010). In essence, green SCM practices concentrate on minimizing the environmental impact of the forward and reverse flows of the supply chain, while creating economic value and lower costs for the firm (Zhu and Sarkis 2004; Vachon and Klassen 2008).

Anecdotal evidence shows firms have used green SCM practices in an attempt to improve performance. For example, Nokia Corporation combines elements of SCM (supplier network management and supply chain design) with green capabilities and policies (products designed for the environment and supplier involvement in environmental management systems) to create integrated green SCM practices intended to improve the financial performance of the company (Nokia Corporation 2004). Similarly, 3M, Kodak and Xerox have all integrated aspects of green management practices in their supply chains with the goal of achieving higher firm performance (Klassen and Johnson 2004).

Interest in green SCM has been growing among researchers since the early 1990s (Carter et al. 2000; Zsidisin and Siferd 2001; Handfield et al. 2005; Linton et al. 2007; Srivastava 2007). Scholars have investigated the benefits related to green operational practices and processes in the firm (Ambec and Lanoie 2008). However, empirical research into the impact of green SCM practices on firm performance has produced mixed evidence (Melnyk et al. 2003; Linton et al.

2007; Markley and Davis 2007). This has led to a continuing discussion in the literature regarding whether or not green SCM practices can lead to higher firm performance.

RESEARCH GAPS AND STATEMENT OF PURPOSE

There are at least three reasons why the extant research has not provided more conclusive evidence on the green SCM-firm performance relationship. The first reason is that the focus in the literature has been almost exclusively on the firm's external business environment, such as regulatory and stakeholder demands, as direct motivators on firms to adopt green practices (e.g. Bansal and Roth 2000). While evidence has been found that external motivators play a role in the development of green practices in the firm, there is a lack of focus in the literature on both external *and* internal directives and resources. Specifically, missing from the literature is the concept of internal corporate cultures or orientations that influence the development of green SCM practices.

The second reason is that the discussion and investigation of green SCM in the literature is still limited, and considered to be in the development stage (Linton et al. 2007; Zhu et al. 2008a). Furthermore, the consideration of the performance outcomes from reducing the environmental impact of a firms' supply chain operations is a concept that has only recently gained momentum (Linton et al. 2007). The lack of research implies that linkages between green practices in SCM and firm performance have not been thoroughly examined and that more empirical testing is necessary to investigate additional areas of the topic (Vachon and Klassen 2008). Indeed, researchers assert that the attention given to the potential benefits of green SCM practices has actually raised more questions than answers (Linton et al. 2007; Carter and Rogers 2008).

The third reason is that researchers might not have always applied the most appropriate theoretical lens to study these relationships. In many cases, no theoretical base has been used. Indeed, much of the research in this area is more prescriptive, rather than explanatory or predictive in nature. Researchers have begun to discuss the relative lack of theory development in the literature and the need for more emphasis on theoretical grounding of green supply chain management research (Stock et al. 2010, Vachon and Klassen 2008).

The first gap was addressed in this dissertation by hypothesizing a connection between a firm's internal corporate cultures and their connection to green SCM practices. Research into green SCM reveals that there are two potentially important determinants of successful green SCM efforts: (1) an environmental focus and the meeting of environmental objectives, and (2) an economic focus and the meeting of economic objectives (Messelbeck and Whaley 1999). Both an environmental focus and an economic focus in supply chain management are driven by internal strategic level corporate cultures or orientations related to their respective focus and objectives, and both orientations are considered to be important internal resources to the firm (Mentzer et al. 2001; Klassen and Johnson 2004; Menguc and Ozanne 2005). A supply chain orientation is a strategic resource that has been indentified, well defined, and empirically tested in the supply chain management literature as an internal economic strategic philosophy that underlies the practice of supply chain management (Mentzer et al. 2001; Min et al. 2007). A parallel environmental philosophy that underlies the environmental responsibility aspect of green supply chain management can be considered an orientation and strategic resource that represents environmental awareness and priorities in a firm as part of its culture (Klassen and Johnson 2004).

An environmental orientation is considered a learning process, a corporate culture, and an organizational belief system of environmental responsibility, understanding, and management (Banerjee 2001; Banerjee et al. 2003). It encourages the development and implementation of proactive environmental strategies through environmental management practices in the firm that are "fused and internalized within the corporate values and beliefs" (Banerjee et al. 2003, p. 111). A firm that possesses an environmental orientation prioritizes the importance of recognizing the impact a firm has on the natural environment and the need to minimize this impact (Banerjee et al. 2003).

The manifestation of an environmental orientation in the firm is evidenced by inclusion of environmental responsibility in managerial goals and objectives (Simpson and Samson 2008). These goals and objectives are pursued through strategic management practices in the firm that are both externally-focused and internally-focused (Banerjee, et al. 2003). Firms that possess an environmental orientation may be in a position to create environmental practices and processes that will lead to improved firm performance (Miles and Covin 2000; Bowen et al. 2001).

Given the inconclusive and conflicting empirical results of research into the effects of green supply chain management practices on firm performance, it is important to investigate these previously unexplored factors that may impact the green-performance relationship. Indeed, the existence of internal orientations focused on business practices (supply chain orientation) and green practices (environmental orientation) may be the missing factors in the literature that provide empirical evidence of connecting green business practices to higher economic performance (Ambec and Lanoie 2008; Hart and Dowell 2010).

The second and third gaps suggest that further empirical research, supported by an applicable and appropriate theoretical base, is critical to further understand the relationship

between green supply chain management and firm performance. The resource-based view of the firm paradigm (RBV) from the strategic management literature is an appropriate theoretical lens through which to research this topic.

RBV attempts to explain and to predict why some organizations are able to create and sustain a competitive advantage (Barney 1991; Day 1994). Early work in the RBV highlighted individual resources that firms are able to identify and develop internally (Hart 1995). Later work highlighted the importance of resources that firms are able to gain through its network connections, i.e. supply chain (Dyer and Singh 1998; Gulati et al. 2000; Hunt and Davis 2008). Interest in RBV by researchers has led to its extensive use in the supply chain management literature (Chen et al. 2009). Current research has found firms that possess and employ combinations of strategic resources can use them in a way that improves firm performance above and beyond the impact of individual resources (Barratt and Oke 2007; Ketchen and Hult 2007; Sirmon et al. 2007; Chen et al. 2009).

Proponents of RBV have argued for the extension of this theory to include the influence of external variables on resources that may be deemed as valuable to the firm, which includes the natural environment (Barney 1991; Hart 1995; Priem and Butler 2001; Aragon-Correa and Sharma 2003). Indeed, Hart (1995, p. 991) states that "strategy and competitive advantage in the coming years will be rooted in strategic resources and capabilities that facilitate environmentally sustainable economic activity."

Recently, Hart and Dowell (2010) encouraged further inquiry into which resources are key to driving the link between green practices in the firm and greater financial performance and how global supply chains and SCM play a part. At present, it remains unclear what determines green SCM and whether green SCM shapes firm performance. Given the amount firms spend on

environmental initiatives, a dissertation focused on the determinants and outcomes of green SCM is both timely and warranted. Therefore, the purpose of this dissertation is to apply the RBV theoretical base to an investigation of relationships among green SCM, environmental orientation, and supply chain orientation, and their impact of firm performance, at the firm level unit of analysis. More specifically, the following research questions are proposed:

1. How does a firm's supply chain orientation affect its green SCM practices?
2. How does a firm's environmental orientation affect its green SCM practices?
3. How do a firm's green SCM practices affect firm performance?
4. How does the combination of a supply chain orientation, an environmental orientation, and green SCM practices affect firm performance?

POTENTIAL CONTRIBUTIONS

Two primary contributions came from this research. The first, drawing on the RBV, is an explanation of how different orientations shape firms' propensities to engage in green SCM. The second, also drawing on the RBV, is an investigation of the performance implications of green SCM. Research implications of these contributions can benefit scholars and managerial implications can benefit practitioners.

RESEARCH IMPLICATIONS

There are a number of research implications from the results of this dissertation. Empirical research on performance outcomes from green SCM practices is limited, conflicting, and often inconclusive (Linton et al. 2007; Carter and Rogers 2008; Vachon and Klassen 2008). First, this research empirically investigated green SCM practices and their impact on firm performance from an alternative application of the RBV theoretical base. The conclusions of the empirical study help contribute to a greater understanding of the relationship between green

SCM and firm performance to the current knowledge in this area. Second, this dissertation uses the well-established strategic concept of an environmental orientation from the marketing and management literature and expands its role into the SCM literature. The inclusion of an environmental orientation in this dissertation contributes to the SCM literature as both the operationalization and empirical testing of this construct is currently missing.

Finally, Vachon and Klassen (2006) emphasize the need to investigate the impact of green SCM on specific operationalized firm performance measures. This dissertation measures the impact of green SCM practices on three operationalized dimensions of firm performance that have been used in the literature: efficiency (reduced costs), effectiveness (improved customer satisfaction), and differentiation (environmental products and processes). The inclusion of these three dimensions allows researchers to gain a more multi-faceted understanding of the impact green SCM practices have on performance outcomes, as opposed to a single measure or dimension of firm performance.

MANAGERIAL IMPLICATIONS

This dissertation provides a number of potentially valuable insights for managers. Despite the scholarly and practitioner interest in green SCM, the literature has struggled to provide managers with applicable ideas and courses of action to manage green practices in supply chains that ultimately improve performance (Pagell and Wu 2009). The results of the empirical research in this dissertation provide managers with information on the nature of the relationship between green supply chain management and firm performance. Furthermore, the empirical results can help managers recognize that internal corporate cultures, in the form of environmental and supply chain orientations, can lead to the formation of green SCM practices. This is in contrast to the assumption some managers make that the implementation of environmental practices is based

solely on external pressures and threats. An understanding of the effect that strategic orientations have on green management practices offers managers insight into the possible control they have over their internal processes and the possible performance outcomes.

Managers can also use the conclusions of this dissertation to assess the impact of employing strategic resources to support strategic environmental management in their supply chains. As the results suggest that green SCM practices may be related to higher firm performance, manager's can assess their firm's corporate culture and supply chain management practices to better understand how these strategic resources are being used and to what degree they contribute value in the firm.

DISSERTATION ORGANIZATION

This dissertation is organized into five chapters. Chapter 1 introduced the research problem. Chapter 2 provides the literature review, theoretical model, and hypotheses. Chapter 3 presents the research methodology. Included in Chapter 3 are discussions of the data collection and analysis procedures for the empirical study. Chapter 4 presents the data analysis and findings. Building on Chapter 4, Chapter 5 presents an in-depth discussion of the research and managerial implications, limitations of the empirical study, and future research opportunities.

CHAPTER 2 – LITERATURE REVIEW

The purpose of this dissertation is to investigate relationships among green SCM, environmental orientation, supply chain orientation, and firm performance, at the firm level unit of analysis. Chapter 2 reviews the literature and develops hypotheses. In particular, Chapter 2:

1. Describes supply chains and SCM, and how SCM potentially shapes firm performance.
2. Provides an in-depth discussion of the RBV paradigm.
3. Presents a discussion of the foundations of corporate environmental responsibility.
4. Identifies the concepts of an environmental orientation, a supply chain orientation, green SCM, and firm performance.
5. Develops a set of specific, testable research hypotheses about the relationships among an environmental orientation, a supply chain orientation, green supply chain management practices, and firm performance, and offers a theoretical model.

SUPPLY CHAINS, SUPPLY CHAIN MANAGEMENT, AND FIRM PERFORMANCE

The potential impact supply chains have on cost savings, customer satisfaction, and the firm's bottom line has renewed organizational interest in harnessing their value (Hult et al. 2004). The simplest conception of a supply chain can be stated as the companies involved in all aspects of the upstream and downstream movement of products and services (La Londe and Masters 1994). A typical supply chain consists of companies in a network linked by the basic processes of supply, transformation, and demand (Chen and Paulraj 2004). Mentzer et al. (2001, p. 4) more succinctly define a supply chain as:

> *"a set of three or more entities (members), directly involved in the upstream and downstream flows of products, services, finances and/or information from a source to a customer"*.

Supply chains have multiple complex processes. Collaborative and cooperative relationships through continuous sharing of information among the members can manage supply

chain complexity and help create stronger and more competitive supply chains that create better product flows (Lambert and Cooper 2000). The planning and coordination of the flows and logistics activities both internally within a firm and externally among supply chain members is described as supply chain management (Cooper et al. 1997).

The term supply chain management emerged in the early 1980s as a concept that brought together the different functional area of logistics, procurement, operations and aspects of production and marketing under one area of management (Lambert and Cooper 2000; Council of Supply Chain Management Professionals 2009). SCM is recognized by scholars and managers as an important business process that continues to grow as a critical part of an organization (Mentzer et al. 2001; Christopher 2005).

Mentzer et al. (2001, p. 18) define SCM as:

> *"…the systemic, strategic coordination of the traditional business functions and the tactics across the business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole."*

The Mentzer et al. (2001) definition describes an integrated, inter- and intra-organizational management phenomenon that is responsible for the coordination of physical, relational, information, and financial flows in the upstream and downstream supply chain.

In today's ultra-competitive global business environment, a well-managed supply chain is essential to creating competitive advantage and value for the firm (Lambert and Cooper 2000; Min and Mentzer 2004; Christopher 2005; Defee and Stank 2005; Stank et al. 2005). Indeed, competition is no longer defined as firm competing against firm, but rather as supply chain competing against supply chain (Min and Mentzer 2004; Christopher 2005; Defee and Stank

2005; Stank et al. 2005). To create value, supply chains need to be managed in a way that creates organization and common goals among the supply chain members (Srivastava et al. 1999; Min and Mentzer 2004; Min et al. 2007).

Research supports the idea that a proactive approach to SCM may represent an "inimitable competitive weapon" in the business environment, one that can deliver value for the firm (Ketchen and Hult 2007, p. 579). A number of empirical studies affirm this idea, as measured by higher than average return on investment Gunasekaran et al. (2004), improved cycle time (Hult et al. 2004), higher marketing performance (Li et al. 2006), greater efficiency and effectiveness (Spekman et al. 1998; Tan et al. 1999), and improved firm financial performance over competitors (Wisner and Tan 2000; Tan 2002; Li et al. 2006).

THEORETICAL FOUNDATION

RESOURCE-BASED VIEW PARADIGM

The RBV paradigm has its origins in strategic management. RBV explains that the identification and possession of internal strategic resources contributes to a firm's ability to create and maintain a competitive advantage and improve performance (Barney 1991; Hart 1995; Crook et al. 2008). A resource is considered strategic if it meets certain criteria - valuable, non-substitutable, rare or specific, and inimitable in order to contribute to improving the performance of the firm (Barney 1991; Crook et al. 2008). Value refers to the extent to which the resources are aligned with the external environment to exploit opportunities and reduce threats. Substitutability is the extent to which competitors can create equivalent resources. Resource rareness refers to the perceived scarcity of the resource with factor markets. Inimitability is the extent to which competitors cannot obtain or replicate the resources, or can only do so at a significant cost disadvantage (Hoskisson et al. 1999). According to RBV, firms attempt to

identify strategic resources that will most likely make the firm more competitive in the market and then employ these resources to exploit their value (Sirmon et al. 2007)

The identification and possession of a strategic resource or strategic resources alone is not sufficient to create superior firm performance over that of the competition (Sirmon et al. 2007). Resources must also be effectively managed and exploited, given the changing external circumstances an organization faces in the competitive business environment (Lippman and Rumelt 2003). In fact, the resource management process has been shown to be a key factor in the how resources affect firm performance (Zott 2003). Figure 2.1 shows the basic concept of the RBV.

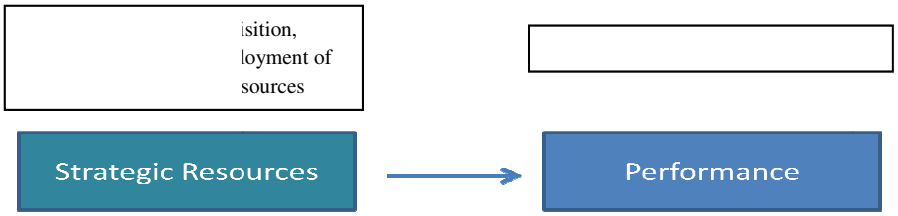


Figure 2.1
Basic RBV Framework

Strategic resources and capabilities are unique processes or operations that a firm uses to compete in its business environment (Ray et al. 2004). Resources can be tangible or intangible (Mentzer et al. 2004). Examples of tangible resources include manufacturing plants, raw materials, logistics networks and technology (Mentzer et al. 2004). Examples of intangible strategic resources and capabilities include proprietary knowledge, relationships, customer loyalty, corporate culture and philosophies, and supply chain competencies (Hult et al. 2002; Mentzer et al. 2004).

The effectiveness of the strategic resources possessed by a firm can be dependent on the possible causal and path dependent relationships among the resources (Black and Boal 1994; Hult and Ketchen Jr 2001). To illustrate, a complex machine may have many processes that make it function effectively, yet there must be a sequence of processes; each process does not happen independently of the others. Similarly, strategic resources in a firm do not necessarily act independently to create value (Amit and Schoemaker 1993; Black and Boal 1994). Combinations of strategic resources that are dependent on other strategic resources through causal relationships can create value for the firm above and beyond the value created by individual resources (Dierickx and Cool 1989; Black and Boal 1994; Newbert 2008). Evidence of the value of resource combinations has been found in empirical studies. Through a systematic review of empirical research that used RBV as the theoretical base, Newbert (2007) found the use of combinations of strategic resources are more likely to explain higher performance in firms than are resources used in isolation. Figure 2.2 shows how RBV is used to explain higher firm performance through the employment of strategic resource combinations, manifested in the firm by relationships among the resources.

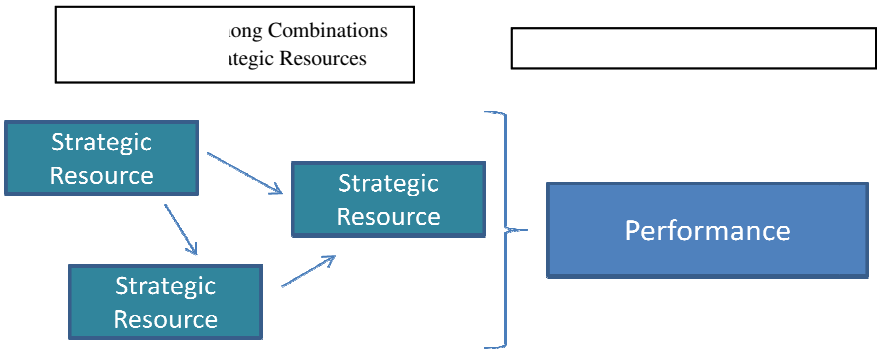


Figure 2.2
RBV Framework of Resource Combinations

Historically, the RBV paradigm has been leveraged to understand the performance implications of the use of internal resources to the firm (Grant 1991; Hart 1995). However, RBV proponents have argued for an extension in its scope to include the influence of external variables on resources that may be deemed as valuable to the firm (Barney 1991; Hart 1995; Priem and Butler 2001; Aragon-Correa and Sharma 2003). Sirmon et al. (2007), for example, argue that resources are only useful to a firm to increase value if the resources are used in a way that takes into account the dynamic external business environment. The outcome of these arguments has extended the use of the RBV paradigm into the research of business and the natural environment (Etzion 2007).

Hart (1995) leveraged RBV's tenants to assert that environmental management in an organization is a strategic resource because it can lead to a higher firm performance (Hart 1995; Hart 1997; Russo and Fouts 1997; Aragon-Correa and Sharma 2003; Vachon and Klassen 2008). Environmental management supports pollution prevention, product stewardship, and sustainable growth (Hart 1995; Sharma and Vredenburg 1998; Christmann 2000; Aragon-Correa and Sharma 2003). Firms incorporate continuous learning, innovation in environmental technologies, stakeholder integration, and the use of best practices in reducing the environmental impact of their operations.

The RBV paradigm has been used extensively by SCM researchers (Vachon and Klassen 2006b; Chen et al. 2009). In particular, researchers have used RBV to investigate phenomena related to green SCM practices (Corbett and Klassen 2006; Markley and Davis 2007). RBV has been used to look at proactive strategic SCM practices and capabilities as resources that can be employed in a way that encourages the implementation of green practices in the firm's SCM (Bowen et al. 2001). Sharma and Vredenburg (1998) argue that proactive business strategies

which includes aspects of green practices and an environmental approach to business operations can be considered a valuable resource. Thus, the combination of SCM practices and green practices may lead to the development of green SCM practices as a strategic resource (Noci 1997; Carter et al. 1998; Bowen et al. 2001). Furthermore, firms that use strategic resources tied to green practices in their supply chains and in the operations of the firm may be in a position to improve firm performance (Zhu and Sarkis 2004; Vachon and Klassen 2008).

The preceding discussion suggests that RBV is a logical choice for research in this area due to its emphasis on explaining how firms use strategic resources to improve firm performance. Firms are at a critical point today where the interaction between business activities and the natural environment are no longer seen as externalities to the firm, but as being inextricably tied (Hart and Dowell 2010). RBV, in the context of environmental responsibility, suggests that firms recognize and apply strategic resources and capabilities to create unique and difficult to imitate practices that simultaneously reduce the impact of the firm's operations on the natural environment and create value for the firm (Hart 1995; Aragon-Correa and Sharma 2003; Hart and Dowell 2010).

THE FOUNDATIONS OF CORPORATE ENVIRONMENTAL RESPONSIBILITY

Understanding the evolution of the relationship between the business environment and the natural environment is important to better understand the nature of the research questions and the proposed theoretical framework in this dissertation. A review of the literature in this section lays the foundation for the current scholarly thoughts on corporate environmental responsibility.

The relationship between business and the natural environment has its origins in the concept of corporate social responsibility. Corporate social responsibility (CSR) is broadly defined as the responsibility expected of businesses to maintain the social norms of the

communities in which they operate and to behave at a level that is "congruent with prevailing social values and expectations of performance" (Sethi 1975, p. 62).

Authors have differed on the meaning of CSR as a concept, with views falling along a continuum of responsibilities, from purely economic, to purely voluntary (Steiner 1975). At one end of the continuum, some authors believe the firm's only responsibility to society is making a profit, as society values successful businesses and expects them to act purely on economic interests to maximize value for shareholders and employees (Friedman 1962; Preston and Post 1975). At the other end of the continuum, authors view CSR as strictly voluntary and altruistic corporate activities which do not include economic activities (McGuire 1963; Manne and Wallich 1972). In this view, society values firms that separate social and economic responsibility so that social responsibility, while important, is pursued only after the first priorities of economic (and legal) responsibility have been met (Carroll 1979). Researchers in the middle ground between these two endpoints combine economic activities and concern for social issues as a way to prescribe that businesses are concurrently expected to work for the betterment of society while remaining a profitable business entity (Davis 1960; Hay et al. 1976).

Research suggests that a corporation's social responsibility, responsiveness to demands from the communities in which they operate, and performance are all related (Carroll 1979; Clarkson 1995). In essence, firms can succeed financially when they focus on social responsibility (Hoffman 2000). This occurs because focusing on CSR not only lowers the potential for costly litigation and helps firms' reputations, but also helps firms identify wasteful activities that, if eliminated, would make the firm more efficient (Hoffman 2000)

The social performance demands on businesses have expanded to include environmental values and responsibilities, as concerns over the negative environmental impact of commercial

and manufacturing activities have grown (Menon and Menon 1997; Rugman and Verbeke 1998). It is important to mention here that the intersection of social, economic, and environmental responsibility in the firm is what Elkington (1998) calls the triple bottom line. It is considered part of a new business paradigm that shifts away from the current industrial mind-set of infinite human, capital, and natural resources to a more sustainable mind-set that views these resources as finite inputs that need to be conserved (Elkington 2007).

