Forging Links between Innovation and Sustainability: An Empirical Examination of the Effects on a Firm's Financial Performance

by

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Greenhouse gas (GHG) emissions from the North American energy and energy-intensive materials production sectors account for more than 50 percent of total GHG emissions. Based on the argument that CO_2 emissions need to be reduced by more than 50 percent by 2050, energy sector and energy-intensive materials production processes that cause environmental harm are considered a key contributor that cannot be neglected. The challenge is to reduce greenhouse gas emissions from both sectors consistent with corporate sustainability goals and government policy objectives. Energy firms have been auctioning aggressively on carbon-free alternatives to minimize their current footprint. Reducing energy demand and consumption along with related GHG emissions decrease in the production processes of the five key materials: steel, cement, plastic, paper, and aluminum; can have a considerable impact on the environment. Therefore, this research studies the role of innovation and sustainability in the evolution and co-evolution of the energy and energy-intensive materials production firms' sectors within North America.

A quantitative understanding of the causal significance of the association between corporate innovation and corporate sustainability and their combined effects on corporate financial performance would be of great value to decision-makers. Previous academic literature has focused on the importance of innovation, but relying solely on innovation will not guarantee a firm's success. Sustainability is becoming an increasingly central feature of business operations. Because firms are more likely to apply financial resources to programs that directly affect their profitability, the study offers an analysis of the combined impact of innovation and sustainability on a firm's financial performance as an aid to support the decision calculus for allocation of scarce resources.

This study presents a synthesis of the literature broadly described as the resource-based view, the capability approach, institutional theory and the stakeholder's theory. A structural equations model is developed with corporate innovation and corporate sustainability as the exogenous (independent) latent constructs and corporate financial performance as the endogenous (dependent) latent construct. The study uses the structural equation modeling (SEM) technique to analyze the hypothesized theory using archived data extracted from different publicly- and privately-available reports. All financial information was obtained from Compustat, an accounting, and financial database for more than 25,000 publicly held companies, as well as research and development expenditures for 2014. All environmental stewardship, social responsibility, and community involvement information was retrieved from public

corporate responsibility reports and corporate citizenship documents. All patent information was acquired from the Lens database, an open public resource for innovation cartography, the USPTO, short for, United States patent and trademark office, and the CIPO, short for, Canadian intellectual property office.

The structural equation model provides evidence that exogenous (independent) latent constructs have strong, significant positive associations with the endogenous (dependent) latent construct. The model shows that corporate sustainability has a significantly greater association with corporate financial performance than corporate innovation. Based upon key innovative characteristics consisting of R&D expenditures, R&D prior, patent applications, patents granted, and R&D expenditure as a proportion of total revenues, namely R&D intensity, the model displayed a positive association with corporate financial viability. The data analyzed showed a strong and positive association between different sustainability themes' indicators and the firms' financial prosperity. Further, it was proven empirically that there is a strong positive association among the innovation manifest variables chosen with the corporations' financial viability different indicators. Analysis of results indicates a strong reciprocal association between corporate innovation and corporate sustainability which is valid in both directions. Sustainability can drive innovation, and innovation can foster and prompt sustainability.

The research illustrates how environmental stewardship, social responsibility, and community involvement manifest indicators can be combined to reflect an organization's level of sustainable development as well as innovation indicators that describe economic performance. Research results provide insights on how businesses respond to societal demands while maintaining long-term business viability. This study offers a clear understanding of different relationships and capability to evaluate the potential impact of key factors. Results of this study will assist corporate managers to better understand the impact of innovation and sustainability expenditures, therefore, improve the allocation of scarce resources. This dissertation outlines new empirical evidence of North America's energy and energy-intensive materials production sectors with time dependency of performance. The research outlines the theoretical and practical basis for improved corporate financial performance and offers recommendations for additional studies. The qualitative components of this study provide a greater understanding of the concepts multidisciplinary and linkages, of the relationship between sustainability and innovation. The study has created an instrument that can help shape organizational transitions and evolution. Stakeholders can use this comprehensive document to aid organizations' response to environmental, social, and economic challenges and issues.

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This dissertation is not only my diligent piece of work on innovation and sustainability, it is a landmark of more than four years of research at the university of waterloo within the Management Sciences Department. My experience at the university of waterloo has been nothing but amazing. My first day goes back to spring 2008, since then, I have felt at home. Unique opportunities have been given to me and have been taking advantage of all of them. I started my teaching career at the Conrad Business, Entrepreneurship and Technology Centre, a fertile environment for educating entrepreneurs, an incubator for spin-offs and born global firms. In this ecosystem, ranked as one of the top startups in the world, I began my journey as an undergraduate teaching assistant. During these 8 years of immense education, I have learned how to build tools so others can benefit from them; my passion is creating these tools was driven by performing cutting edge research. A clear example was this thesis; a special tool called CiCs&FP is the result of my Ph.D. work. This thesis is also the result of dozens of remarkable individuals work and many experiences I have encountered at the university of waterloo whom I also would like to recognize.