The use of the term 'sustainability' has become synonymous with the triple bottom line and is increasingly popular in the literature and among practitioners over the last several years (Linton et al. 2007; Carter and Rogers 2008). Sustainability is generally defined as the ability to meet current needs without compromising the needs of future generations (Hawken 1993). The challenge of applying this definition to business operations is two-fold. First, the definition is loose and ambiguous, as it does not lead to any understanding of what future generations might need (Dyllick and Hockerts 2002). Businesses cannot be held to a standard that has no known parameters, in anticipation of future events (Ehrenfeld 2005). Second, to become a sustainable organization requires a radical change in the traditional way business strategies are formulated and implemented in order to truly meet the needs of today without sacrificing the needs of future generations (Figge and Hahn 2004; Preuss 2005).

The concept of the triple bottom line, and sustainability, while no less important than environmental and economic responsibility, is not included in the concepts under investigation in this dissertation. The scope of this dissertation concentrates on environmental and economic responsibility in the supply chain and in supply chain management, and their potential impact on firm performance.

The next section identifies the concept of orientations in a firm and describes how strategic orientations can be considered resources that can improve the competitiveness of a firm and possibly lead to improved performance. In particular, a supply chain orientation and an environmental orientation are defined and their existence in the firm explained using RBV.

STRATEGIC ORIENTATIONS

An orientation is an underlying consciousness or latent philosophy that directs the nature and scope of a firm's internal and external activities (Borch 1957; Peterson 1989; Miles and Munilla 1993; Kotler 1997). An orientation is considered the way in which a firm views and reacts to the business environment in which it exists. Orientations are considered organizational cultures where the orientation characterizes an organization's disposition toward particular objectives (Deshpande and Webster Jr 1989; Han et al. 1998). For example, a market orientation, as a corporate culture, describes a disposition to continuously create and deliver superior value to the firm's customers (Slater and Narver 1994).

The RBV paradigm suggests that orientations, as corporate cultures, are considered to be a strategic resource, since they are tacit and difficult to define and transfer (Hult et al. 2008). Orientations are comprised of internal systems that bind divergent areas of the firm into a core pattern of beliefs and behaviors (Fiol 1991). The interaction of these beliefs and behaviors can be a critical competitive resource through a cognitive process that is unique, difficult to imitate, and valuable to the firm (Barney 1991; Fiol 1991). A firm's orientations can lead to improvements in the firm's operations and competitiveness (Mello and Stank 2005). For example, Hult et al. (2002) found that the intangible characteristics of cultural competitiveness – an orientation toward the importance of supply chains - improve cycle time in the supply chain, leading them to conclude that culture can be a competitive strategic resource. Both an environmental

orientation and a supply chain orientation can be considered strategic resources as they may be able to improve a firm's financial performance, as discussed in the following sections.

ENVIRONMENTAL ORIENTATION

Research from the marketing and strategic management literature investigating organizational environmental responsibility found an underlying ethic that originates in the collective thinking within a firm that encourages a culture of environmental awareness and priority (Drumwright 1994; Hart 1995; Shrivastava 1995). The term environmental orientation was introduced by Menon and Menon (1997) and is used to describe this ethic as an environmental philosophy and the degree to which environmental values are integrated within the firm's culture (Fraj-Andrés et al. 2009). Specifically, an environmental orientation is defined as "the recognition by managers of the importance of environmental issues facing their firms" (Banerjee et al. 2003 p. 106).

Firms that possess an environmental orientation recognize that the organization needs to minimize its impact on the natural environment and that a proactive corporate stance toward environmental responsibility is an important part of a firm's strategic objectives (Banerjee 2001; Baker and Sinkula 2005). An environmental orientation is also considered a learning process in the collective consciousness of a firm about environmental responsibility (Shrivastava 1995; Menon and Menon 1997; Banerjee 2001). Values and beliefs that form as the result of an environmental orientation eventually influence the creation and implementation of strategic environmental management systems (Mintzberg 1994a; Mintzberg 1994b; Banerjee et al. 2003; Fraj-Andrés et al. 2009).

Empirical research has found that an environmental orientation resides in the firm through two primary dimensions (Banerjee 2001; Banerjee et al. 2003; Fraj-Andrés et al. 2009).

The first is internally-focused and is based on the internal values of the firm, its standards of ethical behavior, its commitment to environmental responsibility, and by its corporate mission statement(s) (Fraj-Andrés et al. 2009). An internally-focused environmental orientation reflects a firm's internal values, standards of ethical behavior, and commitment to environmental ideals across all hierarchical levels of the firm (Banerjee et al. 2003; Fraj-Andrés et al. 2009).

Firms with an internally-focused environmental orientation instill ethical behavior toward the environment across the different areas of the firm and consider environmental objectives as inherent to their economic goals (Shrivastava 1995). Consequently, an internally-focused environmental orientation is supported by corporate management and involves decisions related to the generation and dissemination of environmental information throughout the firm, communication of environmental mission statements, the appointment of environmental managers, and the implementation of environmental projects (Stone and Wakefield 2000; Fraj-Andrés et al. 2009).

The second dimension is based on managers' perceptions of external forces and the need to respond to stakeholder interests. An externally-focused environmental orientation is a corporate culture that strives to concurrently create a positive environmental and economic corporate image to stakeholders (Menon and Menon 1997; Banerjee 2002). The impetus of an externally-focused environmental orientation is part of the larger goal of legitimacy in the eyes of stakeholders, considered one of the strongest motivators of corporate action toward improving its environmental responsibility (Hart 1995; Banerjee 2001).

Managerial perceptions of the external business environment determine how resources are identified, acquired, and employed in the firm (Aragon-Correa and Sharma 2003; Sirmon et al. 2007). Managers that perceive environmental issues as opportunities, rather than threats, will

identify specific strategic resources to create value for the firm through environmental strategies and practices (Menon and Menon 1997).

The RBV paradigm helps explain that an environmental orientation is a strategic resource because an environmental orientation is both valuable and nonsubstitutable; it is based on tacit knowledge and skills, dependent on groups of people, and it is specific to a particular firm (Barney 1991; Menguc and Ozanne 2005). Firms that adopt this orientation acknowledge the importance of environmental responsibility in meeting economic goals and objectives (Fraj-Andrés et al. 2009; Tate et al. 2010). Carter et al. (2000) consider the creation of an environmentally sensitive corporate culture as critical to meeting stakeholder preferences and demands. Banerjee et al. (2003) found that an environmental orientation, as manifested by the dimensions of an internal and an external environmental orientation, is positively related to the creation of valuable marketing and corporate strategies and capabilities. Fraj-Andres et al. (2009) linked environmental orientation to higher commercial performance, with indirect links to higher operational performance and economic performance. Taken together, this evidence suggests that an environmental orientation might shape firm performance.

SUPPLY CHAIN ORIENTATION

Successfully managing a supply chain to create value depends on a philosophy that shows a commitment to managing the complex dimensions of the inter-firm relationships inherent in the supply chain (Trent 2004; Defee et al. 2009). A supply chain orientation is a strategic philosophy that supply chain members may use to help determine those expectations. Supply chain orientation (SCO) is a strategic SCM philosophy that allows for the integration and coordination of strategies and tactical processes among the members of a supply chain (Mentzer

et al. 2001; Klassen and Johnson 2004; Min and Mentzer 2004; Defee et al. 2009). SCO is the philosophy orientation of SCM, and is defined as:

> *"the recognition by an organization of the systemic, strategic implications of the tactical activities involved in managing the various flows in a supply chain"* (Mentzer et al. 2001, p. 11).

SCO is considered a cultural, strategic and holistic concept. From a *cultural* perspective, SCO is considered a philosophy of SCM; SCO is a cultural orientation that impacts the implementation of SCM in a firm and enables some firms to excel at their SCM functions and activities over other firms (Mello and Stank 2005). SCO is also part of a corporate *strategy*, as in cases when a company decides to put forward SCM as a strategic tool (Maloni and Benton 2000). A firm that possesses SCO can be considered one that supports and recognizes the importance of, places strategic emphasis on, and is poised to excel at, SCM (Min and Mentzer 2004; Defee et al. 2009).

From a *holistic* standpoint, SCO is a combination of cultural and strategic concepts. Min and Mentzer (2004) describe supply chain oriented firms as ones that understand the strategic importance of creating and maintaining a philosophical stance toward the importance of forming critical relationships with the members of the upstream and downstream supply chain. Similarly, Bowersox et al. (2002) describe a supply chain oriented firm as one that recognizes critical relationships in the upstream and downstream supply chain.

Mentzer et al. (2001) propose that the supply chain oriented firm should exhibit a number of primary internal behavioral factors. The factors include trust, commitment, cooperative norms, organizational compatibility, and top management support. Min and Mentzer (2004) and Min et al. (2007) found empirical support for these factors, the existence of which enhance or impede SCO and ultimately contribute to the possession of SCO in the firm.

Trust is defined as the disposition to respect and rely on a business partner with confidence (Moorman et al. 1992). Trust is composed of both credibility and benevolence (Ganesan 1994). Credibility is the trust by one party that another party will deliver on promises that it agreed to and fulfill any understood or stated obligations (Dwyer and Oh 1987). Benevolence is a firm's trust that its business partners are interested in the welfare of the firm and will not take actions that may be harmful to the firm (Kumar et al. 1995; Min et al. 2007).

Commitment is the agreement that both parties in a business relationship desire to continue and value the relationship into the future (Dwyer et al. 1987; Moorman et al. 1992; Min et al. 2007). A firm is committed to a relationship with another member of the supply chain if the firm is willing to share in the risk and rewards that may be realized as a result of the relationship. Trust and commitment are proposed to be the most critical relational factors of SCO, as both promote collaboration among the members of the supply chain (Min et al. 2007).

Cooperative norms refers to the perception of the joint efforts of supply chain members to work toward individual organizational goals while abstaining from opportunistic actions (Siguaw et al. 1998). Firms that successfully work together with other members of the supply chain toward defined objectives will experience cooperative norms through the process of mutual recognition and respect (Siguaw et al. 1998; Mentzer et al. 2001).

Members of a supply chain that have compatible management styles and cultural elements stand a greater chance of realizing successful SCM (Novack et al. 1992; Mentzer et al. 2001). Organizational compatibility among members of a supply chain is exhibited by complementary goals and objectives, similarity in operating and management philosophies, and compatibility of corporate cultures (Bucklin and Sengupta 1993).

Finally, recognition of the importance of supply chain relationships by a firm's executives is critical to the process of shaping a firm's orientation (Mentzer et al. 2001). Therefore, top management support is a primary factor in developing and maintaining strong relationships with supply chain partners, both upstream and downstream in the supply chain (Lambert et al. 1998).

SCO is likely a strategic resource for a firm that is centered on the philosophy toward the importance of viewing the supply chain as an integrated system that satisfies internal and external customer's needs (Hult et al. 2008). Satisfying such needs is valuable to a firm, because SCO is reflected in a firm's culture and therefore, difficult to imitate and understand (Mentzer et al. 2001; Mello and Stank 2005).

RBV explains that the advantage of a strategic resource can be identified by the outcomes of using the resources in a way that is used in the firm (Sirmon et al. 2007). SCO is an enabling corporate culture that leads to SCM (Mentzer et al. 2001). Empirical studies show support for the relationship between SCO and higher firm performance. Min and Mentzer (2004) found SCO linked to firm performance, through SCM. Min et al. (2007) found that SCO had a direct relationship to improving firm performance. Hult et al. (2008) found that that SCO as a strategic resource in a firm is positively related to firm performance. These studies provide evidence that SCO as a strategic resource can improve the competitiveness of the firm.

GREEN SUPPLY CHAIN MANAGEMENT

An emerging area of inquiry describes how green practices in SCM can be considered strategic resources and have important performance implications for the firms involved. Green SCM is defined as the intra- and inter-firm management of the upstream and downstream supply chain aimed at minimizing the overall environmental impact of both the forward and reverse

flows (van Hoek 1999; Klassen and Johnson 2004; Zhu et al. 2008a). Green SCM practices fall into five primary dimensions (Zhu et al. 2008a): internal environmental management, green purchasing, eco-design, cooperation with customers and investment recovery. These five dimensions of green SCM practices distinguish it from the traditional definitions of SCM (Zhu et al. 2008a).

The internal environmental management dimension relates to the actions, processes and procedures in place that supports the overall environmental objectives of a firm (Carter et al. 2000; Zhu and Sarkis 2004). The actions of top and middle management are key to supporting the goals and objectives of SCM (Mentzer et al. 2001; Chen and Paulraj 2004). Internal environmental processes are geared toward reducing inefficiencies by coordinating engineering, quality, and marketing departments, and the entire supply chain as an extension of total quality management (Shrivastava 1995; Handfield et al. 1997; Walton et al. 1998). Processes such as ISO 14001 certification, environmental auditing of departments, and eco-labeling of products, are also part of the internal environmental management dimension (Bowen et al. 2001; Klassen and Johnson 2004).

Green purchasing and cooperation with customers are necessary components of green SCM and reflect the importance of upstream and downstream relationships in the supply chain (Zhu and Sarkis 2004). Companies need to include suppliers as part of the implementation of environmentally sound practices for materials management and purchasing processes and procedures, tantamount to "greening" the supplier (Walton et al. 1998; Rao and Holt 2005). Suppliers are seen as key partners that can support the focal firm's environmental initiatives to help improve the environmental performance of the supply chain (Bowen et al. 2001; Seuring and Müller 2008).

Green SCM also involves understanding the demands of the end customer, which is critical to creating value in the supply chain. Working with customers to create products and packaging that are less impactful on the environment – known as eco-design - creates a twofold advantage for the firm: reduced material expenses and higher customer satisfaction (Zhu et al. 2008a).

Eco-design or design for the environment is a key consideration in green SCM as nearly 80% of the lifetime cost of a product is ensured during its design phase (Pujari et al. 2003). Companies recognize that products designed with life cycle considerations in mind can lead to cost savings throughout the life of the product through less material, less waste, and lower disposal and recycling fees (Green et al. 1998). Product design is created through intra-organizational cross-functional teams and inter-organizational collaboration with members of the supply chain.

Investment recovery is considered a traditional SCM process. However, recovery of the investments put into products is also considered a green supply chain management practice as it captures both waste and materials that would otherwise be put into landfills (Zhu and Sarkis 2004). Closed loop supply chains can be used to manage product end-of-life and investment recovery processes (Defee et al. 2009). Closed-loop supply chain designs are the overt management of products in the forward supply chain and the reverse supply chain through product returns for remanufacturing, refurbishing, recycling, or disposal (Krikke et al. 2004; Schultmann et al. 2006). Firms implement and manage closed-loop supply chains with the intent of capturing additional value in the recovery of end-of-use and end-of-life products (Guide et al. 2003; Defee et al. 2009), which enhances efficiency.

The preceding discussion suggests that green management practices are cumulative, ongoing processes that enable a firm to generate value (Etzion 2007). Because these practices are complex, unique, difficult to imitate, valuable, and not easily substitutable (Bowen et al. 2001; Ketchen and Hult 2007), firms that implement green SCM practices likely realize higher performance than firms that have not implemented such practices (Bowen et al. 2001).

In this dissertation, an environmental orientation, in combination with a supply chain orientation, are considered strategic resources and antecedents to green supply chain management, which is also considered a strategic resource that is capable of improving firm performance. In the next sections, the performance implications of these strategic resources are defined and described.

FIRM PERFORMANCE

The RBV explains why some firms are able to create a competitive advantage and superior performance (Crook et al. 2008). The RBV has also been leveraged to explain the impact of SCM practices on firm performance outcomes. Indeed, the motive behind SCM is to improve supply chain competitiveness in order to create value for firms (Crook and Combs 2007) through enhanced efficiency, effectiveness (Mentzer et al. 2001), and differentiation (Fugate et al. 2010).

Efficiency focuses on reductions to the total cost of supply chain operations, necessary to provide a target level of customer value (Houlihan 1987; Christopher and Peck 2004). Effectiveness focuses on meeting customer service demands and creating customer satisfaction (Cooper and Ellram 1993; Otto and Kotzab 2003). In addition, supply chain managers are finding that they must work to create value beyond the performance combination of efficiency and effectiveness in the highly competitive global business environment (Fugate et al. 2010).

Value can be found through differentiating functions to perform better than the competition (Porter 1980). Differentiation, therefore, focuses on creating value for the firm through benchmarking and adherence to best practices to differentiate their supply chains from the competition (Fugate et al. 2010). The three supply firm performance dimensions of efficiency, effectiveness and differentiation are discussed in more detail in the following sections.

COST EFFICIENCY

Efficiency is defined as a measure of how well resources are employed (Mentzer and Konrad 1991). A key step in value generation for the firm is based on cost reductions and efficiency improvements (Lambert and Pohlen 2001). Measuring supply chain efficiency is the comparison of the resources that are used for a supply chain operations, against the outcomes that are derived and expected from the resource usage (Mentzer and Konrad 1991). Improving supply chain efficiency is a primary performance objective of SCM (Mentzer et al. 2001; Lee 2002). This is accomplished through the reduction of operating expenses, the efficient use of fixed capital, and the efficient use of working capital, while meeting or exceeding a necessary level of customer service (Christopher and Ryals 1999; Defee and Stank 2005).

In essence, efficiency results when wastes are reduced or eliminated, ideally resulting in reduced costs (Heikkilä 2002). Therefore, for the purposes of this dissertation, the dimension of efficiency as an indicator of firm performance and a consequence of green SCM is defined as cost efficiency.

CUSTOMER EFFECTIVENESS

Effectiveness is an assessment of the extent to which goals are met by an organization (Mentzer and Konrad 1991; Defee and Stank 2005). Measuring supply chain effectiveness is the

comparison between how well goals and objectives are met versus the stated level of the set goal or objective (Mentzer and Konrad 1991; Kent and Mentzer 2003). Ultimately, improving effectiveness equates to the focus of overall revenue enhancement (Defee and Stank 2005). Revenue enhancement is reliant on serving customers at the highest level possible, given strategic goals and cost constraints. Customer service objectives are accomplished through the impact on product availability, fulfillment time, cycle time and convenience, and the ability of the firm's supply chain to handle difficult or nonstandard orders and emergencies (Langley and Holcomb 1992; Min and Mentzer 2004). Customer service objectives are also accomplished when customer value is created (Ross 1998). Finally, effectiveness is considered a response-oriented concept; managers identify customer demands and work to create an effective response to meet them, including the ability to handle difficult or nonstandard orders and emergencies.

Therefore, effectiveness is considered a customer-centric performance goal, where the firm and its supply chain are able to deliver products to the end customer in a manner that creates customer value and satisfaction (Walters 2006). Effectiveness, as an indicator of firm performance and as a consequence of green SCM, is defined as customer effectiveness, for the purposes of this dissertation.

ENVIRONMENTAL DIFFERENTIATION

Supply chain management activities improve performance beyond that of efficiency and effectiveness to be competitive (Fugate et al. 2010). Another way that value can be created is through differentiation, or when a firm does something unique from competitors in ways that are discernable to the customer (Williamson et al. 1990).

Differentiation can be applied to green aspects of performance (Christmann 2000). Firms that are able to provide products that are designed, manufactured and supplied to the end

customer through processes that are less impactful on the environment can differentiate themselves from the competition (Reinhardt 1998). Environmental differentiation is defined as environmental management that focuses on environmental product characteristics and environmental product markets (Shrivastava 1995; Christmann 2000). Ultimately, environmental differentiation equates to the ability of managers to create a unique image of environmentally-friendly products and processes that translate to higher demand (Stead and Stead 1995).

Measuring supply chain environmental differentiation is the degree to which managers find or create a demand for environmental quality in products, establish credible information about environmental claims, and create inimitability of environmental products and supply chain operations (Reinhardt 1998). Environmental differentiation can be created via take-back services, recycled materials in products and packaging, the use of non-hazardous materials, and durable, high quality products (Handfield et al. 1997; Dyllick and Hockerts 2002; Figge and Hahn 2004; Mollenkopf 2006). Therefore, differentiation, as an indicator of firm performance and as an outcome of green supply chain management, is defined as environmental differentiation in this dissertation.

RESEARCH HYPOTHESES AND THEORETICAL MODEL

The preceding literature review provides the background of the major constructs in this dissertation and supports the investigation into the research questions, as proposed in Chapter 1. Stated again, the purpose of this dissertation is to apply the RBV into relationships among green supply chain management, environmental orientation, and supply chain orientation, and their impact of firm performance, at the firm level unit of analysis. The following sections explain the relationships among the major constructs, develop hypotheses, and introduce the theoretical model.

The RBV explains that identification and employement of strategic resources can improve firm performance. The impact of SCM on firm performance is measured through efficiency, effectiveness, and differentiation (Mentzer et al. 2001; Fugate et al. 2010). Researchers have identified green strategies and practices that are theorized to create value, be a source of competitive advantage, and improve the bottom line of the firm (Porter and van der Linde 1995; Banerjee et al. 2003). In addition, research has found that poor environmental performance can actually impair firm performance (Corbett and Klassen 2006). Improving performance is therefore the most important motivator for firms that seek to implement green supply chain management practices and processes (Zhu and Sarkis 2004). Hypothesized relationships between green supply chain management and each of the three performance indicators identified in the literature, cost efficiency, customer effectiveness, and environmental differentiation, are discussed in the following sections.

Green SCM – Cost Efficiency Link

The RBV paradigm helps explain how the identification and employment of strategic resources in proactive green supply chain management processes can improve firm performance (Zhu and Sarkis 2004). Strategic resources that are used for purposes of making the supply chain leaner help to reduce and eliminate wastes in the supply flow, creating efficiencies that improve financial performance (Heikkilä 2002; Zhu and Sarkis 2004).

Green management emphasizes the reduction of wastes in a firm's operations as a means to remove unnecessary costs and create efficiencies throughout the value chain (Porter and van der Linde 1995). Green supply chain management strives to reduce expenses, improve capital expense efficiencies, and improve fixed capital efficiencies through operations that focus on

elimination of wastes at the source, rather than 'end of pipe' solutions (Handfield et al. 1995). The efficient use of resources improves the environmental impact of the supply chain while concurrently helping to reduce costs to improve overall firm performance.

The literature provides a number of examples of the benefits to implementing green supply chain management processes in the firm, including cost savings and improved efficiency (Zhu and Sarkis 2004). Green supply chain management focuses on efficient, lean processes in a firm's supply chain operations (Handfield et al. 1997). Lean processes improves the efficiency of the supply chain and often results in cost reductions, which can then be passed on to the end customer (Hanssen 1999; Klassen and Whybark 1999). From the results of case study research, Handfield et al. (2005) found green supply chain management was able to reduce and eliminate waste from the supply chain through improved resource efficiency. Handfield et al. (2005) also found firms that implemented green supply chain management processes were able to improve efficiency by reducing landed costs of products, reducing disposal costs, and reducing costs of complying with hazardous materials regulation. Each of these areas impacts cost efficiency and improves firm performance. Therefore, the following hypothesis is presented:

H_{1a}: Green SCM directly and positively contributes to Cost Efficiency

Green SCM – Customer Effectiveness Link

SCM has been shown to improve customer service and customer satisfaction, collectively deemed customer effectiveness (Mentzer and Konrad 1991; Min and Mentzer 2004). Improving customer satisfaction improves customer loyalty and repeat business, both of which are critical to meeting the goals and objectives of the firm. Customer satisfaction therefore enhances revenue, which is the primary focus of supply chain customer effectiveness (Defee and Stank 2005).

Green SCM practices have also been linked to customer effectiveness. Partnering with upstream (suppliers) and downstream (customers) supply chain members to develop and implement green supply chain practices is linked to cost, a measure of efficiency, but also with quality, delivery, and flexibility, measures of effectiveness (Vachon and Klassen 2006a). Support for green practices from top management and employee commitment to green operations conveys a sense of importance to meeting customer expectations (Zhu et al. 2008a). Management and employee commitment to green practices encourages innovation and technological advancement in processes and practices in the supply chain that ultimately help reduce cycle times, product development, and reverse logistics programs (Krikke et al. 2004).

Empirical research has found evidence that green SCM can improve customer effectiveness in several ways. Enhanced and improved returns processes from reverse logistics and closed-loop supply chain practices improve the buying experience (Klassen and Johnson 2004; Zhu and Sarkis 2004; Zhu et al. 2008a). Customers rate ease of returns as an important part of satisfaction with a product and the seller (Defee et al. 2009). Likewise, quality improvements are possible through careful quality management processes that ensure high standards for a product, from both a usability standpoint and an environmental standpoint, which improves firm reputation and image among end consumers (Rao 2002; Zhu and Sarkis 2004; Vachon and Klassen 2006b; Zhu et al. 2008a). In addition, Carter et al. (2000) found that firms can increase net income through environmental purchasing practices. Finally, speed and delivery reliability improvements were shown in firms that prioritize green supply chain management practices and focus on end-customer satisfaction and greater process flexibility (Vachon and Klassen 2006a; Zhu et al. 2008b). Therefore, the following hypothesis is presented:

H_{1b}: Green SCM directly and positively contributes to Customer Effectiveness

Green SCM – Environmental Differentiation Link

RBV explains that the process of managing strategic resources can be a key factor of differentiation. As competitors may hold similar types of resources, the management and use of the resources can ultimately create a competitive difference among organizations. Firms that most effectively manage their resources to differentiate themselves can gain a competitive advantage and potentially improve the financial performance of the firm (Zott 2003).

Supply chain management activities need to provide an overall value to the end customer that differentiates it from the competition (Fugate et al. 2010). Differentiation can come in a number of different forms, including environmental differentiation (Bansal and Roth 2000). Using RBV, Hart (1995) suggests firms that move to develop and implement proactive environmental strategies through the use of strategic resources will have a stronger stakeholder awareness and focus. Managers seem to understand this connection, as firms are increasingly responding to the perceived rise in environmental consciousness among stakeholders by expanding their selection of products that are less harmful to the environment (Zhu et al. 2008b). Green supply chain management practices used to manufacture and deliver products in a manner that is both cost efficient and environmentally responsible have been recognized as a critical component in satisfying the demands of consumers and other stakeholders (Meyer 2001). Therefore, firms stand to gain from using green supply chain management practices to improve relationships with end-consumers and other critical stakeholders, and ultimately, to differentiate their supply chain activities from those of the competition (Zhu and Sarkis 2004). As a result, the following hypothesis is presented:

H_{1c}: Green SCM directly and positively contributes to Environmental Differentiation

STRATEGIC ORIENTATIONS AND GREEN SCM

Scholars have acknowledged for decades that a firm's strategic resources are considered to be unproductive in isolation; it is the exploitation of combinations of valuable resources that help firms create competitive advantage and improve performance (Rubin 1973; Grant 1996; Newbert 2008). Combinations of resources are often manifested through relationships among the resources (Makadok 2001; Newbert 2008). Resource relationships can be path dependent where the value of the resources are dependent on their sequence of use within the firm (Black and Boal 1994; Hult and Ketchen Jr 2001). Organizational orientations, as internal strategic resources, play an important role in driving operational planning and practice (Sharma et al. 1999). Thus, green SCM practices, as strategic resources, are in a path dependent relationship with a firm's environmental orientation and supply chain orientation. The following sections propose the relationships between an environmental orientation, a supply chain orientation, and green SCM practices.

Environmental Orientation – Green SCM Link

The extension of the RBV paradigm to include the influence of the natural environment explains that an internal and an external focus on environmental responsibility is necessary for firms to account for the development of green strategies (Hart 1997) and to consider environmental management practices and objectives as critical to economic goals (Shrivastava 1995). An internally-focused environmental orientation is linked to internal environmental beliefs and values that are manifested in the firm through internal processes. Firms that adopt an internally-focused environmental orientation acknowledge its importance in the implementation of environmental management practices (Menguc and Ozanne 2005). An externally-focused environmental orientation is linked to the need for legitimacy and to satisfy stakeholder demands

(Banerjee et al. 2003; Fraj-Andrés et al. 2009). Firms that adopt an externally-focused environmental orientation acknowledge the importance of developing strategic green management practices in the context of the external business environment (Menguc and Ozanne 2005).

Klassen and Johnson (2004) use RBV to describe the impact of an underlying environmental corporate culture in a firm as one that strengthens the magnitude of green management practices in the supply chain. Bowen et al. (2001) found empirical evidence that a proactive green approach to supply chain management influences the creation of green management practices. Furthermore, the same study found firms that recognize the importance of integrating environmental strategies into the corporate culture, also recognized the potential firm performance benefits that are possible through the identification and use of green supply chain management practices. Values and beliefs evolve from an environmental corporate culture and eventually influence the creation and implementation of environmental management systems (Mintzberg 1994a; Mintzberg 1994b; Banerjee et al. 2003; Fraj-Andrés et al. 2009). Therefore, an environmental orientation as an antecedent to green supply chain management can be theoretically established and the following hypotheses presented:

H_2: Environmental Orientation directly and positively contributes to Green Supply Chain Management.

SCO – Green SCM Link

Mentzer et al. (2001), Min and Mentzer (2004), and Min et al. (2007) established a critical relationship between SCO and SCM. SCO is the philosophy of SCM that resides in the individual members of a supply chain, and SCO is necessary for the successful coordination and management of the supply chain by all members. SCO is a culture of understanding the value of

relationships with other supply chain members through trust, commitment, cooperative norms, organizational compatibility, and top management support (Min et al. 2007). The intent of green supply chain management is for a firm to work with its upstream and downstream supply chain members to act in a proactive way that focuses on the environmental impact of the entire supply chain system (Makower 1994; Sarkis 2003; Seuring and Müller 2008).

The RBV paradigm explains that firms create strategies through bundling strategic resources that are based on efficiency-advantages in the firm that can be used to improve a firm's supply chain processes (Teece et al. 1997; Sirmon et al. 2007). To be successful, these bundled resources need to have dynamic qualities and to be adaptable to the ever-changing business environment (Prahalad and Hamel 1990; Teece et al. 1997; Sirmon et al. 2007). Strategic resources that are identified and used to create environmental strategies are the product of a firm's culture of environmental responsibility and the recognition that combining environmental and economic concerns can create value for the firm (Azzone and Bertelè 1994; Noci 1997).

RBV further explains that strategic resources can create environmental capabilities that lead to green management practices (Aragon-Correa and Sharma 2003). However, the impact of green SCM practices is not as effective if undertaken only by a single firm (Walton et al. 1998; Klassen and Johnson 2004). Firms that integrate their upstream and downstream supply chain members into green supply chain management practices will be more successful in these endeavors. SCM links firms together with their supply chain partners and SCO is necessary as the underlying philosophy for effective supply chain management. Collaborative relationships and partnering with supply chain members facilitate the introduction of green supply chain management practices in the firm (Bowen et al. 2001; Klassen and Johnson 2004; Vachon and Klassen 2006). Therefore, SCO as a philosophy of strategically linking processes and flows

throughout the supply chain with the involvement of supply chain members is needed for the implementation of green supply chain management practices as well (Klassen and Johnson 2004). As a result, SCO functions as an antecedent of green supply chain management and the following hypothesis is presented:

H_3: A Supply Chain Orientation directly and positively contributes to Green Supply Chain Management.

RESOURCE COMBINATION AND FIRM PERFORMANCE

The RBV recognizes the strength of combinations or configurations of resources on firm performance over resources used in isolation (Hoskisson et al. 1999). Moreover, configurations of resources create complexity, which makes them valuable by impeding imitation from competitors (Rivkin 2000). Research into the antecedents of firm performance in the area of green SCM practices is important to understanding the connection between configurations of green resources and performance (Hart and Dowell 2010). Hypotheses 1 and 2 are concerned with the relationship between an environmental orientation and green supply chain management and a supply chain orientation and green supply chain management. Hypotheses 3a, 3b, and 3c are concerned with the relationship between green supply chain management and three dimensions of firm performance. Given the theoretical implications of strategic resource configurations, manifested through the hypothetical relationships already described, three additional hypotheses are needed to show the relationship between the combination of strategic resources and firm performance.

H_{4a}: The combination of resources through the path dependence of an Environmental Orientation and a Supply Chain Orientation as antecedents to Green Supply Chain Management, directly and positively contributes to Cost Efficiency

H_{4b}: The combination of resources through the path dependence of an Environmental Orientation and a Supply Chain Orientation as antecedents to Green Supply Chain Management, directly and positively contributes to Customer Effectiveness

H_{4c}: The combination of resources through the path dependence of an Environmental Orientation and a Supply Chain Orientation as antecedents to Green Supply Chain Management, directly and positively contributes to Environmental Differentiation

THEORETICAL MODEL

A theoretical model, shown in Figure 2.3, displays the hypothesized relationships among the constructs of an environmental orientation (EO), a SCO, green SCM, and the three dimensions of firm performance. A summary of the hypotheses is shown in Table 2.1.

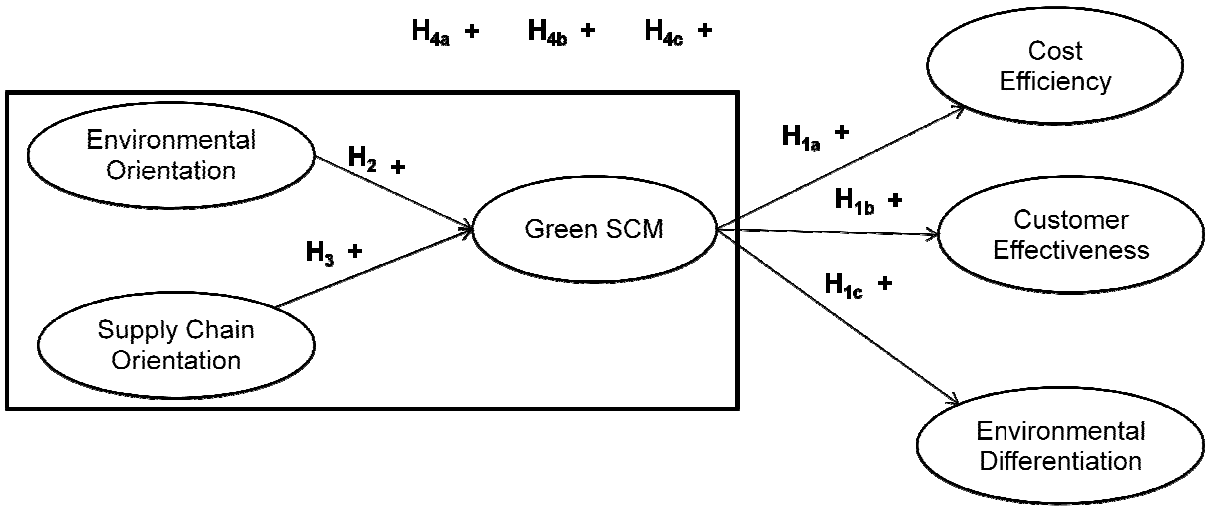


Figure 2.3
Theoretical Model of Green Supply Chain Management Practices

Table 2.1 Summary of Hypotheses

Hypothesis	Description
H_{1a}	Green Supply Chain Management directly and positively contributes to Cost Efficiency
H_{1b}	Green Supply Chain Management directly and positively contributes to Customer Effectiveness
H_{1c}	Green Supply Chain Management directly and positively contributes to Environmental Differentiation
H_2	An Environmental Orientation directly and positively contributes to Green Supply Chain Management
H_3	A Supply Chain Orientation directly and positively contributes to Green Supply Chain Management
H_{4a}	The combination of resources through the path dependence of environmental orientation, and supply chain orientation as antecedents to green supply chain management directly and positively contributes to Cost Efficiency
H_{4b}	The combination of resources through the path dependence of environmental orientation, and supply chain orientation as antecedents to green supply chain management directly and positively contributes to Customer Effectiveness
H_{4c}	The combination of resources through the path dependence of environmental orientation, and supply chain orientation as antecedents to green supply chain management directly and positively contributes to Environmental Differentiation

CHAPTER SUMMARY

This chapter laid out the theoretical background in the literature for the empirical research that is planned to be executed in this dissertation. Specifically, the literature review identified an environmental orientation, a supply chain orientation, and green supply chain management as strategic resources. It further identified the three dimensions of firm performance

that are hypothesized to be impacted by green supply chain management: cost efficiency, customer effectiveness, and environmental differentiation.

An empirical study is proposed in Chapter 3 and seeks to answer the research questions through testing the hypotheses summarized in Table 2.1 and illustrated in the theoretical model in Figure 2.2. Chapter 3 lays out the methodology that was used to test the hypotheses in the theoretical model.

CHAPTER 3 – METHODOLOGY

INTRODUCTION

The purpose of Chapter 3 is to present the research design that was used to conduct the empirical research for this dissertation. The research design connects the broader assumptions of a study to its detailed methods of data collection, analysis, and interpretation (Creswell 2009). Research designs enable researchers to achieve the goal of answering research questions as validly, objectively, accurately, and economically as possible (Kerlinger and Lee 2000).

This dissertation employs a quantitative research design using a survey methodology. The factor model and the final model are both built using structural equation modeling (SEM) and the data collected from the survey were analyzed using SEM. The next section introduces SEM and the quantitative research design, including the details of the sampling technique. This is followed by the theoretical and operational definitions of the constructs in the model and the sample construct measures. Next is a discussion of the pre-test and final test. Finally, the reliability and validity of quantitative methodology are reviewed.

QUANTITATIVE RESEARCH OVERVIEW

STRUCTURAL EQUATION MODELING

Structural equation modeling (SEM) was used as the main statistical analysis tool to purify the measurement items for each of the variables shown in Figure 2.3 and to test the hypotheses shown in Table 2.1. SEM is a powerful statistical tool that combines a measurement model (exploratory and confirmatory factor analysis) with a structural model (path analysis) into a simultaneous statistical test (Garver and Mentzer 1999). SEM was used for this dissertation because it is able to handle multiple relationships simultaneously and efficiently. It is also able to

assess relationships comprehensively and provide a transition from exploratory to confirmatory measurement analysis.

The theoretical path model identifies two exogenous (independent) variables and four endogenous (dependent) variables. The two exogenous variables are environmental orientation and supply chain orientation. The four endogenous variables are green supply chain management, cost efficiency, customer effectiveness, and environmental differentiation. The nomological network of all exogenous and endogenous variables is shown by the relationships among the six variables, represented by the directional arrows in the structural equation model show in Figure 3.1.

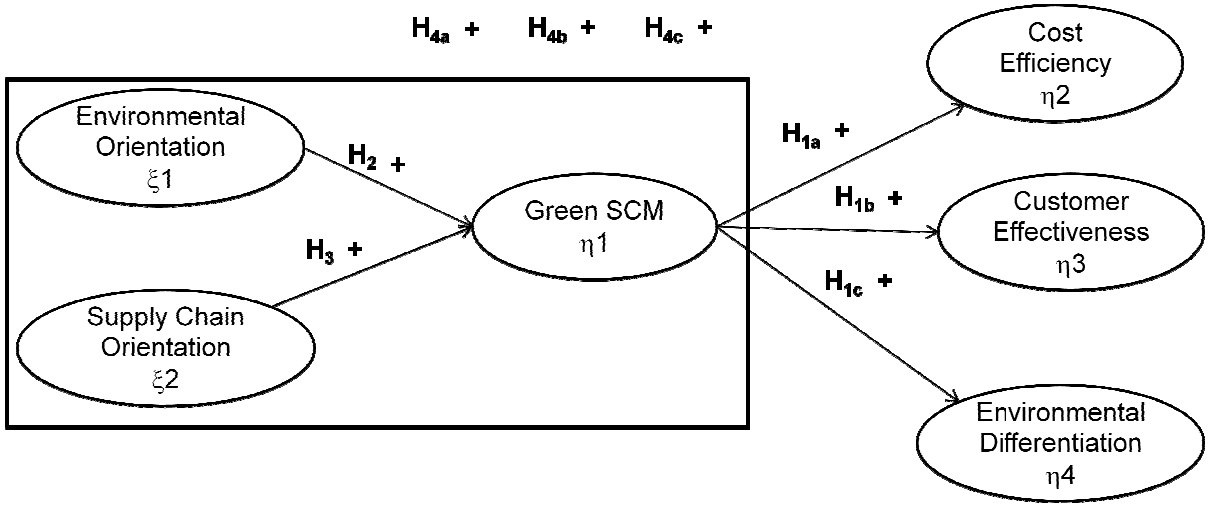


Figure 3.1
Structural Equation Model of Green Supply Chain Management

QUANTITATIVE RESEARCH DESIGN

A survey methodology was utilized in this dissertation to collect data for use in testing the hypotheses developed in Chapter 2. Advantages of survey research design include: (1) a great deal of information can be obtained from a large population, (2) surveys are relatively economical, (3) survey accuracy is high, especially when good sampling procedures are followed, and (4) surveys have a unique advantage among scientific methods as it is possible to check the validity of survey data, using various statistical methods (Kerlinger and Lee 2000).

This dissertation used an internet survey to collect data to test the hypotheses discussed in Chapter 2. Internet surveys are employed extensively in research due to their ease of use, flexibility of responding, confidentiality and relatively low-cost (Sheehan and Hoy 1997). Online surveys are easily quantifiable and suitable for statistical testing, as the results are typically collected in a file that is easily manipulated for analysis. In addition, internet surveys reduce the degree of interviewer bias and are appropriate for collecting a large number of geographically dispersed respondents in a cost-effective manner. Internet survey methods are favorable to mail survey methods as the former offers easier access to respondents, shorter time for implementation, and the ability to provide a more dynamic interaction between the respondent and the questionnaire. Internet surveys are also more efficient, easier to conduct, and more adaptable than mail surveys (Dillman 2000).

One challenge of internet surveys is gaining the trust of potential respondents. With the deluge of e-mail traffic that most business professionals receive, potential respondents may ignore questions for participation in an internet survey, believing it to be an internet marketing promotion. A second challenge of internet surveys, and survey methodology in general, is that researchers often find that business professionals do not have time complete a survey and/or are

over-surveyed, resulting in "survey fatigue" (Boyer and Swink 2008). These challenges were addressed through employing a two-phase approach to reaching potential participants. The first phase consisted of sending out a mass e-mail to a list of potential participants using the Qualtrics internet survey tool. Qualtrics allows for individualized e-mails to be sent to each potential participant containing a link to the on-line survey, and a requested completion date of two weeks from the send date of the e-mail. The topic and the message in the individualized e-mails were personable and were directed at convincing the potential participants that the survey is legitimate and connected with an important program of research that needs their expertise. Three reminders followed the initial mailing.

The second phase started after the final reminder e-mail. Once the results of the personalized e-mails and reminders were collected, the remaining, valid, contact information for participants that did not respond to the survey was sent to a third party marketing firm that specializes in personal calls for survey data collection. The third party marketing firm contacted the remaining potential participants, provided them with background information on the research, the objective of the research, and why their participation is critical for the success of the research. For participants that agreed to complete the survey, follow-up contact was made as reminders until the completed survey was received. Follow-up contact included additional reminder phone calls and e-mails. An executive summary of the findings and entry to win a $100 VISA gift card were offered as an incentive to all participants who complete the survey.

Sampling

Samples were drawn from the databases of a third-party firm that maintains contact information for business professionals, in order to gain participants to answer the survey. In particular, Dun & Bradstreet (D&B) was targeted to provide contact information for the survey

participants. A database of potential participants for the main survey test was purchased from D&B. The database contained critical contact information (name, phone number, e-mail and title). The individuals came from U.S.-based companies in a diverse set of industries. Diverse backgrounds of participants in survey research help establish a higher level of external validity (Cook and Campbell 1979). The preferred target respondents were individuals that have the following attributes:

- Knowledge of strategic SCM practices and processes
- Knowledge of boundary-spanning aspects of SCM
- An understanding of corporate green attitudes and culture
- Knowledge of main competitors and their behavior

Given these desired attributes, senior supply chain executives were targeted as the ideal potential participant. However, due to the limited number of senior executives with "supply chain" in their title, potential participants also included executives from logistics, purchasing, and operations.

Construct Measurement

In order to test the relationships among the constructs in the theoretical model, the constructs must be operationalized (Dillman 2000). The theoretical and operational definitions of the main constructs in the model are shown in Table 3.1.

Table 3.1 Theoretical and Operational Definitions of Constructs

Construct	Theoretical Definition	Operational Definition
Environmental Orientation	The recognition by managers of the importance of environmental issues facing their firms.	The degree to which a firm exhibits the importance of internally-focused and externally-focused environmental orientations.
Supply Chain Orientation	The recognition by a firm of the systemic and strategic implications of the tactical activities involved in managing the various flows of the supply chain.	The degree to which the firm exhibits the following characteristics toward other supply chain members: trust, commitment, cooperative norms, organizational compatibility among supply chain members, in addition to top management support.
Green Supply Chain Management	The intra- and inter-firm management of the upstream and downstream supply chain aimed at minimizing the overall environmental impact of both the forward and reverse flows.	The degree to which the following elements occur within supply chain management practices: internal environmental management, green purchasing, eco-design, cooperation with customers, and investment recovery.

Table 3.1. Continued

Construct	Theoretical Definition	Operational Definition
Firm Performance – Cost Efficiency	An assessment of how well an organization's resources are employed in the management of its supply chain.	The degree to which the firm achieves operating expense reductions, working capital efficiencies, and fixed capital efficiencies, relative to the competition.
Supply Firm Performance – Customer Effectiveness	An assessment of the extent to which goals are met by an organization's supply chain management.	Degree to which the firm achieves revenue enhancement through product availability, market and sales growth, customer service, and ROS, relative to the competition.
Firm/ Performance – Environmental Differentiation	The assessment of the extent to which green supply chain management focuses on environmental product characteristics and environmental product markets.	Environmental differentiation in terms of the extent to which objectives of environmental compliance, product and process differentiation are met, relative to the competition.

The three constructs identified as strategic resources (environmental orientation, supply chain orientation and green supply chain management) are all multidimensional second order constructs. Environmental orientation is measured by the two first-order dimensions of internally-focused environmental orientation and externally-focused environmental orientation. Environmental orientation was operationalized by reflective scales that measure these two dimensions. Supply chain orientation builds and maintains several behavioral first-order dimensions such as trust, commitment, cooperative norms, organizational compatibility, and top management support (Mentzer et al. 2001; Min and Mentzer 2004; Min et al. 2007). Supply

chain orientation was operationalized by reflective scales that measure these five behavioral dimensions. Green supply chain management is defined by several key first-order dimensions, including internal environmental management, green purchasing, eco-design, cooperation with customers, and investment recovery (Zhu and Sarkis 2004; Zhu et al. 2008a). Green supply chain management was operationalized by reflective scales that measure these five dimensions of green supply chain management practices. Figure 3.2 is the theoretical model with the reflective scales added for the three second-order constructs in model.