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Dedication

My Ph.D. thesis would not be possible without an indication of the support given to me by my first and only **love**, to whom all my scholarly research and especially my dissertation work is dedicated. She is my own "soul out of my body," who lifted me up high when the muses failed me. She is my inspiration who kept my spirits up when this thesis seemed interminable, I doubt it would ever have been completed without her unconditional, continuous love, which seemed to me like a flood.

I dedicate this Ph.D. work to my treasurable son, who is also my best friend, for being there for me throughout the entire masters/doctorate programs. **Anthony** has been delighted and caring of my research work. He has put up with the countless defies, hurdles, obstacles and difficulties. He has made lots of sacrifices for me to complete this piece of work and presenting it.

I dedicate this dissertation to my precious daughter, who is the joy of my life. She has been my best supporter. **Chantalle** helped me in every possible way and has given me her fullest care. Her incessant reassurance and continuous love have pushed me throughout the entire journey. She endured lots of worries till this work is seen the light.

This thesis is dedicated to my father, whose little words of praise and thrust for tenacity ring in my ears. **Samy Fahim** taught me that the best kind of knowledge to have is that which is used to serve others and can change their lives. He has been the hard work role model for me. His persistence is my guidance. His ongoing sacrifices imparted in me the stimulus to set high goals and the self-confidence to achieve them. There is no absolute doubt in my mind that without his sustained support and advice I could not have finished my Ph.D., the highest degree one can earn.

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Chapter 1

Sustainability Dilemma: Firms' Adaptation to External Environment

1.1 Background

Changing organizational behavior for the purpose of reducing GHG emissions remains a difficult problem in both the market and policy arenas. According to Kolk and Pinkse (2007) and (2008), firms have raised doubts about the predictability of climate change and have opposed related regulations. Moreover, Jeswani et al. (2007) stated that firms are reasonably indifferent to climate change policy. However, many businesses have developed carbon management programs, such as carbon capture and sequestration. Other firms are actively engaging in the carbon emissions management and trade policymaking process. Corporations are responding differently to climate change issues through the development of a number of political postures (CICL, 2015). Kolk (2003) and Kolk and Van Tulder (2005) confirmed that climate change is expected to change how firms operate.

Since the markets and policymakers have failed to address these environmental and social issues in a coherent fashion, there are opportunities to expand problem-centred organizational research and theory. According to Biggart and Lutzenhiser (2007), the economic sociology is now well poised to deal with social, issues such as energy poverty, pollution prevention, and waste management. These are all issues embedded in relation to different economic markets. The most pressing of those issues is climate change. It among the current social problem due to its embodiment in energy markets and energy-intensive materials production processes. Even when you exclude business transportation emissions, the US industrial sector is responsible for the largest share of annual US GHG emissions (EPA, 2015).

A firm's reliance on non-renewable fossil-based energy sources directly inflates their CO_2 and other GHG emissions. Adger, Arnell, and Tompkins (2005) stated that organizations must adapt to global changes because climate science now confirms with great urgency the need for action. Firms can act as primary agents of change for sustainable development through innovation to shape the transformation of our current energy system to a lower carbon one. According to the IPCC (2001; 2007; 2013; 2014), firms can play a critical role in transitioning current energy systems. By following an innovative path and relying on revolutionary sustainable energy solutions, they can help promote global change consistent with managing the impacts of climate change.

Aragon-Correa and Sharma (2003) argued that companies must acknowledge and take the necessary step to adapt to the changing external environment. According to Pennings (1992, 1998), firms must also constantly analyze these changes within its external environmental. Aldrich and Marsden (1988) stated that an organization's external environment includes everything beyond organizational boundaries. In specific, Dess and Beard (1984), showed that organizational external environment consists of three dimensions: munificence, dynamism, and complexity. Munificence refers to an organization's attempts to promote growth and stability; dynamism refers to an organization's response to unpredicted and uncertain external change, and complexity refers to the range of activities performed within an organization.

Jennings and Seaman (1994) observed that conceptual literature on organizational adaptation has generally assumed that external environment changes lead to organizational change. Galunic and Eisenhardt (1994) argued that an organization's performance will suffer if it does not properly conform to its external environment. According to Linnenluecke et al. (2013) and Winn et al. (2011), organizations that do not adapt to climate change are faced with financial, social, and environmental problems. Berkhout, Hertin and Gann (2006) also concluded that there are several strategies that can be adopted by organizations to respond to external environment changes (i.e., reactive versus proactive) (Aragon-Correa and Rubio-Lopez, 2007). According to Winn et al. (2011), various forces are compelling organizations to develop appropriate responses to tangible climatic changes. Organizations' urgent responses to these issues are essential for solving the energy sustainability dilemma. However, business activities that are tied to this issue are prone to uncertainty and as a result, companies must evolve and respond to changing.