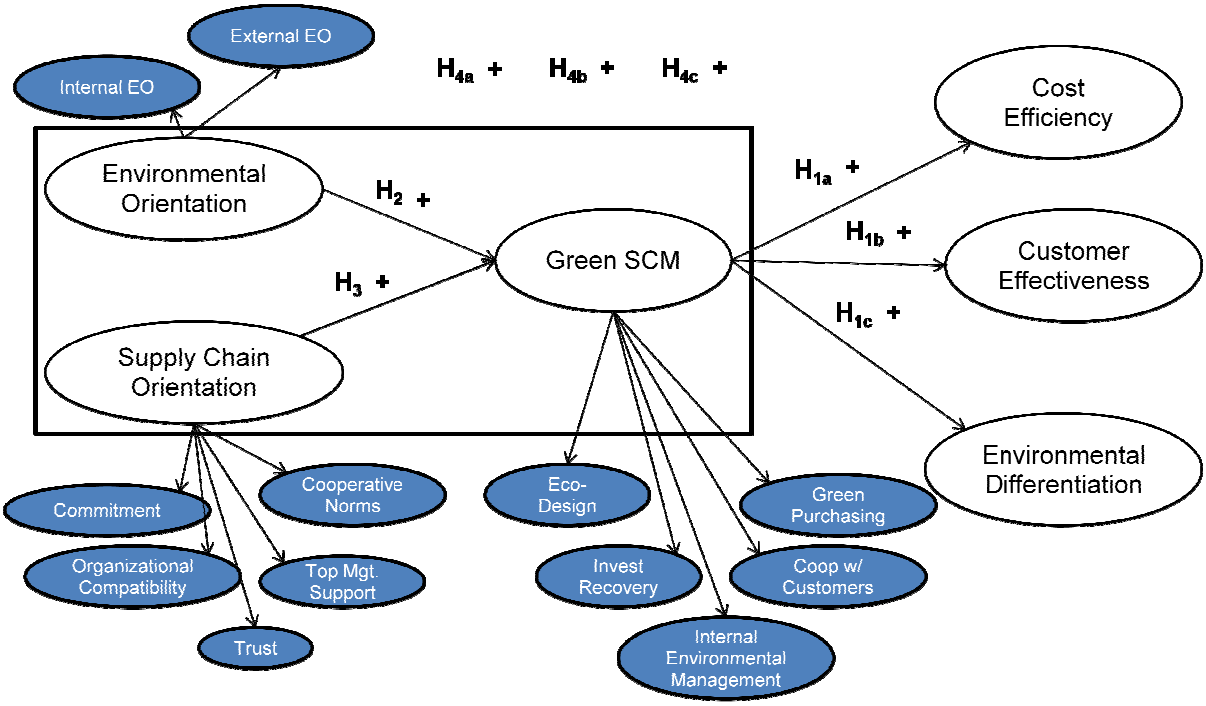


Figure 3.2
Theoretical Model of Green Supply Chain Management Practices
(with Reflective Dimensions)

Each of the first level constructs and each of the dimensions of the second level constructs shown in Figure 3.2 were measured by multi-item scales to increase reliability, decrease measurement error, allow greater variability among the survey participants, and

improve validity (Churchill Jr 1979). Each construct was measured by at least three items in order to effectively measure the construct and analyze it using SEM (Anderson and Gerbing 1982). All existing scales have been adapted for each of the constructs in the theoretical model. Construct reliability and validity was assessed following Garver and Mentzer (1999). Confirmatory factor analysis (CFA) was used to test each construct individually, then for all possible pairs, and finally for the overall measurement model and each construct in the presence of other constructs (Garver and Mentzer 1999).

Participant Bias

To test for common method bias, a marker variable was used (Podsakoff et al. 2003). The marker variable is a construct that should not be theoretically related to any of the other constructs. The marker variable for the survey is "Employee Commitment to the Organization". Employee commitment is used to measure the degree of employee loyalty and involvement in the organization (Escrig-Tena and Bou-Llusar 2005). The scale for this construct is shown in Table 3.2. Three items are included in the survey to measure the marker variable.

To combat social desirability bias (Nederhof 1985; Podsakoff et al. 2003), respondents were assured anonymity of their responses. In addition, scale items were arranged in a way that socially desirable measures (in the case of this dissertation, measures that ask about environmental culture and green practices) were spaced apart from one another (Nederhof 1985). Finally, the use of self-administered surveys also helped to reduce social desirability bias by isolating the respondent. Self-administered surveys help reduce the salience of social acceptability cues that a respondent might pick up on from an interviewing and/or other respondents (Nederhof 1984; Nederhof 1985).

SURVEY PRETEST AND MAIN TEST

To increase reliability, decrease measurement error, and improve the validity of each construct measurement, all measures were pretested (Dillman 2000). The pretest also helped identify any potential problems with the design and layout of the survey before the final test is launched. The pre-test was conducted using the participants of the University of Tennessee Supply Chain Forum. Included in the pre-test study are four optional questions at the end whose specific purpose is to gauge the survey's clarity, relevance, and interest to the pre-test participants. These questions were used for the pre-test survey only. The measures used in the pre-test survey are shown in Table 3.2.

The pre-test survey was launched using the same internet-based survey tool used to launch the main test. A personalized e-mail was sent to each potential participant, with a link to the survey included. The message in the e-mail explained the importance of the study and requested their participation, as supply chain management experts. The results of the four questions at the end of the survey were analyzed separately for similar themes; appropriate changes were made to the final survey when concurrence among the pre-test participants emerged in their responses to these questions. The results of the data obtained from the pre-test survey was analyzed for reliability using Cronbach's alpha and for data reduction and scale purification using principal component analysis. After the survey was modified in the survey tool, the main survey test was sent to the purchased database of potential participants.

Table 3.2. Pre-Test Survey Items

Internal Environmental Orientation (INT-EO) (Adapted from – Banerjee et al. 2003; Fraj-Andres et al. 2009)	**Strongly Disagree**			**Neutral**			**Strongly Agree**
1. Employees in our business unit understand the importance of environmental responsibility. /	1	2	3	4	5	6	7
2. Our business unit makes a concerted effort to promote the value of environmental responsibility across all departments.	1	2	3	4	5	6	7
3. Our business unit urges environmental awareness in our operations.	1	2	3	4	5	6	7
4. Environmental responsibility is **not** important to our business unit.**	1	2	3	4	5	6	7
External Environmental Orientation (EXT-EO) (Adapted from – Banerjee et al. 2003; Fraj-Andres et al. 2009)	**Strongly Disagree**			**Neutral**			**Strongly Agree**
1. Our business unit believes it is important to balance responsibility to our customers, stockholders, employees, and the environment.	1	2	3	4	5	6	7
2. Environmental responsibility is considered part of our business unit's long-term performance strategy.	1	2	3	4	5	6	7
3. The ability of our business unit to create a positive image of environmental responsibility is important.	1	2	3	4	5	6	7
4. Environmentally responsibility does **not** significantly affect our business unit's financial performance.**	1	2	3	4	5	6	7
Supply Chain Orientation – Trust (SCO-TR) (Adapted from – Doney and Cannon 1997; Min et al. 2007)	**Strongly Disagree**			**Neutral**			**Strongly Agree**
1. Our key supply chain members are trustworthy.	1	2	3	4	5	6	7
2. Our key supply chain members keep our best interests in mind.	1	2	3	4	5	6	7
3. Our key supply chain members are genuinely concerned that our business succeeds.	1	2	3	4	5	6	7
4. Our key supply chain members are concerned about our welfare.	1	2	3	4	5	6	7

Table 3.2. Continued

Supply Chain Orientation - Commitment (SCO-COM) (Adapted from – Kumar, et al. 1995; Min, et al. 2007)	**Strongly Disagree**			**Neutral**			**Strongly Agree**
1. It is important to maintain strong relationships with key supply chain members.	1	2	3	4	5	6	7
2. We do whatever it takes to preserve relationships with key supply chain members.	1	2	3	4	5	6	7
3. The continuity of our relationships with key supply chain members is very important to us.	1	2	3	4	5	6	7
4. We expect our relationships with key supply chain members to last for a long time.	1	2	3	4	5	6	7
Supply Chain Orientation – Organizational Compatibility (SCO-OC) (Adapted from – Bucklin and Sengupta 1993; Min et al. 2007)	**Strongly Disagree**			**Neutral**			**Strongly Agree**
1. Our business unit's goals and objectives are consistent with those of key supply chain members.	1	2	3	4	5	6	7
2. The culture of our business unit is similar to those of key supply chain members.	1	2	3	4	5	6	7
3. Our executives have a management style similar to that of key supply chain members.	1	2	3	4	5	6	7
4. Our CEO and the CEOs of key supply chain members have similar operating philosophies.	1	2	3	4	5	6	7
Supply Chain Orientation – Cooperative Norms (SCO-CN) (Adapted from – Min, et al. 2007)	**Strongly Disagree**			**Neutral**			**Strongly Agree**
1. Our business unit is willing to make cooperative changes with key supply chain members.	1	2	3	4	5	6	7
2. Our business unit believes it necessary for key supply chain members to work together with us in order to be successful.	1	2	3	4	5	6	7
3. Our business unit views our supply chain as an important value added piece of our business.	1	2	3	4	5	6	7
4. Our business unit believes it can improve performance by agreeing to changes suggested by key supply chain members.	1	2	3	4	5	6	7

Table 3.2. Continued

Supply Chain Orientation – Top Management Support (SCO-TMS) (Adapted from – Min, et al. 2007)	**Strongly Disagree**			**Neutral**			**Strongly Agree**
1. Top managers reinforce that building and maintaining long-term relationships with key supply chain members is critical to our business unit's success.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. Top managers reinforce that sharing valuable information with key supply chain members is critical to our business unit's success.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. Top managers reinforce that sharing risk and rewards with key supply chain members is critical to our business unit's success.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. Top managers reinforce that our business unit's success depends on supply chain management.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Green Supply Chain Management – Internal Environmental Management (GSCM-I) (Adapted from Zhu et al. 2008; Bowen et al. 2001)	**Not Considering It**			**Planning It**			**Implementing It Successfully**
To what extent are the following actions enacted within your business unit?							
1. Environmental performance metrics are used regularly by corporate management	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. Cross-functional cooperation to create environmental improvements in the supply chain.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. Implementation of total quality environmental management (TQEM).	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. Environmental compliance and auditing programs in all departments.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5. ISO 14001 certification.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Table 3.2. Continued

Green Supply Chain Management – Green Purchasing (GSCM-GP) (Adapted from Zhu et al. 2008; Melnyk et al 2003; Bowen et al. 2001)	**Not Considering It**			**Planning It**			**Implementing It Successfully**
To what extent are the following actions enacted within your supply chain management practices?							
1. Collaboration with our supply base to meet environmental objectives.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. Environmental audits of our supply base.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. ISO14001 certification of our supply base.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. Joint decisions with our supply base about ways to reduce overall environmental impact of products.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5. Joint decisions with our supply base about ways to reduce overall environmental impact of logistics operations.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
6. Working with our supply base to address environmental problems and/or issues.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Table 3.2. Continued

Green Supply Chain Management – Eco-Design (GSCM-ED) (Adapted from Zhu and Sarkis 2004; Zhu et al. 2008; Melnyk et al. 2003)	**Not Considering It**			**Planning It**			**Implementing It Successfully**
To what extent are the following actions enacted within your supply chain management practices?							
1. The design or redesign of products to reduce consumption of material and/or energy.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. The design or redesign of products for recovery, reuse, recycling, and/or remanufacturing.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. The design or redesign of products to avoid or reduce use of hazardous substances.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. The design or redesign of products to reduce the overall environmental impact of the product.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5. The design or redesign of product packaging for recovery, reuse, and/or recycling.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
6. The design or redesign of products to increase the durability and the life of the product.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Green Supply Chain Management – Cooperation with Customers (GSCM-CC) (Adapted from Zhu and Sarkis 2004; Zhu et al. 2008)	**Not Considering It**			**Planning It**			**Implementing It Successfully**
To what extent are the following actions enacted within your supply chain management practices?							
1. Cooperation with our customers to reduce the environmental impact of our products.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. Cooperation with our customers to reduce the environmental impact of our product manufacturing processes.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. Cooperation with our customers to reduce product packaging requirements.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. Cooperation with our customers to anticipate and/or resolve environmental-related problems.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5. Joint decisions with our customers about ways to reduce overall environmental impact of logistics operations.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Table 3.2. Continued

Green Supply Chain Management –Investment Recovery (GSCM-IN) (Adapted from Zhu et al. 2008; Melnyk et al. 2003)	**Not Considering It**			**Planning It**			**Implementing It Successfully**
To what extent are the following actions enacted within your supply chain management practices?							
1. Sale of excess inventories/materials to recover product investments.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. Sale of scrap and used materials to recover materials investments.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. Reuse of scrap and waste as inputs to saleable products.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. Implementation of reverse logistics program(s).	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Firm Performance – Efficiency (FP-E) (Adapted from Min et al. 2007)	**Far Below Competitors**			**On Par With**			**Far Above Competitors**
Respond to each of the following based on the performance of your business unit over the past three (3) years, relative to your competitors:							
1. Average amount of physical inventory in our pipeline.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. Physical inventory turnover.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. Order-to-delivery cycle time.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. Order-to-delivery cycle time consistency.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5. Return on assets (ROA).	**1**	**2**	**3**	**4**	**5**	**6**	**7**
6. Supply chain costs as a percent of revenue.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
7. Return on investment (ROI).	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Table 3.2. Continued

Firm Performance – Effectiveness (FP-F) (Adapted from Min et al. 2007)	**Far Below Competitors**			**On Par With**			**Far Above Competitors**
Respond to each of the following based on the performance of your business unit over the past three (3) years, relative to your competitors:							
1. Consistent stock availability.	1	2	3	4	5	6	7
2. Ability to handle customer emergencies (i.e. stock outs).	1	2	3	4	5	6	7
3. Ability to handle difficult, nonstandard orders to meet special needs.	1	2	3	4	5	6	7
4. Providing customers real time information about their order.	1	2	3	4	5	6	7
5. Return on sales (ROS).	1	2	3	4	5	6	7
6. Market share growth.	1	2	3	4	5	6	7
7. Sales growth.	1	2	3	4	5	6	7
8. Consistent order fulfillment.	1	2	3	4	5	6	7
Firm Performance – Environmental Differentiation (FP - D) (Adapted from Melnyk et al. 2003; Christmann 2000)	**Far Below Competitors**			**On Par With**			**Far Above Competitors**
Respond to each of the following based on the performance of your business unit over the past three (3) years, relative to your competitors:							
1. Eco-friendly reputation.	1	2	3	4	5	6	7
2. Breadth of eco-friendly product range.	1	2	3	4	5	6	7
3. Revenue generated from eco-friendly products.	1	2	3	4	5	6	7
4. Quality of products.	1	2	3	4	5	6	7
5. Eco-friendliness of returns programs.	1	2	3	4	5	6	7

Table 3.2. Continued

Marker Variable – Employee Commitment to the Organization (EMP-COM) (Adapted from Escrig-Tena and Bou-Lluser 2005)	**Strongly Disagree**			**Neutral**			**Strongly Agree**
1. Employees in our business unit play a large part in deciding what work is to be carried out.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. Employees in our business unit have significant participation in setting goals and deciding how they are to be achieved.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. Employee loyalty in our considered high.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

The following information will help the research team understand differences in various business settings.

(1) Which term best describes your industry? Please check all that apply.

__Automotive __Electronics __Chemicals/plastics

__Medical/pharmaceutical __Industrial products __Appliances

__Apparel/textiles __Consumer packaged goods __Other:_____

(2) What is the approximate annual sales revenue of your business unit?

__Less than $1 million __$1.1 - $5 billion

__$1-50 million __$5.1 - $10 billion

__$51-500 million __Greater than $10 billion

__$501 million - $1 billion

(3) What percentage of your inbound procurement is sourced internationally (approximately)?

___ 0-20% ____ 21-40% ___41-60% __ 61-80% ___ 81-100%

(4) What percentage of your sales are international (approximately)?

___ 0-20% ____ 21-40% ___41-60% __ 61-80% ___ 81-100%

(5) How many personnel directly or indirectly report to you?_____

(6) What is the name of your department? _____

(7) How many years have you been at your company? _____

(8) Please provide your job title: _____

(9) How knowledgeable did you feel about answering this questionnaire?

__ Not knowledgeable __Below average __Average __Above average __Very knowledgeable

Table 3.2. Continued

The following questions are designed to help the researcher better understand the clarity and relevancy of this survey

(1) In terms of understanding what each survey asked, please rate the clarity of the survey:

__Very Clear __Clear __Somewhat clear __Neutral __Somewhat unclear __Unclear __Very unclear

(2) In terms of how applicable the survey questions were to your firm, please rate the relevancy of the survey:

__Very Relevant __Relevant __Somewhat relevant __Neutral __Somewhat irrelevant __Irrelevant __Very Irrelevant

(3) Were there any questions in particular that you found difficult to understand? If so, please identify the specific questions(s), along with comments about what aspect was confusing, or what you interpreted the question to mean. Please be as specific as possible. You may scroll back through the pages to find the specific question if you wish.

(4) In the space below, please add any other comments you might have about the survey. I encourage you to be as candid as possible

VALIDITY AND RELIABILITY IN QUANTITATIVE RESEARCH

Quantitative research is evaluated through the reliability and validity of the constructs and their measures. A rigorous piece of quantitative research should contain four primary components of validity: statistical conclusion validity, internal validity, construct validity, and external validity (Mentzer and Flint, 1995). Each component is described in more detail below:

- *Statistical Conclusion Validity* - variables in the study must show non-spurious and non-coincidental correlation and demonstrate causality.

- *Internal validity* – identification of a causal relationship among the variables whereby the relationship precludes the influence of all other extraneous events on the relationship. Internal validity is used to rule out any other plausible rival hypothesis, such as history, maturation, and sample selection.

- *Construct Validity* – existence of theoretical and empirical meaning within the framework of the theory. Construct validity consists of the following components:
    - Nomological validity – the constructs "fit" logically into the theory framework.
    - Face/Content validity – the constructs at face value seem to measure what the study says they should measure.
    - Convergent validity – different methods measuring the same concept agree with each other.
    - Discriminant validity – different measures do not correlate highly with other measures, with which they should differ.
    - Reliability – results are consistent through multiple applications of the same test.
- *External Validity* – the ability of the study to generalize its findings across population, situations, and temporal space.

CHAPTER 4 – DATA ANALYSIS

INTRODUCTION

Chapter 4 presents the results of the measurement model analysis and the test of the theoretical model presented in Chapter 3. A pre-test was used to analyze the initial survey items to determine if measurement and/or procedural modifications were needed before the main test was launched. The main test was launched after the pre-test, using the modified survey. Analysis of the data collected from the main test survey includes a review of the descriptive statistics, missing data, data distribution, reliability and validity of the constructs, and the modifications made to the *a priori* measurement model to establish a final, refined measurement model. This is followed by an analysis of the data in the structural model to test the hypotheses. Chapter 4 concludes with a summary of the findings.

SURVEY PRE-TEST

The pre-test was launched using a web-based survey instrument, according to the process described in Chapter 3 (Dillman 2000). A personalized e-mail was sent to each participant of the University of Tennessee Supply Chain Forum, requesting their help in pre-testing the dissertation survey and asking them to share their thoughts about the clarity and relevancy of the survey questions. No reminder e-mails were sent to non-responders on the contact list, in agreement with the Forum facilitator's conditions. Therefore, an early-late response test was not used to examine any potential bias among the participants in the survey (Armstrong and Overton 1977).

DESCRIPTIVE STATISTICS

The participants in the pre-test survey answered 77 substantive questions related to the hypotheses and the theoretical model. They also answered 9 demographic/control-type questions. Finally, they answered 4 additional questions related to the nature of the survey. Of the 184 potential survey participants, 51 completed the survey, for a response rate of 28 percent. A breakdown of participants by industry is shown in Table 4.1. The largest number of pre-test survey participants came from the automotive industry, with 22 percent. The packaged goods and retail industries were also well represented, making up over 32 percent of the total, combined. Industries in the "other" category included building products, aerospace, and pharmaceuticals.

Table 4.1 Pre-Test Participants by Industry

	Frequency	**(%)**
Automotive	11	22.00%
Consumer Packaged Goods	10	20.00%
Retail	6	12.00%
Industrial Products	5	10.00%
Apparel / Textiles	3	6.00%
Electronics	3	6.00%
Raw Materials	3	6.00%
Appliances	2	4.00%
Other	8	14.00%
TOTAL	51	100.00%

The majority (71%) of participants in the pre-test survey reported they worked for firms with approximate annual sales of more than $1 billion. Another 26% reported approximate annual sales revenue of between $51 million and $1 billion. The majority of respondents

reported job titles at the manager level and higher in logistics, supply chain management, supply chain analysis, and transportation. The average number of years experience was 12.5.

PRE-TEST DATA ANALYSIS

Data from completed surveys was downloaded from the on-line survey website into an Excel file and then loaded into the software tool SPSS 18 for further analysis. A missing data analysis was conducted for each respondent and for each variable. The results of the analysis found that 5% of the completed surveys had some missing data, containing 10 or fewer missing questions, but were still deemed usable. Missing data accounted for less than one percent (0.63%) of all responses; non-significant t-tests using Missing Value Analysis in SPSS showed that data was missing at random. Thus, missing data was not a threat to the integrity of the pre-test data set. Missing data points were estimated and replaced by using the Expectation Maximization (EM) method in SPSS. EM is commonly used to compute maximum likelihood estimates for missing data in a sample and is generally considered less biased that other missing value techniques (Schafer and Olsen 1998).

Descriptive statistics were run on responses to the 77 substantive 7-point scale items. Mean values ranged from 3.32 to 6.54. The standard deviation values ranged from 0.607 to 2.572 (see table 4.2). In addition, normality was assessed in SPSS. The results of the kurtosis and descriptive statistics are shown in Table 4.2. Three supply chain orientation items, TR1, CN1, and CN3, raised concerns for kurtosis (2.7, 5.076, and 3.92 respectively). A close examination of the cases using the Explore command in SPSS revealed that each dimension had outliers (TR1 = observation 21; CN1 = observation 37; CN3 = observation 21). Once the outliers were removed, the modified statistics for all three dimensions were found to have acceptable levels of kurtosis.

Table 4.2 Pre-Test Descriptive Statistics

	Mean	Std. Deviation	Kurtosis
GIN1	5.18	2.095	-.383
GIN2	5.80	2.107	1.078
GIN3	4.68	2.572	-1.487
GIN4	4.82	2.364	-1.261
FPF1	5.22	1.082	-.657
FPF2	5.38	1.037	-1.201
FPF3	4.90	1.063	.047
FPF4	4.42	1.022	-.561
FPF5	5.10	1.187	.364
FPF6	5.16	1.065	1.526
FPF7	5.12	1.070	-.350
FPF8	5.28	1.167	.168
FPD1	4.62	1.164	.233
FPD2	4.48	1.187	-.103
FPD3	4.16	.857	1.456
FPD4	5.32	.989	-.678
FPD5	4.20	1.020	2.139
FPE1	4.28	1.357	-.289
FPE2	4.50	1.170	-.316
FPE3	4.50	1.100	.186
FPE4	4.70	1.237	-.369
FPE5	4.98	1.191	-.932
FPE6	4.20	1.327	-.689
FPE7	4.96	1.095	-.765
TR1	5.82	.792	**2.700**
TR2	5.36	1.179	.334
TR3	5.78	1.025	-.086
TR4	5.66	1.051	.067
COM1	6.54	.607	.078
COM2	4.96	1.183	1.746
COM3	6.18	.767	.928
COM4	6.14	.721	1.551
OC1	5.40	1.039	.370
OC2	4.84	1.084	-.031
OC3	4.80	1.114	-.245
OC4	5.18	1.161	-.066
CN1	6.04	.979	**5.076**
CN2	6.06	.759	.598
CN3	6.16	.784	**3.924**
CN4	5.64	1.015	.997
TMS1	5.74	.934	.424
TMS2	5.46	.964	.244
TMS3	5.40	.959	.595
TMS4	5.86	.849	1.355
INT1	5.02	1.319	.637
INT2	5.16	1.222	-.257

Table 4.2. Continued

	Mean	Std. Deviation	Kurtosis
INT3	5.28	1.184	-.235
INT4	5.72	1.312	.540
EXT1	5.64	1.127	.721
EXT2	5.24	1.305	.945
EXT3	5.38	1.181	-.617
EXT4	4.00	1.456	-.670
GED1	5.12	1.946	-.459
GED2	5.02	2.159	-1.152
GED3	5.40	2.030	.114
GED4	4.72	2.050	-.959
GED5	5.12	2.065	-.421
GED6	4.30	2.317	-1.539
GGP1	4.22	2.081	-1.297
GGP2	3.62	2.465	-1.727
GGP3	3.38	2.473	-1.511
GGP4	3.80	2.040	-1.315
GGP5	4.20	2.191	-1.357
GGP6	4.54	2.165	-1.177
GCC1	4.84	1.973	-.765
GCC2	3.32	2.213	-1.311
GCC3	4.74	2.279	-1.143
GCC4	4.20	2.263	-1.436
GCC5	4.10	2.081	-1.344
GI1	4.63	.893	-1.697
GI2	3.38	.893	-1.378
GI3	4.13	.968	-1.738
GI4	6.00	.775	-1.276
GI5	6.25	.793	-1.101

EVALUATION OF ITEMS

The items used in the pre-test survey were evaluated through both quantitative and qualitative tools of analysis. Quantitative analysis included testing for statistical validity and reliability. Validity was assessed in SPSS using principal component analysis and reliability was assessed using Cronbach's coefficient alpha, due to the small sample size of the pre-test. Since all scales contained more than three items, the if-item-deleted and the inter-item correlation matrices were examined to further assess reliability. All of the scales showed coefficient alpha values of .70 or higher (Churchill 1979), with the exception of COM, GIN and FP-E.

Discriminant validity was assessed through the principal component analysis. All items showed strong loading on single factors with the exception of FP-F, FP-E, FP-D (the three performance measures), COM1, INT4, and EXT4.

To better understand the aforementioned problems with reliability and validity, a qualitative analysis was conducted on the responses to the four questions given at the end of the pre-test survey. These four questions asked about the clarity of the survey, the relevancy of the questions to the responder, any questions the responder found difficult to understand, and any other candid comments the participant wished to share about the survey. Results of the qualitative analysis were consistent with the statistical analysis in identifying problem areas of the survey and the following changes were made:

- COM1 wording was deemed too extreme and unrealistic in tone. It was changed to reflect a more realistic attitude towards key supply chain members.
- EXT4 and INT4 were both reverse coded measures and were confusing to the participants, many of whom claimed that the questions did not belong in the survey. Both questions were revised to eliminate the reverse coding.
- While Fugate, et al. (2010) used end points of "far below competitors" and "far above competitors" for items measuring performance, the qualitative analysis showed that these end points confused participants. Therefore, the end points of the performance measures were changed to be clearer.

The measures for GIN were left unchanged for two reasons: First, theoretical justification has been established and replicated in the literature for the inclusion of a dimension that measures the recovery and reuse of materials as a part of green supply management practices (Zhu and Sarkis 2004; Zhu et al. 2008b; Zhu et al. 2008a). Second, the pre-test sample size,

while large enough to make wording changes to the survey, was not deemed large enough to conclude dimensions or constructs should be removed. A summary of the changes to the pre-test survey scales for each latent variable in the model is shown in Table 4.3.

Table 4.3 Results of Pre-Test Scale Purification

Variable	Alpha	Item / Description of Change
Internal Environmental Orientation	.880	INT4 – reverse coding eliminated
External Environmental Orientation	.700	EXT4 – reverse coding eliminated
Trust	.889	No changes made
Commitment	.676	COM1 – "critical" replaced by more realistic "important" to describe relationship
Coop Norms	.817	No changes made
Compatibility	.739	No changes made
Top Management Support	.704	No changes made
Internal Enviro Mngmt	.884	No changes made
Green Purchasing	.834	No changes made
Eco-Design	.868	No changes made
Coop with Customers	.820	No changes made
Investment Recovery	.502	No changes made
Efficiency	.750	End points changed to "far worse" and "far better"
Effectiveness	.660	End points changed to "far worse" and "far better"
Differentiation	.820	End points changed to "far worse" and "far better"

SURVEY MAIN TEST

Following the refinements and revisions suggested through the analysis conducted on the pre-test results, the main survey was administered (see Table 4.4).

Table 4.4 Main Survey

Internal Environmental Orientation (INT) (Adapted from – Banerjee et al. 2003; Fraj-Andres et al. 2009)	**Strongly Disagree**			**Neutral**			**Strongly Agree**
1. Employees in our business unit understand the importance of environmental responsibility.	1	2	3	4	5	6	7
2. Our business unit makes a concerted effort to promote the value of environmental responsibility across all departments.	1	2	3	4	5	6	7
3. Our business unit urges environmental awareness in our operations.	1	2	3	4	5	6	7
4. Environmental responsibility is important to our business unit.	1	2	3	4	5	6	7
External Environmental Orientation (EXT) (Adapted from – Banerjee et al. 2003; Fraj-Andres et al. 2009)	**Strongly Disagree**			**Neutral**			**Strongly Agree**
1. Our business unit believes it is important to balance responsibility to our customers, stockholders, employees, and the environment.	1	2	3	4	5	6	7
2. Environmental responsibility is considered part of our business unit's long-term performance strategy.	1	2	3	4	5	6	7
3. The ability of our business unit to create a positive image of environmental responsibility is important.	1	2	3	4	5	6	7
4. Environmentally responsibility affects our business unit's financial performance.	1	2	3	4	5	6	7
Supply Chain Orientation – Trust (TR) (Adapted from – Doney and Cannon 1997; Min et al. 2007)	**Strongly Disagree**			**Neutral**			**Strongly Agree**
1. Our key supply chain members are trustworthy.	1	2	3	4	5	6	7
2. Our key supply chain members keep our best interests in mind.	1	2	3	4	5	6	7
3. Our key supply chain members are genuinely concerned that our business succeeds.	1	2	3	4	5	6	7
4. Our key supply chain members are concerned about our welfare.	1	2	3	4	5	6	7

Table 4.4. Continued

Supply Chain Orientation - Commitment (COM) (Adapted from – Kumar, et al. 1995; Min, et al. 2007)	**Strongly Disagree**			**Neutral**			**Strongly Agree**
1. It is important to maintain strong relationships with key supply chain members.	1	2	3	4	5	6	7
2. We work hard to preserve relationships with key supply chain members.	1	2	3	4	5	6	7
3. The continuity of our relationships with key supply chain members is very important to us.	1	2	3	4	5	6	7
4. We expect our relationships with key supply chain members to last for a long time.	1	2	3	4	5	6	7

Supply Chain Orientation – Organizational Compatibility (OC) (Adapted from – Bucklin and Sengupta 1993; Min et al. 2007)	**Strongly Disagree**			**Neutral**			**Strongly Agree**
1. Our business unit's goals and objectives are consistent with those of key supply chain members.	1	2	3	4	5	6	7
2. The culture of our business unit is similar to those of key supply chain members.	1	2	3	4	5	6	7
3. Our executives have a management style similar to that of key supply chain members.	1	2	3	4	5	6	7
4. Our CEO and the CEOs of key supply chain members have similar operating philosophies.	1	2	3	4	5	6	7

Supply Chain Orientation – Cooperative Norms (CN) (Adapted from – Min, et al. 2007)	**Strongly Disagree**			**Neutral**			**Strongly Agree**
1. Our business unit is willing to make cooperative changes with key supply chain members.	1	2	3	4	5	6	7
2. Our business unit believes it necessary for key supply chain members to work together with us in order to be successful.	1	2	3	4	5	6	7
3. Our business unit views our supply chain as an important value added piece of our business.	1	2	3	4	5	6	7
4. Our business unit believes it can improve performance by agreeing to changes suggested by key supply chain members	1	2	3	4	5	6	7

Supply Chain Orientation – Top Management Support (TMS) (Adapted from – Min, et al. 2007)	**Strongly Disagree**			**Neutral**			**Strongly Agree**
1. Top managers reinforce that building and maintaining long-term relationships with key supply chain members is critical to our business unit's success.	1	2	3	4	5	6	7
2. Top managers reinforce that sharing valuable information with key supply chain members is critical to our business unit's success.	1	2	3	4	5	6	7
3. Top managers reinforce that sharing risk and rewards with key supply chain members is critical to our business unit's success.	1	2	3	4	5	6	7
4. Top managers reinforce that our business unit's success depends on supply chain management.	1	2	3	4	5	6	7

Table 4.4. Continued

Green Supply Chain Management – Internal Environmental Management (GI) (Adapted from Zhu et al. 2008; Bowen et al. 2001)	**Not Considering It**					**Planning It**	**Implementing It Successfully**
To what extent are the following actions enacted within your business unit?							
1. Environmental performance metrics are used regularly by corporate management	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. Cross-functional cooperation to create environmental improvements in the supply chain.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. Implementation of total quality environmental management (TQEM).	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. Environmental compliance and auditing programs in all departments.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5. ISO 14001 certification.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Green Supply Chain Management – Green Purchasing (GGP) (Adapted from Zhu et al. 2008; Melnyk et al 2003; Bowen et al. 2001)	**Not Considering It**					**Planning It**	**Implementing It Successfully**
To what extent are the following actions enacted within your supply chain management practices?							
1. Collaboration with our supply base to meet environmental objectives.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. Environmental audits of our supply base.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. ISO14001 certification of our supply base.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. Joint decisions with our supply base about ways to reduce overall environmental impact of products.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5. Joint decisions with our supply base about ways to reduce overall environmental impact of logistics operations.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
6. Working with our supply base to address environmental problems and/or issues.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Table 4.4. Continued

Green Supply Chain Management – Eco-Design (GED) (Adapted from Zhu and Sarkis 2004; Zhu et al. 2008; Melnyk et al. 2003)	**Not Considering It**			**Planning It**			**Implementing It Successfully**
To what extent are the following actions enacted within your supply chain management practices?							
1. The design or redesign of products to reduce consumption of material and/or energy.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. The design or redesign of products for recovery, reuse, recycling, and/or remanufacturing.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. The design or redesign of products to avoid or reduce use of hazardous substances.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. The design or redesign of products to reduce the overall environmental impact of the product.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5. The design or redesign of product packaging for recovery, reuse, and/or recycling.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
6. The design or redesign of products to increase the durability and the life of the product.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Green Supply Chain Management – Cooperation with Customers (GCC) (Adapted from Zhu and Sarkis 2004; Zhu et al. 2008)	**Not Considering It**			**Planning It**			**Implementing It Successfully**
To what extent are the following actions enacted within your supply chain management practices?							
1. Cooperation with our customers to reduce the environmental impact of our products.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. Cooperation with our customers to reduce the environmental impact of our product manufacturing processes.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. Cooperation with our customers to reduce product packaging requirements.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. Cooperation with our customers to anticipate and/or resolve environmental-related problems.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5. Joint decisions with our customers about ways to reduce overall environmental impact of logistics operations.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Table 4.4. Continued

Green Supply Chain Management –Investment Recovery (GIN) (Adapted from Zhu et al. 2008; Melnyk et al. 2003)	**Not Considering It**			**Planning It**			**Implementing It Successfully**
To what extent are the following actions enacted within your supply chain management practices?							
1. Sale of excess inventories/materials to recover product investments.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. Sale of scrap and used materials to recover materials investments.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. Reuse of scrap and waste as inputs to saleable products.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. Implementation of reverse logistics program(s).	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Firm Performance – Efficiency (FP-E) (Adapted from Min et al. 2007)	**Far Worse Than Competitors**			**On Par With**			**Far Better Than Competitors**
Respond to each of the following based on the performance of your business unit over the past three (3) years, relative to your competitors:							
1. Average amount of physical inventory in our pipeline.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. Physical inventory turnover.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. Order-to-delivery cycle time.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. Order-to-delivery cycle time consistency.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5. Return on assets (ROA).	**1**	**2**	**3**	**4**	**5**	**6**	**7**
6. Supply chain costs as a percent of revenue.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
7. Return on investment (ROI).	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Firm Performance – Effectiveness (FP-F) (Adapted from Min et al. 2007)	**Far Worse Than Competitors**			**On Par With**			**Far Better Than Competitors**
Respond to each of the following based on the performance of your business unit over the past three (3) years, relative to your competitors:							
1. Consistent stock availability.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. Ability to handle customer emergencies (i.e. stock outs).	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. Ability to handle difficult, nonstandard orders to meet special needs.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. Providing customers real time information about their order.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5. Return on sales (ROS).	**1**	**2**	**3**	**4**	**5**	**6**	**7**
6. Market share growth.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
7. Sales growth.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
8. Consistent order fulfillment.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Table 4.4. Continued

Firm Performance – Environmental Differentiation (FP-D) (Adapted from Melnyk et al. 2003; Christmann 2000)	**Far Worse Than Competitors**			**On Par With**			**Far Better Than Competitors**
Respond to each of the following based on the performance of your business unit over the past three (3) years, relative to your competitors:							
1. Eco-friendly reputation.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. Breadth of eco-friendly product range.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. Revenue generated from eco-friendly products.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. Quality of products.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5. Eco-friendliness of returns programs.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Marker Variable – Employee Commitment to the Organization (EC) (Adapted from Escrig-Tena and Bou-Lluser 2005)	**Strongly Disagree**			**Neutral**			**Strongly Agree**
1. Employees in our business unit play a large part in deciding what work is to be carried out.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. Employees in our business unit have significant participation in setting goals and deciding how they are to be achieved.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. Employee loyalty in our considered high.	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Potential respondents were selected from a database obtained from the marketing firm D&B. Following the selection criteria of desired participants, as discussed in Chapter 3, names and critical contact information of potential participants were pulled from three categories of titles in the D&B database:

1. Supply Chain – all titles
2. Logistics – all titles
3. Purchasing – V.P, director, and manager only

These potential participants were chosen for their perceived knowledge of supply chain management processes, corporate culture, and firm performance compared to the competition.

To prevent potential bias from multiple respondents at a single company, only one contact per company was included.

The final database purchased from D&B contained information for 3,437 potential respondents. Four personalized e-mails (one initial e-mail and three reminder e-mails) were sent to the potential participants, resulting in 804 total visits to the website. Out of this, 311 respondents fully completed the survey and another 418 either started or partially completed the survey. Of the partially completed surveys, 14 were deemed usable, as each had less than 12 incomplete substantive questions. All potential participants that did not respond to the survey, minus those who requested to be taken off the distribution list, were then given to the third-party calling company, WRS. An additional 40 fully completed surveys and two usable, partially completed surveys were obtained through this method. Once all data collection methods had been concluded, a total of 367 usable surveys were collected, for a total response rate of 10.6% of the total potential participants and 45.8% of the potential participants who visited the website.

MISSING DATA ANALYSIS

The 16 (14+2) partially complete surveys that were deemed usable represent 4.36% of all surveys used for the final data analysis. All of the partially completed surveys contained 12 or fewer missing questions. The total missing data points accounted for less than one-half of one percent (0.31%) of all responses and non-significant t-tests using Missing Value Analysis in SPSS showed that they were missing at random. Thus, missing data was not deemed a threat to the integrity of the main data set. Missing data points were estimated and replaced by using the Expectation Maximization (EM) method in SPSS.

DATA DISTRIBUTION

Accurate assessment of data using SEM relies on the assumption that the data fit a normal distribution curve (Baumgartner and Homburg 1996). Therefore, the data were assessed for normality in order to identify and eliminate any cases that could pose a threat to the integrity of the data. Seven of the supply chain orientation scales raised concerns for kurtosis. An examination of the cases revealed a number of outliers (see Table 4.5). Case 184 was shown to have numerous outliers that affected normality statistics. Removing case 184 brought the kurtosis statistics into an acceptable range for TR1, TR4, COM2, COM4, CN1, and CN2. Additional cases were removed from COM1 and TMS1 (92 and 216; 137, 207 and 260, respectively). Two additional outlier cases were also identified for TMS1 (208 and 261) and removed. Subsequently, normality and kurtosis statistics for all variables were found to be acceptable.

Table 4.5 Main Test Normality Analysis

Scale	Kurtosis	Outlier Case(s)
TR1	3.2	184
TR4	2.6	184
COM1	5.5	92, 216
COM2	3.9	184, 362
COM4	3.0	184, 201
CN1	3.5	64, 184
CN2	3.9	184, 289
TMS1	3.2	184, 137, 207, 260, 208, 261

Normality was also assessed using Mahalanobis D^2 in the AMOS 18 program. The Mahalanobis D^2 test estimates the distance in the multidimensional space of each observation from the centroid, or the mean center of the observations. Cases 184, 254, 365, and 360 were significantly distant from the centroid. Thus, each case, or survey participant, had responses to questions that were collectively significantly distant from the mean and standard deviation of all other responses to those questions. Therefore, each of the four cases represent outliers in the data set because their inclusion significantly skews descriptive statistics toward one tail or the other in the distribution. To prevent a skewed distribution, all four cases were removed, reducing the dataset to 363 total observations.

Potential non-response bias was evaluated by capturing non-respondent's verbal answers to five items and testing for differences against survey data responses (Mentzer and Flint 1997). A total of 30 non-respondents to the survey were contacted by phone and asked to respond to five substantive questions from the survey, four from the cooperative norms scale and one from the trust scale (Garver and Mentzer 1999). An independent t-test indicated no significant difference ($p<.05$) between the survey respondents and the verbal answers of the non-respondents to the five questions. Thus, non-response bias was not deemed a threat to data integrity.

DESCRIPTIVE STATISTICS

Survey respondents represented expertise across a variety of industries (Table 4.6). The consumer packaged goods industry represented largest number of main test survey participants from a single industry, with 17 percent. The industrial products industry was a close second, with nearly 15 percent of the total. The medical/pharmaceutical industry and the automotive industry

together made up another nearly 17 percent. Other industries included food manufacturing and distribution, paper products, and metals fabrication.

Table 4.6 Main Test Participants by Industry

Industry	Frequency	(%)
Consumer Packaged Goods	62	17.08%
Industrial Products	54	14.88%
Medical / Pharma	33	9.09%
Automotive	28	7.71%
Chemicals / Plastics	27	7.44%
Electronics	16	4.41%
Raw Materials	16	4.41%
Retail	13	3.58%
Energy	10	2.75%
Apparel / Textiles	9	2.48%
Appliances	7	1.93%
Aerospace	7	1.93%
Other	81	22.31%
TOTAL	363	100.00%

Over 25% of participants reported they worked for firms with approximate annual sales revenue of more than $1.1 billion. Another 11% reported annual sales revenue of between $501 million and $1 billion. The majority of the participants worked for firms with approximate annual sales revenue of between $1 million and $500 million (63%). The majority of respondents reported job titles at the manager level and higher in purchasing, logistics, supply chain management, manufacturing, production, operations, materials management, and transportation. The average number of years of experience was 13.

EVALUATION OF MEASUREMENT ITEMS

The purpose of the measurement model is to assess unidimensionality, validity, reliability, and the psychometric properties of all latent variables in a variance model (Anderson and Gerbing 1988; Garver and Mentzer 1999). The measurement model was constructed, analyzed, and revised using SPSS 18 and AMOS 18. Robust statistical approaches available within the confirmatory factor analysis (CFA) component of SEM were used as the primary tests. CFA within the SEM analysis is a rigorous test and affords a strict interpretation of construct validity (Anderson and Gerbing 1982; Gerbing and Anderson 1988).

The following indices and their associated heuristics served as guidelines for assessing the fit of the CFA and structural models (Garver and Mentzer 1999). These metrics are recommended as ideal fit indices because: 1) they are relatively independent of sample size; 2) they are accurate and versatile in their assessment of different levels of complexity in CFA models; and 3) they are easy to interpret (Marsh et al. 1988).

The comparative fit index (CFI) - an accepted incremental fit statistic which compares the existing model fit with a model assuming the latent variables are uncorrelated. The CFI index ranges from 0-1 and should be greater than .90, indicating that 90% of the covariation in the data can be reproduced by the model (Medsker et al. 1994).

The Tucker-Lewis index (TLI) compares a proposed model's fit to a null model that serves as a baseline for comparison. TLI also measures parsimony of a model by comparing the degrees of freedom in the proposed model to that of the null model. An acceptable TLI value is greater than .90 (Marsh et al. 1988).

The root mean square error of approximation (RMSEA) measures the discrepancy between the degrees of freedom expected to occur in the population. Because the

RMSEA measures in terms of the population and not the sample, it is not affected by sample size. Statistical methodologists indicate that RMSEA values between .05 and .08 are acceptable (Medsker et al. 1994).

The chi-Square (χ2 or CMIN) goodness of fit reports an absolute measure of fit indicating the degree to which the estimated model corresponds with the pattern of variances and covariances in the observed data. A χ^2 difference test is commonly used as a measure of testing for measurement invariance across groups. A significant finding indicates lack of fit.

The chi-square ratio (CMIN/df) is the chi-square fit index divided by degrees of freedom and is less dependent on sample size. Ratios in the range of two to five are considered adequate (Hair et al. 1998).

While the CMIN and CMIN/df test statistics are commonly used metrics for evaluating the goodness of fit in CFA models, both test statistics are considered to be more sensitive to sample size than CFI, TLI and RMSEA (Garver and Mentzer 1999). Both are included in this analysis, but as the sample size is large, interpreted carefully in light of the other fit indices.

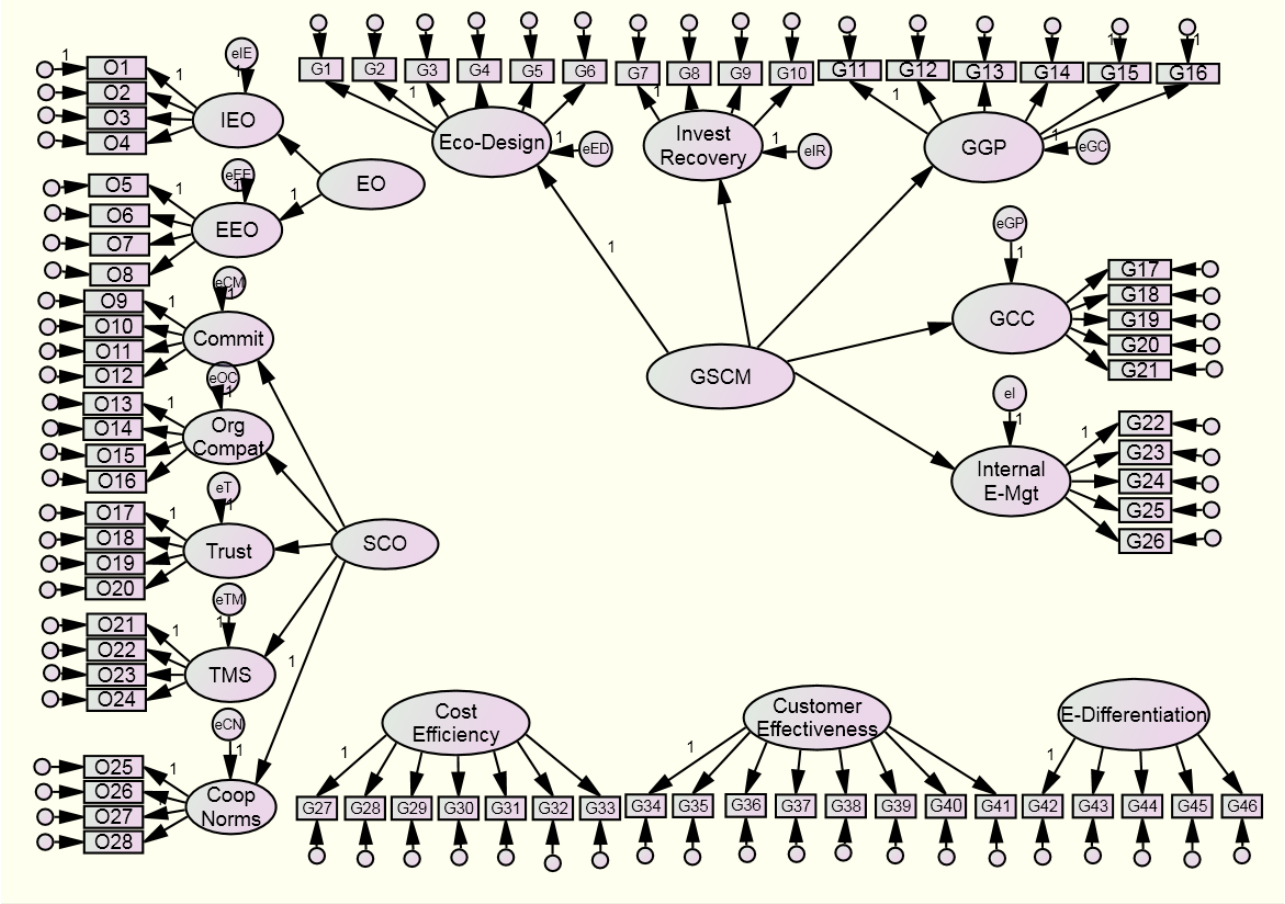
MEASUREMENT MODEL REFINEMENT

A key concern when working with SEM is determining when to make changes to the theoretical model *(a priori)*. Changes to construct measurement based on sample-dependent results will often change a model's theoretical meaning in some way, which can alter the conclusions for both practitioners and academics (Garver and Mentzer 1999). Extensive modification reduces the likelihood that the model will be replicable in future samples.

Therefore, refinements were considered with caution based on whether each modification made sense, both statistically and theoretically.

A Priori Model

The *a priori* CFA model (Figure 4.1) was assessed in AMOS for the endogenous and exogenous variables, using the refined data set. This was done to understand the base line fit indices from which any refinement would occur. The fit statistics for the *a priori* model were not acceptable ($\chi 2$= 8100, df= 2601, $\chi 2$/df=3.114, CFI= .72, TLI= .71, and RMSEA=0.077). Refinement of the measurement model was undertaken by assessing the reliability, unidimensionality, convergent validity, and discriminant validity of the items used for each of the measurement scales. This was done through the assessment of several metrics: construct reliability, standardized regression loadings, average variance extracted and covariance among all latent variables, and the modification indices of all latent variables (Anderson and Gerbing 1988). In all cases, once a modification was made to the measurement model, fit indices were assessed to understand how the modification impacted the fit of the model. The following sections describe the reliability and validity tests that were run on the *a priori* measurement model, as well as the modifications that were made to improve the fit indices.



Note: All endogenous and exogenous variables are set to covary when testing the *a priori* CFA model shown in Figure 4.1. Covariance lines are not shown in this figure for aesthetic purposes.

Figure 4.1 *A Priori* CFA Model

Reliability

Cronbach's alpha is the standard used for assessing the reliability of a construct's items. However, the accuracy of using Cronbach's alpha for testing reliability has several limitations, including underestimation problems (Anderson and Gerbing 1988; Garver and Mentzer 1999). A more robust and conservative test of reliability is SEM construct reliability (Garver and Mentzer 1999). The equation for construct reliability is $(\Sigma\lambda)^2 / [(\Sigma\lambda)^2 + \Sigma(1-\lambda_j^2)]$, where λ is the standardized regression of the item (Fornell and Larcker 1981). Construct reliability was

assessed using standardized item loadings generated from the CFA model. An acceptable cut-off point for the construct reliability metric is .70 or higher (Garver and Mentzer 1999). All variables in the measurement model had construct reliability greater than .70, with the exception of GIN (construct reliability=0.63). Purification of the GIN scale was postponed until after assessment of validity.

Unidimentionality

To achieve unidimensionality, within-factor items should possess one and only one underlying construct in common (Hair et al. 1998). A robust interpretation of unidimensionality can be obtained using CFA in AMOS by assessing and refining the overall goodness of model fit and the components of the measurement model fit, e.g. reliability, convergent and discriminant validity (Garver and Mentzer 1999). Thus, constructs that possess reliability, convergent validity, and discriminant validity are deemed unidimensional (Anderson and Gerbing 1988; Gerbing and Anderson 1988).

Convergent Validity

Convergent validity is demonstrated when items have substantial loadings on the constructs they are intended to measure. In AMOS, the standardized regression loading of an item on its intended dimension or construct is the metric used to measure convergent validity. A reasonable benchmark of convergent validity is that item loadings are a) greater than or equal to .70, and b) statistically significant (Garver and Mentzer 1999). However, item loadings as low as between .50 and.40 have been deemed acceptable when preserving the theoretical integrity of the measurement model.

Assessment of the *a priori* measurement model revealed that two items had loadings well below .40 (FPD4; GGP3) and two were just above .40 (GED6; GCC3). All four of the items were carefully reviewed for theoretical importance and it was determined that removal of these items would not compromise the theoretical integrity of the model. FPD4 did not fit with the rest of the environmental differentiation items; it was related to quality, rather than the more explicit questions asked about environmental issues. GGP3 describes an action that is undertaken by the firm that is acted out on the supplier. Other items describe collaboration with suppliers. Thus, GGP3 doesn't fit. GED6 does not relate to the other items because it describes durability and life, rather than the more explicit environmental aspects of product design. GCC3 is about packaging rather than products, the subject of the other items in this scale. As a result of the statistical and theoretical analysis and determination that these four items were not significant in either category, they were removed from the model, improving model fit.

Discriminant Validity

Beyond convergent validity, additional analysis of discriminant validity is needed to confirm that items designed to measure different constructs are indeed measuring different constructs. In particular, though certain pairs of constructs are likely to be highly correlated, items from one scale should not converge too closely with items from a different scale, nor should the items that are meant to discriminate different variables load together on one variable. If they do, then the model needs to be carefully examined to see if variables should be combined or separated (Garver and Mentzer 1999).

Discriminant validity was assessed several ways. First, the average variance extracted (AVE) was computed by the equation $\Sigma\lambda^2 / [\Sigma\lambda^2 + \Sigma(1-\lambda_j^2)]$, where λ is the standardized

regression of the item (Fornell and Larcker 1981). An AVE of .50 or higher is considered a benchmark of acceptable discriminant validity. A second test compares the AVE of a dimension or construct to the shared variance between all possible pairs of dimensions or constructs in the model. This conservative test of discriminant validity is supported when the AVE of a construct exceeds shared variance with other constructs.

The AVE analysis for each variable in the *a priori* model revealed six that fell below the cut-off point of .50: Cooperative Norms (CN), Eco-Design (GED), Investment Recovery (GIN), and Customer Effectiveness (FP-E) (see Table 4.7). A careful review found that several items in each of these scales prevented the scale from attaining discriminant validity. A total of six items from the CN (1 total), GED (2 total), and FP-E (3 total) scales were found to not compromise the theoretical integrity of the model, if dropped: The wording for CN4 was found to be too strong for most supplier-buyer relationships. Agreeing to suggested supplier changes may improve product designs or create more efficient delivery schedules, for example. However, the link between agreement to suggestions and firm performance is not apparent to managers. It was already determined that GED6 did not meet convergent validity requirements and was dropped. The wording for GED5 was related to packaging and not consistent with the other items, all of which were concerned with packaging. FP-E5 and FP-E7 did not fit well with the more operational items in the cost efficiency scale. FP-E4 was correlated too closely with FP-E2; both were related to inventory carried by the firm. It was determined that FP-E4 had a poorer loading than FP-E2, and was thus not considered a strong item. Once all six items were removed, the model fit indices improved.

The GIN dimension of Green SCM remained problematic. Three items had loadings below the .50 cut-off point. Removing these would have left the GIN dimension with only one

item, which falls well below the measurement theory recommendation of three or more items per latent variable (Steenkamp and Van Trijp 1991; Garver and Mentzer 1999). Previous empirical studies that operationalized green SCM using the investment recovery dimension show low reliability, low regression scores, and low validity scores (Zhu and Sarkis 2004; Zhu et al. 2008a). Furthermore, careful analysis of the items reveal wording that could be confusing or misleading to participants. Therefore, the results of the measurement model analysis, which used a large sample size (as opposed to the pre-test), did not support GIN as a dimension of green SCM, and it, along with its four items, were dropped from the theoretical model, resulting in improved fit indices.

TABLE 4.7 *A Priori* Model Average Variance Extracted (AVE)

	IEO	EEO	COM	OC	TR	TMS	CN	GED	GIN	GGP	GCC	GI	COST EFFIC	CUST EFFEC	E-DIFF
IEO	**.73**														
EEO	*.990*	**.69**													
COM	.163	.176	**.51**												
OC	.202	.213	.501	**.65**											
TR	.133	.149	.465	.455	**.63**										
TMS	.309	.347	*.671*	.483	.269	**.54**									
CN	.190	.225	*.828*	.480	.453	*.651*	**.48**								
GED	.442	.473	.040	.082	.029	.081	.057	**.45**							
GIN	.099	.112	.027	.013	.007	.084	.067	.349	**.31**						
GGP	.345	.359	.056	.086	.031	.100	.051	*.588*	.247	**.56**					
GCC	.342	.365	.049	.089	.031	.131	.056	.441	.245	*.999*	**.60**				
GI	.415	.401	.039	.067	.030	.110	.047	.457	.120	.412	.245	**.60**			
COST EFFIC	.023	.052	.144	.092	0.85	.125	.121	.004	.007	.014	.019	.007	**.50**		
CUST EFFEC	.030	.056	.180	.090	.091	.108	.130	.014	.008	.018	.019	.008	*.665*	**.38**	
E-DIFF	.336	.358	.057	.060	.051	.077	.036	.283	.211	.177	.175	.211	.073	.076	**.55**

Diagonal = Average Variance Extracted (AVE)
Lower Matrix = R^2

When the AVE of each variable was compared to the shared variance pairs of variables, a number of them had high shared variance (equivalent to R^2) scores that exceeded the AVE of one or both variables. The AVE analysis found seven pairs of shared variance that exceeded AVE (highlighted in Table 4.7). These include IEO-EEO, TMS-COM, CN-COM, CN-TMS, GGP-GED, GGP-GCC, and COST EFFIC-CUST EFFEC. A high shared variance suggests the items measuring two constructs could indeed be measuring just one. To assess if two constructs converge onto one, a third test of discriminant validity was used. This test compares the $\chi 2$ of each pair of variables, covaried in a nested model consisting only of the two variables and their

items. The nested model is run twice in AMOS to calculate the $\chi 2$: once when the covariance between the variables is constrained (set to 1) and when the covariance is allowed to vary freely (no setting).

The results of the third test for discriminant validity showed the difference between the $\chi 2$ of the constrained and free nested models involving all pairs of variables to be significant and therefore, not loading onto one construct, with two exceptions: IEO and EEO; GGP and GCC. The $\chi 2$ test using the constrained and free nested models involving IEO and EEO showed the pair to be on the border between significant and not significant. A comparison of the fit indices of the CFA model with EO as a second-order construct to EO as a first-order construct showed significant improvement from the former to the latter. Thus, IEO and EEO were removed and EO was made a first-order construct with no dimensions. All eight of the IEO and EEO items were retained, loading on EO.

The $\chi 2$ test between constrained and free nested models involving GGP and GCC was also conducted. The test showed the GGP and GCC were nearly identical, with no significant difference. Therefore, the two were combined to create one 1st order dimension that represents partnering with supply chain members in the upstream and downstream supply chain (supplier and customers) and was named Supply Chain Partnering or SCP. Additional item purification was conducted for the SCP scale and four additional items showed low discriminant validity scores. It was not surprising that some of the GGP and GCC items would show poor disciminant validity, as many of the items were asked about both the upstream (GGP) and downstream (GGC) members of the supply chain. Thus, it is possible that participants answered these questions the same way, resulting in very little differentiation between any set of similar

questions. All four items were therefore removed. Revised calculations for AVE found that all latent variables, including EO and SCP, exceeded the .50 cut-off point.

Modification Indices

An additional assessment of the measurement model for purification purposes involved a review of the modification indices for each item in the *a priori* model. Unidimenstional variables should have items with low modification indices (Anderson and Gerbing 1988). Modification indices (MI) show the expected change in the chi-square value and expected free parameter estimate, given that all other parameters are held constant (Garver and Mentzer 1999). While no absolute metric is agreed upon, the larger the MI value associated with an item, compared to all other items, the greater chance that the item correlates highly with other items. A review of the MI for all items revealed several that were quite large. A careful review of each high-MI item relative to its theoretical rationale resulted in the removal of four additional items: COM1 was removed because the wording used in the survey does not accurately describe customer-supplier relationships. FP-F5, FP-F6, and FP-F7 did not fit well with the more operational-oriented items in the customer effectiveness scale. These three items could be results of the other operational performance items in the scale, but MI results show that they were not congruent as part of the same scale.

The measurement model was finalized after the assessment of convergent and discriminant validity analysis, reliability tests, and a review of the modification indices, as well as careful consideration of all items considered for removal with respect to the theory. The final refined measurement model resulted in a much better fit than the *a priori* model and is deemed acceptable ($\chi 2$= 2582, df= 1302, $\chi 2$/df=1.983, CFI= .912, TLI= .907 and RMSEA=0.052). The final AVE statistics are shown in Table 4.8.

TABLE 4.8 Final Average Variance Extracted (AVE)

	EO	COM	OC	TR	TMS	CN	GED	SCP	GI	COST EFFIC	CUST EFFEC	E-DIFF
EO	**.71**											
COM	.166	**.58**										
OC	.195	.342	**.65**									
TR	.140	.432	.514	**.63**								
TMS	.342	*.624*	.450	.278	**.54**							
CN	.208	*.824*	.412	*.689*	*.689*	**.51**						
GED	.446	.038	.090	.031	.110	.063	**.53**					
SCP	.359	.056	.086	.032	.131	.054	*.598*	**.62**				
GI	.446	.039	.073	.032	.135	.051	.458	.412	**.60**			
COST EFFIC	.036	.141	.101	0.90	.135	.119	.004	.019	.007	**.53**		
CUST EFFEC	.035	.175	.090	.091	.103	.127	.014	.019	.008	*.707*	**.44**	
E-DIFF	.353	.061	.066	.057	.111	.045	.283	.175	.211	.114	.084	**.67**

Diagonal = Average Variance Extracted (AVE)
Lower Matrix = R^2

The AVE of each variable was again compared to the shared variance of each variable pair. It was found that several still had high shared variance scores that exceeded the AVE of one or both variables (Table 4.6). These include TMS-COM, CN-COM, CN-TR, CN-TMS, SCP-GED, and COST EFFIC-CUST EFFEC. All pairs of variables were tested using the third test of discriminant validity as before and all showed a significant difference between the $\chi 2$ of the constrained and free nested models involving all of the suspect pairs. Therefore, all latent variables showed good discriminant validity.

The AVE of Customer Effectiveness was found to still be below the .50 cut-off point. However, due to the theoretical importance of this construct in the model and the importance of the remaining items that measure Customer Effectiveness, it was decided to keep the construct in the model without eliminating any additional items.

In total, 21 items were deleted for theoretical and statistical reasons, including four items related to the GIN dimension of GSCM. A list of deleted items, along with the justification as to why they were deleted, is shown in Table 4.9.

Table 4.9 Deleted Items with Justification – Final CFA Model

Item Number	Description	Justification
COM1	It is important to maintain strong relationships with key supply chain members.	High MI; weak reliability. Does not accurately describe most customer-supplier relationships.
CN4	Our business unit believes it can improve performance by agreeing to changes suggested by key supply chain members.	High MI; correlated with COM1. Wording is too strong for most customer-supplier relationships.
GED5	The design or redesign of packaging for recovery, reuse, and/or recycling.	High MI. Managers do not include packaging when considering design of green products.
GED6	The design or redesign of products to increase the durability and the life of the product.	Low regression loading. Durability and product life not considered a part of eco.
GGP1	Collaboration with our supply base to meet environmental objectives.	High MI; GGP1, GGP6, and GCC4 essentially ask the same broad question, that is too vague for managers to quantify.
GGP2	Environmental audits of our supply base.	High MI; correlated too closely with GI5 and not considered a separate question by respondents.
GGP3	ISO14001 certification of our supply base.	Low regression loading.

Table 4.9. Continued.

Item Number	Description	Justification
GGP6	Working with our supply base to address environmental problems and/or issues.	See GGP1
GCC3	Cooperation with our customers to reduce packaging requirements.	Low regression loading.
GCC4	Cooperation with our customers to anticipate and/or resolve environmental-related problems.	See GGP1
FPE1	Average amount of physical inventory	High MI; correlated too closely with FPE2.
FPE5	Return on assets (ROA)	High MI; correlated with FPE7. Does not fit with the rest of the operation-oriented scale.
FPE7	Return on investment (ROI)	See FPE5
FPF5	Return on sales	High MI; FPF5, FPF6, FPF7 do not fit with the rest of the operational-oriented scale
FPF6	Market share growth	See FPF5
FPF7	Sales growth	See FPF5
FPD4	Quality of products	Low regression loading.
GIN1	Sale of excess inventories/materials to recover product investments.	GIN deleted from model due to poor fit
GIN2	Sale of scrap and used materials to recover materials investments.	GIN deleted from model due to poor fit
GIN3	Reuse of scrap and waste as inputs to saleable products	GIN deleted from model due to poor fit
GIN4	Implementation of reverse logistics program(s).	GIN deleted from model due to poor fit.

The final refined scales are shown in Table 4.10, along with the scale reliability scores (Fornell and Larcker 1981), AVE, standardized regression values (*r*), mean, and the standard deviation for the individual items. The final measurement model is shown in Figure 4.2.

Table 4.10 Final Items and Scales – Main Test

Scale	Scale Reliability	AVE	Items	*r*	Mean	SD
EO	0.96	.71	(INT1) Employees in our business unit understand the importance of environmental responsibility	0.90	5.33	1.25
			(INT2) Our business unit makes a concerted effort to promote the value of environmental responsibility across all departments.	0.89	5.13	1.32
			(INT3) Our business unit urges environmental awareness in our operations.	0.91	5.30	1.30
			(INT4) Environmental responsibility is important to our business unit.	0.81	5.69	1.16
			(EXT1) Our business unit believes it is important to balance responsibility to our customers, stockholders, employees, and the environment.	0.78	5.65	1.17
			(EXT2) Environmental responsibility is considered part of our business unit's long-term performance strategy	0.92	5.38	1.31
			(EXT3) The ability of our business unit to create a positive image of environmental responsibility is important	0.88	5.40	1.25
			(EXT4) Our environmentally responsibility affects our business unit's financial performance.	0.74	4.73	1.45
SCO-Trust	0.87	.63	(T1) Our key supply chain members are trustworthy	0.79	5.91	0.84
			(T2) Our key supply chain members keep our best interests in mind	0.82	5.59	1.02
			(T3) Our key supply chain members are genuinely concerned that our business succeeds.	0.79	5.89	0.91
			(T4) Our key supply chain members are concerned about our welfare.	0.76	5.67	0.98
SCO-Commitment	0.81	.58	(COM2) We work hard to preserve relationships with key supply chain members.	0.84	6.06	0.87
			(COM3) The continuity of our relationships with key supply chain members is very important to us.	0.72	6.27	0.80
			(COM4) We expect our relationships with key supply chain members to last for a long time.	0.72	6.13	0.84

Table 4.10. Continued

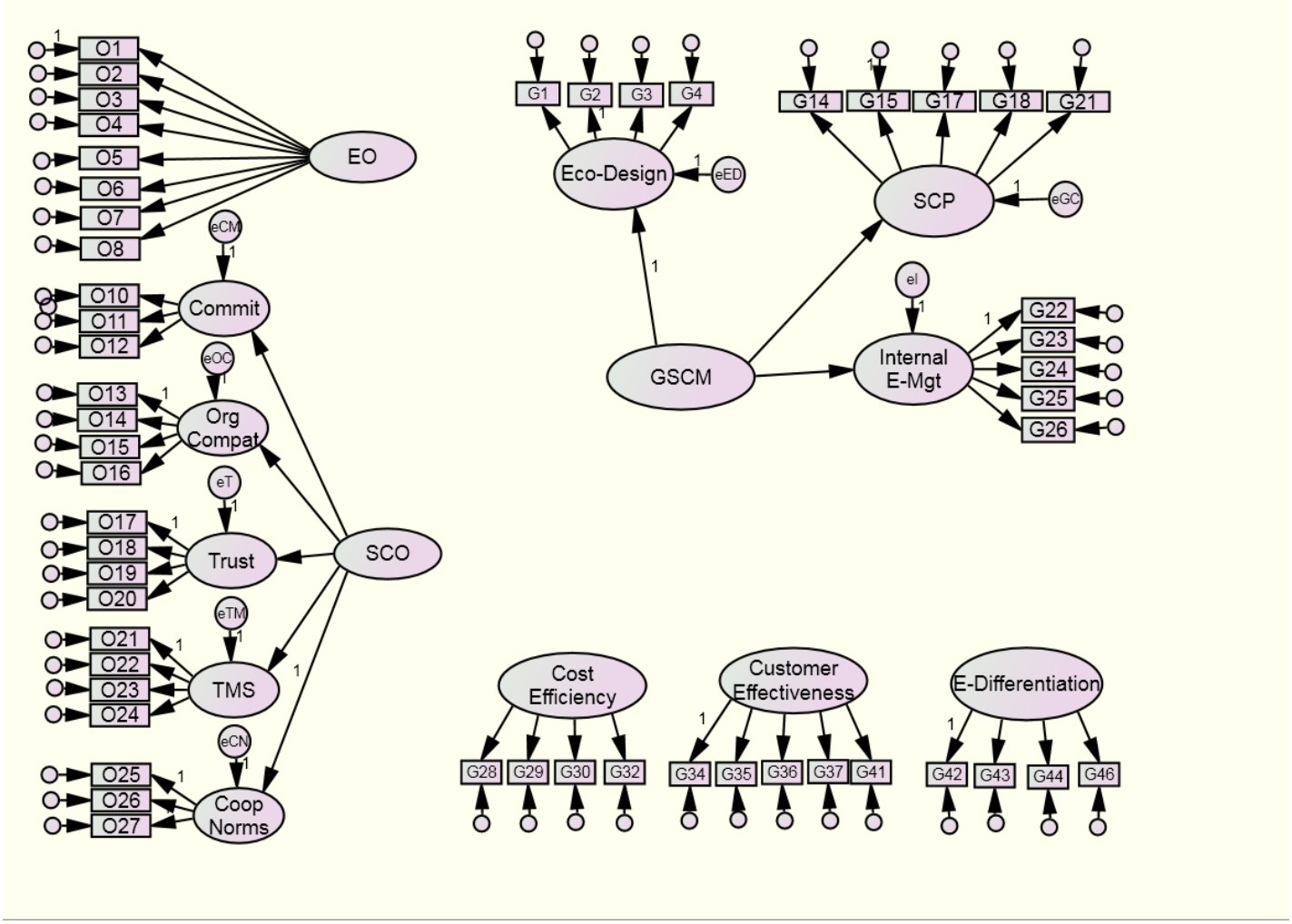
Scale	Scale Reliability	AVE	Items	*r*	Mean	SD
SCO-Coop Norms	0.75	.51	(CN1) Our business unit is willing to make cooperative changes with key supply chain members.	0.66	5.98	0.87
			(CN2) Our business unit believes it necessary for key supply chain members to work together with us in order to be successful.	0.73	6.10	0.83
			(CN3) Our business unit views our supply chain as an important value added piece of our business	0.74	6.04	1.00
SCO-Org. Comp.	0.88	.65	(OC1) Our business unit's goals and objectives are consistent with those of key supply chain members.	0.68	5.51	1.00
			(OC2) The culture of our business unit is similar to those of key supply chain members.	0.86	4.8	1.26
			(OC3) Our executives have a management style similar to that of key supply chain members.	0.92	4.85	1.21
			(OC4) Our CEO and the CEOs of key supply chain members have similar operating philosophies.	0.75	5.15	1.20
SCO-Top Mgt Sup.	0.82	.54	(TMS1) Top managers reinforce that building and maintaining long-term relationships with key supply chain members is critical to our business unit's success	0.84	5.83	1.04
			(TMS2) Top managers reinforce that sharing valuable information with key supply chain members is critical to our business unit's success.	0.68	5.46	1.16
			(TMS3) Top managers reinforce that sharing risk and rewards with key supply chain members is critical to our business unit's success.	0.76	5.33	1.16
			(TMS4) Top managers reinforce that our business unit's financial performance depends on supply chain management.	0.64	5.60	1.15
GSCM – Int. E-Mngmnt	0.88	.60	(GI1) Environmental performance metrics are used regularly by corporate management	0.81	3.96	2.39
			(GI2) Cross-functional cooperation to create environmental improvements in the supply chain.	0.85	3.70	2.22
			(GI3) Implementation of total quality environmental management (TQEM).	0.73	2.96	2.18
			(GI4) Environmental compliance and auditing programs in all departments	0.78	3.99	2.35
			(GI5) ISO 14001 certification.	0.67	2.91	2.31

Table 4.10. Continued

Scale	Scale Reliability	AVE	Items	*r*	Mean	SD
GSCM SCM Partnering	0.89	.62	(GGP4) Joint decisions with our supply base about ways to reduce overall environmental impact of products	0.99	3.71	2.11
			(GGP5) Joint decisions with our supply base about ways to reduce overall environmental impact of logistics operations	0.73	4.09	2.17
			(GCC1) Cooperation with our customers to reduce the environmental impact of our products	0.61	4.16	2.19
			(GCC2) Cooperation with our customers to reduce the environmental impact of our product manufacturing processes.	0.56	3.49	2.18
			(GCC5) Joint decisions with our customers about ways to reduce overall environmental impact of logistics operations.	0.99	3.71	2.12
GSCM Eco-Design	0.81	.53	(GED1) The design or redesign of products to reduce consumption of material and/or energy.	0.67	4.90	1.98
			(GED2) The design or redesign of products for recovery, reuse, recycling, and/or remanufacturing.	0.65	4.46	2.21
			(GED3) The design or redesign of products to avoid or reduce use of hazardous substances.	0.63	4.82	2.22
			(GED4) The design or redesign of products to reduce the overall environmental impact of the product.	0.91	4.33	2.21
Firm Performance Efficiency	0.81	.53	(FP-E2) Physical inventory turnover.	0.67	4.74	1.23
			(FP-E3) Order-to-delivery cycle time.	0.85	5.14	1.14
			(FP-E4) Order-to-delivery cycle time consistency.	0.83	5.18	1.15
			(FP-E6) Supply chain costs as a percent of revenue.	0.50	5.01	1.09
Firm Performance Effectiveness	0.78	.44	(FP-F1) Consistent stock availability.	0.73	5.28	1.13
			(FP-F2) Ability to handle customer emergencies (i.e. stock outs).	0.72	5.71	1.04
			(FP-F3) Ability to handle difficult, nonstandard orders to meet special needs.	0.50	5.48	1.21
			(FP-F4) Providing customers with real time information about their order	0.56	4.99	1.29
			(FP-F8) Consistent order fulfillment	0.75	5.52	1.10
Firm Performance Differentiation	0.89	.67	(FP-D1) Eco-friendly reputation.	0.86	4.54	1.03
			(FP-D2) Breadth of eco-friendly product range.	0.85	4.61	1.06
			(FP-D3) Revenue generated from eco-friendly products.	0.81	4.25	0.96
			(FP-D5) Eco-friendliness of returns programs.	0.74	4.37	0.97

Table 4.10. Continued

Scale	Scale Reliability	AVE	Items	*r*	Mean	SD
Marker Variable	0.75	.75	(EC1) Employees in our business unit play a large part in deciding what work is to be carried out.	0.74	5.22	1.22
			(EC2) Employees in our business unit have significant participation in setting goals and deciding how they are to be achieved.	0.81	5.13	1.26
			(EC3) Employee loyalty in our business unit is considered high.	.057	5.63	1.24



Note: All endogenous and exogenous variables are set to covary when testing the refined CFA model shown in Figure 4.2. Covariance lines are not shown in this figure for aesthetic purposes.

Figure 4.2 Final Refined CFA Model

COMMON METHOD BIAS

The potential influence of common method bias is an issue in survey research (Campbell and Fiske 1959). Common method bias, if present, can skew correlations between constructs in a model and create doubts about findings and conclusions. A marker variable representing a theoretically unrelated construct was incorporated into the main survey to assess whether the survey method itself influenced respondents' answers (Lindell and Whitney 2001). The construct and corresponding scale chosen was Employee Commitment to the Organization (adapted from Escrig-Tena and Bou-Llusar 2005). Reliability for the marker variable was .75 and the AVE was .753, which exceeded the variable's shared variance with all other constructs. Furthermore, when paired with each of the other latent variables in the model, none of the correlations were significant at the .05 level. Thus, common method bias was not deemed a problem in the data.

HYPOTHESIS TESTING

The measurement model purification process is the first step in preparing the theoretical model for testing. The second step is to set up and test the hypotheses in the final structural model. The theoretical model shown in Figure 4.3 is similar to the one presented in Chapter 3 (Figure 3.2) with two exceptions: environmental orientation (EO) is a first-order construct, and green supply chain management (Green SCM) has three first-order dimensions, instead of five.

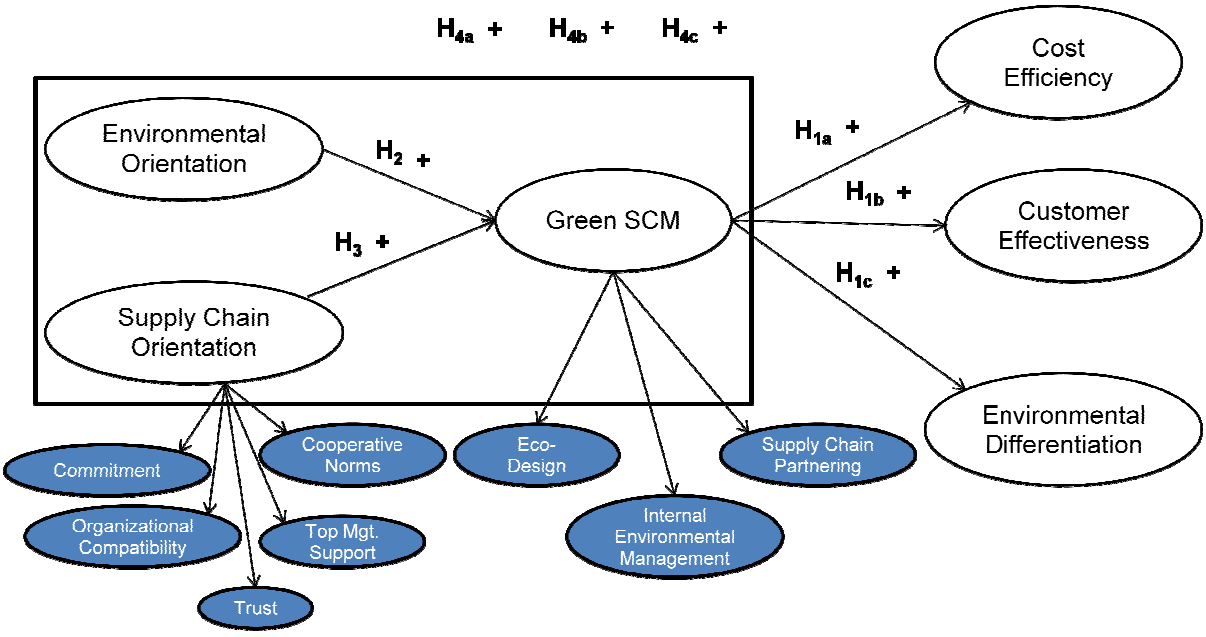


Figure 4.3 Revised Theoretical Model of Green Supply Chain Management Practices

The relationships between GSCM and all three firm performance constructs were significant. The relationship between GSCM and environmental differentiation was strongest (significant at p<.001), while the relationships with both efficiency and effectiveness were significant at p< .05. The relationship between EO and GSCM in hypothesis 2 was strong, as expected (significant at .001). However, the relationship between SCO and GSCM in hypothesis 3 was not significant. A summary of statistics for H_{1a} - H_3 is shown in Table 4.11.

Hypotheses 4a, 4b, and 4c were not supported because all three hypotheses relied on a significant relationship between the bundle of resources in the model of EO, SCO and GSCM, in the configuration of EO and SCO as antecedents to GSCM. Because the relationship between SCO and GSCM was not significant, the hypotheses cannot be considered supported by the data (Table 4.11).

Table 4.11 Structural Model Statistics

Hypothesis	Relationship	Estimate (Std Regression)	p-value	Result
H_{1a}	GSCM=>Efficiency	0.18	.003	Supported
H_{1b}	GSCM=>Effectiveness	0.19	.003	Supported
H_{1c}	GSCM=>Differentiation	0.62	<.001	Supported
H_2	EO=>GSCM	0.81	<.001	Supported
H_3	SCO=>GSCM	-0.06	0.29	Not Supported
H_{4a}	Bundle=>Efficiency	-0.06	0.29	Not Supported
H_{4b}	Bundle=>Effectiveness	-0.06	0.29	Not Supported
H_{4c}	Bundle=>Differentiation	-0.06	0.29	Not Supported

The fit of the theoretical model was acceptable ($\chi 2$: 2678; df: 1310; $\chi 2$/df: 2.045; CFI: 0.906; TLI: 0.901; RMSEA: 0.054). The $\chi 2$/df ratio of 2.045 was well within the acceptable range, as was the RMSEA index at 0.054. The CFI and TLI indices were both above the 0.90 threshold.

POST HOC ANALYSIS

Researchers have suggested that alternative models should be investigated in order to better understand the findings of a theoretical model (Bollen and Long 1992; Min et al. 2007). An alternative model is one in which the antecedents affect the outcomes directly, such as SCO directly to firm performance or EO directly to firm performance (Morgan and Hunt 1994). An alternative model is judged by comparing its overall fit versus the hypothesized model, the number of significant structural paths (relationships) it contains, and its comparative ability to explain variance in the dependent variables (Rust et al. 1995).

While the fit of the theoretical model was acceptable, suitable alternative models were investigated to see if a better fit was possible. Alternative models were examined by saturating the theoretical model (structural paths between independent and dependent variables), fixing all paths to 1, and then releasing each path one by one in order to assess the fit of all possible combinations of relationships among the independent and dependent constructs. None of the alternative models were found to be significantly better than the theoretical model.

The next step in the alternative model investigation process was to look carefully at which hypotheses were supported and which were not supported in the theoretical model. The theoretical model predicted that green SCM fully mediated the relationship between SCO and the three performance dimensions. While this relationship was not supported, the fully mediated model did show support for the hypothesized relationships between green SCM and the three performance dimensions. The saturated model found no support for green SCM – performance relationships, but did find support for the direct SCO – firm performance relationships. Thus, SCO influences the relationships between green SCM and firm performance.

To better explain the relationships among SCO, green SCM and the firm performance constructs, the relationship between SCO and EO was investigated. Exogenous variables are always set to covary in SEM structural models. The value of the covariance between EO and SCO was found to be 0.55. This result logically points to a possible alternative path from SCO and green SCM, through the EO construct. Two alternative models connecting SCO to EO were therefore investigated with indirect and indirect/direct effects of SCO to performance (Figures 4.4a and 4.4b).

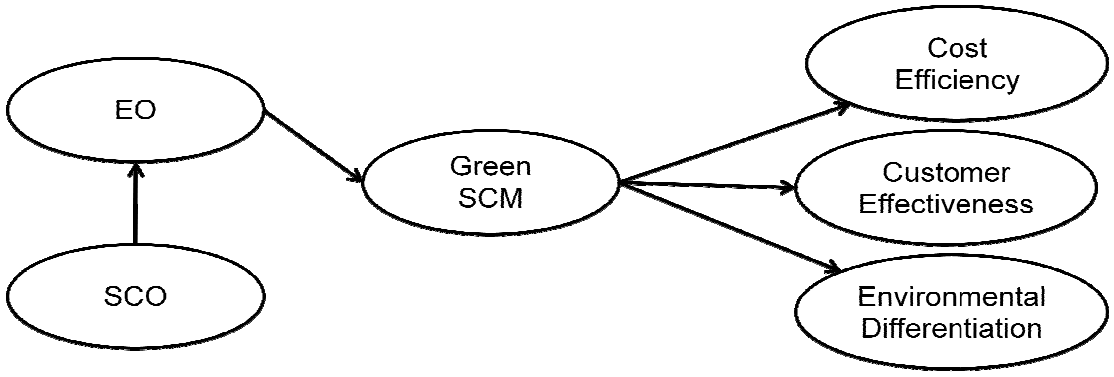


Figure 4.4a Alternative Model 1: Indirect

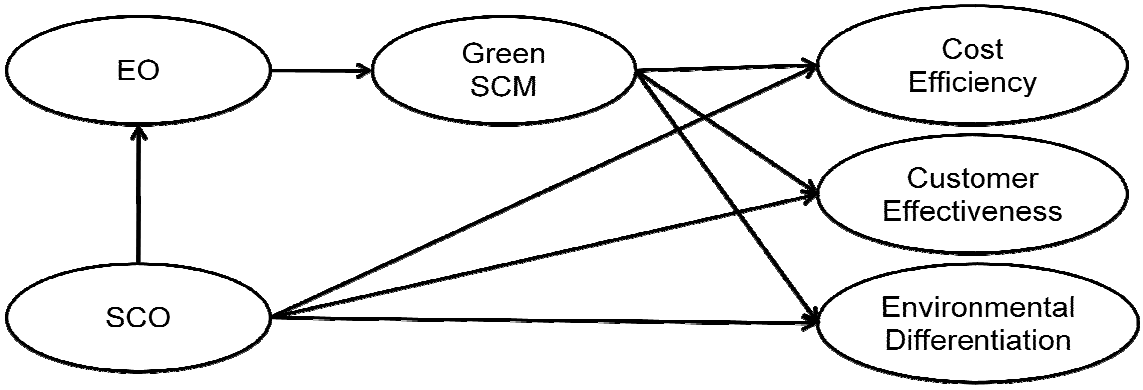


Figure 4.4b Alternative Model 2: Indirect/Direct

Analysis of alternative model 1 revealed that the direct path between SCO and EO was positive and strong (standardized regression loading = 0.55; significant at p<.001). The fit of alternative model 1 was identical to the theoretical model, with the exception of one degree of freedom ($\chi 2$: 2678; df: 1311; $\chi 2$/df: 2.045; CFI: 0.906; TLI: 0.901; RMSEA: 0.054).

Analysis of alternative model 2 revealed again, that the direct path between SCO and EO was positive and strong (standardized regression loading = 0.54; significant at p<.001). However, alternative model 2 was measured with direct paths from SCO to all three of the firm performance dimensions (Figure 4.4b). The analysis revealed that all three pathways were significant (see Table 4.12). The fit of alternative model 2 was marginally better than alternative

model 1 and the theoretical model ($\chi 2$: 2631; df: 1308; $\chi 2$/df: 2.012; CFI: 0.909; TLI: 0.904; RMSEA: 0.053).

Table 4.12 SCO – Firm Performance Direct Path (Alt. Model 2)

Path	Estimate (Std Regression)	p-value	Result
SCO-Efficiency	0.45	<.001	Significant
SCO-Effectiveness	0.45	<.001	Significant
SCO-Differentiation	0.13	.024	Significant

Alternative models 1 and 2 both help to better explain the relationships that were found in the analysis of the theoretical model: SCO is an antecedent to EO, and EO fully mediates the relationship between SCO and green SCM. As the fit indices of all three models (theoretical model, alternative model 1, and alternative model 2) are not significantly different, alternative model 1 is considered the strongest for at least two reasons: First, explanatory power; the positive, direct significant relationship between SCO and EO better explains the relationships between green SCM and firm performance than are indicated in the theoretical model. Second, parsimony; there are only five directional paths (Figure 4.4a) vs. eight in alternative model 2 (Figure 4.4b).

SUMMARY

Chapter 4 explained the specifics of the data analysis procedures, the analysis results for the pre-test and the main test, results of the CFA and structural models, hypotheses testing, and post-hoc analysis of alternative models to the theoretical model. Analysis of the theoretical structural model found it to have acceptable fit and supported four of the hypothesized

relationships: EO – green SCM, green SCM-efficiency, green SCM-effectiveness, and green SCM-differentiation. The significance of these relationships provide evidence that green SCM practices in the firm positively impact firm performance, when an environmental orientation is pervasive in the firm. The hypotheses testing also found no support for the relationship between SCO and green SCM, and no support for the bundle of resources and firm performance. These findings help to answer the research questions of this dissertation, all of which were based on investigating the relationships among the strategic resources EO, SCO, and green SCM, and their impact on firm performance. A post-hoc analysis found support for a mediated relationship between SCO and green SCM through EO, and an indirect relationship among SCO and the three dimensions of firm performance in an alternative model. This model (alternative model 1) was adopted because of its ability to better explain the relationships in the theoretical model, and its parsimonious structure. Chapter 5 explains the results of the hypotheses testing and post-hoc analysis in detail, the limitations of the study, implications for scholars and managers, and concludes with suggestions for future research opportunities.

CHAPTER 5 - CONCLUSIONS AND IMPLICATIONS

OVERVIEW

This dissertation set out to investigate the relationship between green SCM and firm performance by addressing three primary gaps in the literature: the lack of focus on both external and internal motivators and resources as impetus to develop green SCM practices; the limited and still evoloving literature on green SCM; and the lack of application of an appropriate theoretical lens. To addess these three gaps, the purpose of this dissertation was to investigate the relationships among green SCM, environmental orientation, and supply chain orientation, and their impact on firm performance, at the firm level unit of analysis, using the RBV theoretical lens.

Chapter 2 presented the relevent literature on green SCM, its proposed antecedents, EO and SCO, and the proposed outcomes of green SCM practices, cost efficiency, customer effectiveness, and environemental differentiation. A theoretical model was built with hypothesized relationships among these six primary latent variables and their respective dimensions, in Chapter 3. A quantitative study was conducted and the results reported in Chapter 4. The analysis and findings were presented in Chapter 5. The following sections analyze the findings from the quantitative study for each of the hypothesized relationships, dicuss implications for scholar and managers, assess the limitations of the study, and present future avenues of scholarly resesarch.

DISCUSSION OF THE FINDINGS

GREEN SCM AND PERFORMANCE

The theoretical model hypothesized a direct, positive relationship between green SCM and each of the three dimensions of firm performance. The three dimensions, efficiency,

effectiveness and differentiation, are considered indicators of how well a firm manages its intra- and inter-firm supply chain functions and processes (Fugate et al. 2010). Support for the green SCM-firm performance relationships indicates that managers recognize the ability of green SCM practices to impact similar operational metrics of firm performance as other SCM practices and operations such as inventory turnover, order fulfillment and stock availability (Beamon 1999; Sarkis and Talluri 2004; Srivastava 2007).

The relationship between green SCM and customer efficiency/cost effectiveness is interesting because both dimensions represent direct economic performance measures of SCM processes in the firm (Mentzer et al. 2001). The development and implementation of green practices in the firm has been a controversial topic because managers have traditionally believed that the economic benefits are not outweighed by the costs (Hoffman 2000). While direct costs are not taken into account in this study, the support found for these relationships does seem to provide evidence managers may be starting to recognize the benefits of green SCM practices on firm performance.

Building on the RBV paradigm, the significance of these relationships is logical. RBV explains that firms attempt to identify critical strategic resources, and then develop and exploit these resources to gain competitive advantage, which improves firm performance (Sirmon et al. 2007). Comparing performance to the competition allows managers to strategically benchmark their own practices and employment of resources (Wernerfelt 1984). As the items used to measure the performance constructs in the survey asked managers about firm performance, relative to the competition, the significant relationships between green SCM and efficiency/effectiveness provide evidence that managers consider green SCM to be a resource that plays a strategic role in the firm.

The strength of the green SCM-environmental differentiation relationship was not surprising. The significance of this relationship indicates that firms recognize differentiating their SCM functions from the competition is an important component of the impact SCM has on firm performance. Environmental differentiation can be a source of value for the firm in two ways (Reinhardt 1998). The first source of value relates to the reputation of the firm and its products; firms that produce green products with green processes are viewed as responsible and compliant by government and society (Bansal and Roth 2000). The second is an economic effect that comes from the recognition by consumers of the firm's commitment to green products, which in turn can generate additional revenues from customer loyalty (Christmann 2000; Chitra 2007).

The RBV paradigm helps explain the relationship between green SCM and environmental differentiation as the employment of a strategic resource to improve firm performance through differentiation. Strategic resources are identified by their ability to improve firm performance beyond that of their competitors. Firm performance is measured several ways in the RBV literature, including the ability of a firm to differentiate itself from competitors (Sharma and Vredenburg 1998; Aragon-Correa and Sharma 2003). Environmental differentiation defines firm performance through metrics such as reputation, eco-friendly product range, revenue generated from eco-friendly products, and returns programs; all are items that can differentiate the firm from competitors (Melnyk et al. 2003).

The significance of the relationships found between green SCM and the three constructs of firm performance provides evidence of a more widespread proactive environmental strategy in firms that participated in the survey. All organizations have an environmental strategy that range from resistant to proactive and determines which performance goals the firm will pursue (Hart 1995; Zsidisin and Siferd 2001; Aragon-Correa and Sharma 2003). Firms with a proactive

environmental strategy seek to create value throughout the firm by consistently working to improve environmental performance in order to create a sustained competitive advantage to meet different performance goals and metrics (Hart 1995; Porter and van der Linde 1995). Researchers posit that an understanding of potential financial gains drives firms to adapt proactive environmental strategies (Hart 1995; Aragon-Correa 1998). Support for the pathways between green SCM and firm performance may provide evidence that a proactive environmental strategy underlies the formation of green SCM practices.

EO AND GREEN SCM

Hypothesis 2 predicted EO as an antecedent to green SCM with a direct, positive effect and was supported. The high loading provides evidence that successful green SCM practices need to be supported by an underlying environmental corporate culture (Klassen and Johnson 2004; Bowen et al. 2006). EO is the proactive recognition of the strategic importance environmental responsibility and environmental practices are to the firm (Menon and Menon 1997; Banerjee et al. 2003) and in SCM (Bowen et al. 2001; Klassen and Johnson 2004). An orientation is considered the way in which a firm views and reacts to the business environment in which it exists. Orientations are considered organizational cultures where the orientation characterizes an organization's disposition toward particular objectives (Deshpande and Webster Jr 1989; Han et al. 1998). EO has a disposition toward successful environmental practices and strategies (Banerjee et al. 2003). Thus, the strength of the relationship between EO and green SCM is not surprising. Values and beliefs evolve from an environmental corporate culture and eventually influence the creation and implementation of environmental management systems, practices, and processes (Mintzberg 1994a; Mintzberg 1994b; Banerjee et al. 2003; Fraj-Andrés et al. 2009).

SCO AND GREEN SCM

The relationship between SCO and green SCM was not supported, which is counterintuitive. Previous empirical research has established SCO as an antecedent to SCM (Min and Mentzer 2004; Min et al. 2007). The justification in Chapter 2 for SCO as an antecedent to green SCM stemmed from the logic that green SCM is comprised of an environmental culture or orientation in the firm and an economic culture or orientation in the firm which were defined as EO and SCO, respectively. Therefore, EO and SCO were both hypothesized as important antecedents to green SCM (Klassen and Johnson 2004). The relationship between EO and green SCM was supported, so a culture of collaboration and partnering relationships with supply chain members through SCO was expected to also positively impact green SCM practices (Vachon and Klassen 2006b).

The finding that SCO did not show a significant path to green SCM indicates that managers possibly look at green practices as a separate strategic area of emphasis or a sub-area of SCM. The degree of integration between green strategies/practices and corporate strategies and goals has been investigated in the literature, yet remains an area of research that is not fully explored (Buysse and Verbeke 2003; Paulraj 2009). If evidence were to be found that managers do not view green SCM as synonymous with SCM, then it logically flows that the existence of SCO in the firm would have little to no impact on green SCM practices.

Similarly, the lack of support for the SCO–green SCM relationship could also be related to differences in how SCM and green SCM are measured. SCM is operationalized by dimensions that measure agreement among supply chain partners on focus and vision, sharing information, risks and rewards, cooperation, process integration, and the desire to build long-term relationships. Green SCM includes aspects of these dimensions, but ignores others, such as long-

term relationships and agreement on risk and reward sharing. It is possible that the omission of these key elements severs the connection managers make between the internal locus of SCO, and the external local of SCM (Min et al. 2007).

BUNDLE OF RESOURCES AND PERFORMANCE

Hypotheses 4a, 4b, and 4c, concerning the relationships between the bundle of resources, EO, SCO, and green SCM, and the three dimensions of firm performance, were not supported. The configuration of EO and SCO as antecedents to green SCM was hypothesized to improve each of the three dimensions of firm performance. However, for the hypotheses to be supported, the relationship between EO and green SCM and SCO and green SCM needed to be significant.

An explanation for the lack of support for hypotheses 4a, 4b, and 4c can be derived from the RBV paradigm. Bundles of resources have been shown to improve firm performance over and above the impact of individual resources (Newbert 2007; Newbert 2008). However, a "bundle" of resources is characterized by specific relationships between the resources in the bundle. The actual relationship configurations are important when firms identify and manage the resources, i.e. causal (Black and Boal 1994; Hult and Ketchen Jr 2001). When relationships are causal, these configurations are critical to the influence of the bundle on performance (Newbert 2007; Newbert 2008). The bundle of resources hypothesized in the theoretical model had a specific causal order: EO and SCO are antecedents to green SCM. While support for the hypothesized version of the resource bundle was lacking, it is possible that an alternative version, using the same resources but with different causal relationships, may help to explain the findings. A post hoc analysis of alternative models to the theoretical model is discussed in the next section.

DISCUSSION OF THE POST HOC ANALYSIS

The post hoc analysis suggested that alternative relationships among the constructs in the theoretcial model may help to better explain the findings. The hypothesized relationship between SCO and green SCM was found to be statistically insignificant, while green SCM had significant relationships with the three dimensions of firm performance. However, post hoc analysis of direct and indirect relationships between SCO and efficiency and effectiveness nullified the significance of the green SCM - efficiency and effectiveness relationships. This finding suggests that influence from SCO was channeled through green SCM to efficiency and effectiveness, despite the insignificance of the SCO – green SCM path in the original hypothesized model.

An alternative model in the post hoc testing (identified as alternative model 1 in Chapter 4) was created to help explain this finding. SCO was modeled as an antecedent to EO, rather than green SCM, as in the theoretical model. This relationship makes theoretical sense for at least two reasons. First, the items for EO asked managers questions about environmental issues in their business unit. As the respondents were supply chain, logistics and purchasing managers, the business unit would be part of the firm's internal and external supply chains. Managers may therefore relate the dimensions of SCO, trust, commitment, top management support, cooperative norms, and organizational compatibility with EO because of the manager's frame of reference when asked about their business unit. Second, firms can have numerous orientations; each are typically unique but also connected in some manner, either through an antecedent or reciprocal relationship, and are often manifested in different functional areas and at the corporate level (Miles and Munilla 1993). Klassen and Johnson (2004) theorized a broadly defined relationship between SCO and EO because both have salience and implications for supply chain managers. Thus, SCO as an antecedent to EO is not unprecedented.

The relationship between SCO and EO was positive and significant. The new structural path between SCO and EO did not improve the fit of alternative model 1 from the theoretical model, but did help to interpret the findings. Alternative model 1 supports the argument that bundles of resources improve resource impact on firm performance.

The alternative model with the SCO-EO relationship (identified as alternative model 2 in Chapter 4) was modified again to include direct paths from SCO to the three performance dimensions to test the mediating strength of EO and green SCM on SCO. The analysis found SCO as having a significant direct effect on all three performance dimensions while simultaneously negating the significance of the green SCM on performance. However, alternative model 2 did not significantly improve the overall model fit. Therefore, alternative model 1 proved to be preferable because of it's ability to theoretcially explain the findings from the empirical study and because it was the most parsimonious of similar fit.

CONTRIBUTIONS

Scholarly research should contribute to and extend the current literature by filling in existing gaps for both researchers and managers (Varadarajan 2003). The findings from this dissertation contribute to the body of knowledge in the areas of SCM, firm orientations, green practices, and the RBV paradigm. Each of these areas has important theoretical and managerial implications.

THEORETICAL IMPLICATIONS

EO as a Single Construct

The inclusion of the construct EO in this dissertation contributes to the SCM literature as both the operationalization and empirical testing of EO has only been investigated in the

marketing and management literature. The findings from the empirical study provides evidence of EO as an antecedent to green SCM, and evidence of indirect linkages to firm performance. This extends the conceptual and empirical research in areas related to green SCM by suggesting that firms with an EO may be more likely to implement green SCM practices, and realize improvement in firm performance, compared to the competition.

The operationalization of EO as a single construct is also a contribution to the literature. This single construct finding is a departure from previous findings in the marketing and management literature (e.g. Menon and Menon 1997; Banerjee et al. 2003; Fraj-Andrés et al. 2009), which found EO to be a second-order construct consisting of two first-order constructs, internal environmental orientation and external environmental orientation. There are possible explanations for this finding: supply chain managers perceive environmental issues differently than other managers. Previous research on EO pulled samples from among plant, general, and marketing managers. It is possible that previous empirical studies of the EO construct have not measured it correctly for use in SCM. Managers in the areas of purchasing, logistics and SCM may view internal and external aspects of EO as one because of their propensity to think of their business unit (aka supply chain operations and management) as a boundary-spanning function that integrates internal and external culture and activities.

Green SCM with Three First-Order Dimensions

Green SCM has been previously postulated as a second-order construct with five first-order dimensions: internal environmental management, eco-design, cooperation with customers, green purchasing, and investment recovery (Sarkis 2003; Zhu and Sarkis 2004; Zhu et al. 2008b; Zhu et al. 2008a). The findings from the study in this dissertation confirmed two of the dimensions, internal e-management and eco-design, but not the other three. Instead, the findings

show that investment recovery did not load well with green SCM and that the two supply chain relationship dimensions of green purchasing and cooperation with customer collapsed onto a single dimension. These findings are noteworthy, as they challenge the current operationalization of the green SCM construct.

The lack of support for the inclusion of investment recovery could be related in part to the measurement of the construct and the theoretical fit of the construct as a dimension of green SCM. Items used to measure this dimension suggest participants to not think of selling excess inventories, materials, and scrap materials as recovering investments, as stated in the wording of the questions. Rather, managers look at these activities as necessary operational practices that remove stagnant assets from their books. Furthermore, it's possible that this finding suggests firms do not include asset and waste recovery activities as a part of their green practices in SCM. This finding doesn't mean reverse logistics is not part of firm's operations or strategies, evidenced by the inclusion of item FPD5 that asks managers about the eco-friendliness of their reverse logistics programs. Rather, it possibly points to a more proactive approach to waste management and waste reduction. Firms that are proactive in reducing and eliminating wastes seek do to so at the source of waste (e.g. product and packaging design phase), rather than at the end of the waste stream (e.g. recycling) (Christmann 2000). Furthermore, previous empirical studies that included investment recovery in their theoretical models found it to have the lowest reliability, the lowest loading score, and had one of the lowest individual item loadings of the five green SCM dimensions (Zhu et al. 2008a). The findings from this research provide evidence that investment recovery is not a part of current green SCM.

The finding that green purchasing and cooperation with customers collapsed together onto one dimension (aptly named supply chain partnering) is another contribution of this

dissertation to scholars. The literature has often looked at upstream and downstream environmental practices separately. For example, Zsidisin and Siferd (2001), Carter et al. (1998), and Walton et al. (1998), hypothesized and tested green purchasing models, related to upstream supply chain activities. Bowen et al. (2006) theorized a green supply model based on intra-firm and upstream operations. Others have focused on environmental issues in the downstream supply chain (e.g. Buysse and Verbeke 2003; Kärnä et al. 2003; Rivera-Camino 2007). The green SCM scale used in this dissertation was developed using the Zhu et al. (2008a) scale, which established two separate dimensions, green purchasing and cooperation with customers, to measure green SCM. The findings from this study suggest that managers conceptualize upstream and downstream green-practices as an inter-firm concept, rather than separate supplier-focused or customer-focused issues.

The supply chain partnering dimension of green SCM is quite interesting because it suggests supply chain managers may evaluate their supply chain relationships as continuous, even when dealing with emerging issues such as green SCM. Taken another way, this finding suggests that supply chain managers' continuous view of the supply chain is ingrained in their operational, relational, and strategic attitudes to the point where it applies extensions of traditional SCM (i.e. Beamon 1999).

Green SCM and Firm Performance

Firms develop and implement green SCM practices due to stakeholder pressure, regulatory demands, and social legitimacy, as well as the perceived direct economic benefits (Hall 2000). However, these proposals, particularly the motivation resulting from perceived economic benefits, have rarely been tested empirically (Zhu et al. 2008b; Thun and Müller 2010). The findings in this dissertation represent the first study that has found a significant

positive relationship between green SCM practices and the three primary areas of firm performance theorized to be impacted by SCM. This indicates that firms use green SCM practices to address multiple dimensions related to firm performance and provides evidence of the level of understanding by supply chain managers about the potential benefits of green practices.

This study also widens the avenue for further research on the benefits of green, and more broadly, sustainable SCM practices in the firm. Scholars can use the results to extend performance metrics, study comparisons of different sample sets according to demographics (e.g. size, industry, country where headquartered), and look at longitudinal data for break-even points after the implementation of green and sustainable SCM practices.

MANAGERIAL IMPLICATIONS

Defining and Measuring Green SCM

Previous research studies have discussed various issues regarding green SCM. The findings from this dissertation benefit managers by defining and measuring the elements of green SCM in U.S. firms and by extending the research in this area through an alternate operationalization of the green SCM construct. Strategists and supply chain managers can use this to assess their current levels of green SCM practices in their intra- and inter-firm supply chains. Understanding how to measure and assess the integration of green SCM practices into the firm's operations could be valuable in the expanding and increasingly competitive global business environment. This research provides supply chain managers with better conceptual framework for assessing their current green supply chain initiatives and capabilities.

Identification and Use of Firm Resources

The RBV paradigm explains that firms attempt to identify, develop and employ strategic resources that are perceived to yield the greatest amount of return (Sirmon et al. 2007). Intangible resources, such as orientations and complex practices may be particular difficult for managers to identify (Fiol 1991; Hult et al. 2008). An important finding from this dissertation that may benefit managers is the evidence of higher firm performance, as compared to the competition, through the use of three intangible resources. The identification of these resources in this study and the evidence of their potential provides managers with the motivation to develop and employ them in SCM relationships and operations.

A related benefit to managers is the concept of resource bundles and causal relationships. By carefully analyzing current and potential resource relationships, managers may find that certain combinations will prove more beneficial than others. The effectiveness of resources may be dependent on causal relationships among the resources (Black and Boal 1994; Hult and Ketchen Jr 2001). Resource bundles, in turn, can create more value for a firm than individual resources employed independently of one another (Newbert 2008). Findings from the study provide evidence that managers should explore how resources are used in the firm and what types of relationships exist among the resources.

Economic Benefits of Green SCM

The findings of the empirical study provide managers evidence of the economic benefits of implementing green SCM practices. Firms increasingly seek to create inimitable distinctive capabilities through their supply chain management practices in order to positively impact their performance. As the global business environment has become more dynamic and complex, in which changes happen rapidly (Walters 2004), supply chain managers seek out and identify new

resources to use in the management of their supply chains, in order to remain competitive (Vachon and Klassen 2006b). An emerging phenomenon of interest in this area is green SCM (Klassen and Johnson 2004; Markley and Davis 2007). However, the literature has struggled to provide managers with applicable ideas and courses of action to manage green SCM practices that ultimately improve performance (Pagell and Wu 2009).

A proactive environmental strategy seeks to create value throughout the firm by the continuous improvement of environmental performance, with the goal of sustained competitive advantage and improved firm performance (Hart 1995; Porter and van der Linde 1995). Evidence that a proactive environmental strategy may underlie the creation of green SCM practices could encourage managers to assess the environmental strategies in their firm and supply chain. A firm with a more proactive the environmental strategy has the potential to reap economic returns from the implementation of this strategy.

LIMITATIONS AND FUTURE RESEARCH OPPORTUNITIES

LIMITATIONS

All research designs and methods are flawed and limited in their validity (McGrath 1982; McGrath and Brinberg 1983). It is desirable for researchers to maximize generalizability, precision in control, and realism of the context in any research project, *ceteris parabis* (McGrath 1982). In reality, however, research is plagued by the "three-horned dilemma" that arises with the very choice researchers make: as one desirable trait is maximized, the other two are diminished (McGrath 1982).

Survey methodology, in particular, is strong in its ability to maximize the generalizability of the findings. It is weaker in the areas of precision in control and realism of the context. Precautions were taking in this research to ensure participants answered the questions based on

their understanding of their positions and the firms where they work. The wording of the survey questions was carefully edited before and after the pre-test to ensure the questions would be salient and applicable to the participants. Both actions were used to improve control and realism.

Despite these precautions, key limitations in the empirical study are present. These include the lack of non-U.S. firms in the participant database, weaknesses associated with cross-sectional surveys (e.g. Podsakoff et al. 2003), and constraints on the depth of information provided in survey methodology research (Van Bruggen et al. 2002).

Managers' attitudes toward emerging issues in SCM range from the pursuit of proactive strategies that address critical changes, to cautiously watching and waiting. Often these attitudes are dependent upon factors such as firm culture and national culture. The rapid increase in the number of non-U.S. Fortune 500 firms means that any given global manager's attitudes toward SCM and firm operations cannot be assumed to match those of U.S. firms, especially in the area of green SCM. This dissertation used U.S. firms exclusively in the data sample. To truly measure the attitudes of managers at global firms and thus, improve the external reliability and generalizability of this research, participants from both U.S. and non-U.S. based firms should be included in the sample.

The use of a cross-sectional survey also limits the investigation of green SCM to a point-in-time assessment. A single cross-section survey limits this study's ability to capture long term effects and changes. By contrast, longitudinal research designs can capture changing phenomena without relying on static assessments. The intent of this dissertation was to focus on managers' perceptions of the phenomenon green SCM, its causes and its consequences. However, the ability to track how particular aspects of this phenomenon evolved over time would give a more complete view of the phenomenon, particularly because green SCM is an emerging area and

managerial attitudes toward it may change significantly over time, both short-term and long-term.

Related to survey methodology, the depth and breadth that can be obtained through web-based, Likert-scale type surveys is limited. Survey items are designed to measure properties of a latent variable. To that extent, the variance obtained from Likert-scales answers is the only additional information that can be captured from participants' responses. Thus, this study was unable to capture any additional information that may relate to the phenomenon under investigation. For example, it would have been interesting to understand participants' view on other types of green practices in SCM, additional ways in which green SCM benefits the firm, and constraints to the implementation of green SCM practices. Answers to all of these questions may provide additional information about the relationships among the constructs in the theoretical model.

Another limitation related to depth and breadth in this research is gaining the perspective of a manager at one firm, versus a dyadic approach. Focusing on just one side of the dyad may induce bias in the research and could miss important details regarding the phenomenon that could only be captured by studying both sides of a dyad. Investigating a dyadic relationship is an important step to understanding and consequently improving a firm's processes and strategies (Achrol et al. 1983). A dyadic approach takes two party exchange relationships as its fundamental subject matter to be explained (Achrol et al. 1983). By looking at both sides of the dyad, manufacturers and their suppliers or the manufacturers and their customers, valuable insights into green SCM practices and strategies may be gained.

SUGGESTIONS FOR FUTURE RESEARCH

Beyond addressing the limitations listed in the previous section, future research possibilities based on the findings from this dissertation are interesting and exciting. Possible future research paths concentrate on theoretical issues, investigation of new conceptual questions, and the execution of new empirical studies to improve upon the conclusions of the findings.

Additional Variables

Additional variance in the model could be explained through the inclusion of moderators to the hypothesized relationships. Uncertainty has been hypothesized to positively moderate the relationship between green strategies and green practices in the firm and between green practices and firm performance (Aragon-Correa and Sharma 2003). Risk factors also impact managerial decisions about the allocation of resources toward sustainable SCM and the impact they have on sustainability and firm performance (Carter and Rogers 2008). Risk and uncertainty could both be used to moderate antecedent and outcome relationships of green SCM. Furthermore, the interaction of risk and uncertainty could be investigated, which would lead to a greater understanding of how different combinations of risk and uncertainty impact green SCM practices.

Other studies could be conducted that look at firm size, industry type, and global presence to assess if there are differences among groups that make up these demographics. For example, how does the theoretical model change when the sample is split into large firms and small/medium sized firms and in what ways do these two groups compare? Do older or newer industries show a greater propensity toward the existence of orientations and green SCM practices? Does the level of green practices in SCM increase or decrease in firms with a greater

global presence (i.e. greater percentage of purchasing made globally) as opposed to firms with a smaller global presence?

External Validity

External validity cannot be ensured in a single study (Mentzer and Flint 1997). Additional empirical research is needed to test the primary components of external validity, namely statistical generalizability, conceptual replicability, and situational replicability (Ferber 1977; Lynch 1982). One way to do this is by expanding the sample to include non-US firms. A related study could investigate the differences between industrialized, newly industrialized, and developing countries. Another way to assess the external validity of research is to triangulate methods to see if the findings of different research methodologies are consistent with one another (McGrath 1982). Qualitative research would be one such methodology.

Qualitative Research Design

Qualitative research could help improve the operationalization of the green SCM construct through the development of a more valid and reliable scale. Green SCM has been operationalized by several authors, including Zhu et al. (2008a), Rao (2002), and Zsidisin and Hendrick (1998). The scales for green SCM in this dissertation were taken from Zhu et al. (2008a) because of its replication in more than one study. However, this research, based on a sample of U.S. firms, provided evidence of yet another scale for green SCM. Furthermore, the findings in Zhu et al. (2008a) were based on a sample of Chinese firms. An exhaustive exploratory study of interviews with managers from U.S. and non-U.S. based firms would add to the literature by refining and better defining what it means to have green SCM practices in firms.

Another phenomenon that could be pursued using qualitative research methodology is exploring managerial attitudes toward green SCM practices. Sustainability is an emerging issue in SCM and has been at the forefront of considerable research in recent years (Carter and Rogers 2008). However, emerging issues can become mainstream or exist only as trends, with the former becoming relevant in the literature and assimilated into practitioner's strategies and operations, and the latter eventually becoming obsolete (Pagell and Wu 2009). Understanding managers' attitudes toward the longevity of environmental and sustainability issues in SCM would give greater insight into the number and types of resources dedicated to these areas in the firm.

Qualitative research could also be used to gain insight into the origins of corporate orientations. The theoretical model in this dissertation relied heavily on two orientations to help explain the use of green SCM practices in the firm and their outcomes. The development of these orientations was therefore critical to the logic in the model and in the logic of the hypothesized relationships. Orientations, as corporate cultures, are described as beliefs and theories that management carries with them as part of their cognitive logic (Prahalad and Bettis 1986). Eventually, these beliefs become an organization-wide "dominant logic" that permeates integrates with the current culture of the firm, creating a new culture (Fiol 1991). Greater insight into the different steps that managers go though, from origin of the beliefs and theories, to the assimilation of them into an orientation would be a worthwhile research endeavor. Qualitative research methods would be ideal in uncovering the details of the orientation genesis and formulation.

Extending the Research

Using longitudinal survey data to see how green SCM practices are evolving in firms would be another interesting and worthwhile research project. This project could be linked with qualitative studies to see how closely manager's attitudes about environmental and sustainability issues in SCM follow patterns of firm investment in green SCM practices. Longitudinal data could also be collected using secondary sources such as annual reports, press releases, corporate sustainability reports, and other public information.

CONCLUDING REMARKS

This dissertation lays a broad foundation for an ongoing program of research concerning the integration of environmental and economic concerns in the supply chain. This study is unique from previous research by helping to explain the role green SCM plays in the firm, its antecedents and its outcomes. Future research in this area is promising not only for academics interested in exploring emerging areas in SCM, but also for practitioners seeking to find competitive advantage in the management of their supply chain operations in increasingly challenging and competitive global business markets.

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