Developing carbon management approaches and sustainable energy solutions that use inexhaustible energy sources as an alternative to fossil fuels could help with addressing current issues (Moore and Wüstenhagen, 2004; Hanjalic, Van de Krol and Lekic, 2008). However, there are several challenges to switching to a zero carbon economy and efficient energy use and conservation. Altering the existing energy system to a low/zero carbon energy system is a path-dependent. Path-dependent processes are governed by higher returns to scale determined by technological trajectories and institutional elements. According to Cowan (1990), this process includes new market characteristics, institutional and regulatory factors, and customers' expectations. Arthur (1989) stated that achieving increasing returns to existing technologies prevents the adoption of more efficient, less polluting alternatives. He added that similar types of increasing returns that create lock-in involve large technological systems (e.g., electricity generation) and individual technologies (e.g., use of sustainable materials). Rip and Kemp (1998) argued that evolutionary approaches in technological change can help with understanding the technological development path that influences, and is influenced by, its surrounding social and economic environment. There is particular interest in how much these factors favor incumbent technologies over newcomers. Based on Kemp (2000), the developmental path of a newly invented technology determines its successful implementation.

Unruh and Carrillo-Hermosilla (2006) suggest that the result is a persistent market that interferes with the growth and dispersal of low carbon technologies even when they possess obvious environmental and economic advantages. Unruh (2002) indicated that the phenomenon of "carbon lock-in" occurs due to the continuous interactions between institutions and technologies, referred to as the Techno-Institutional Complex (TIC). According to Unruh (2000), TIC refers to systematic forces that complicate the process of changing the developmental path of an existing techno-institutional system. Although there is mounting evidence that fossil fuel-based energy sources pose a substantial environmental risk, TIC can cause or promote failures that prevent the growth of low carbon technologies. To better understand techno-institutional lock-in, we must take a closer look at all interactions between technological systems and governing institutions.

A technological system is comprised of interconnected physical, social and informational elements. The dynamic relations between industries, technologies, infrastructures and users, which are referred to by the network externalities, increase carbon lock-in. Positive externalities support system dominance because users determine that there is greater value in physical and virtual networks that increase in size and interconnectivity. Institutions continue to reinforce technological system by developing formal rules (e.g., regulatory structures) and informal constraints (e.g., codes of behavior). Institutions act as a form of constraint, as they determine human interaction, which includes both formal (e.g., legislation, economic rules, contracts) and informal constraints (e.g., social conventions, codes of behavior). Therefore, factors that support institutional lock-in can also support factors that promote technological lock-in. For example, institutional factors in the energy sector, which are driven by the need to meet increasing demand and a regulatory framework that requires reductions in price, support the expansion of the fossil fuel-based technological energy system, such as building coal-fired power stations. On the other hand, regulatory drivers that promote the expansion of renewable energy have not yet been effective in helping the energy sector to overcome carbon lock-in (Daim and Cowan, 2010). As a result, institutional factors reinforce carbon lock-in in the current technological system.

Hoffert et al. (1998) and (2002) argued that energy's major impacts play a significant role in fostering a green economy and green growth. According to Clarkson et al. (2011), a green economy rests on the environmental, societal, and economic pillars of sustainable development. It fully incorporates the social and environmental sustainability aspects of growth (Shafik, 1994). Daly (1990) defined sustainable green growth as the development model that reconciles the sustainable development's economic, social and environmental pillars into a single policy planning process to produce sustainable growth. Green growth fosters economic growth and ensures that natural resources are used sustainably to continue supporting human well-being (Kemp and Soete, 1992). It refers to the dynamic ability that uses natural resources efficiently, minimizes pollution and environmental impacts, and accounts for natural hazards (Kemp, 1994). Chapple (2008) argued that emission reductions and economic growth do not necessarily represent tradeoffs.

According to Makower (2009) and Daim and Intarode (2009), transforming a dominant carbon-intensive fossil fuel energy system into a less intensive carbon-based system requires novel strategies. Faulin et al. (2006) stated that reducing vulnerability to volatile, increasing international fossil fuel prices, and supply disruptions by adopting renewable energy sources with low to zero emissions could offset price fluctuations and mitigate the impact of emissions on growth. Daim et al. (2009) acknowledged that transition of current energy systems has become a key in achieving a free-carbon economy. The sustainability dilemma and firms' adaptation to external environment needs to be addressed. It will profoundly affect the way companies will evolve or co-evolve and their future natural environment conservation efforts (Haas, Watson, and Eichhammer, 2008). The current energy system constitutes a major emitter of GHG emissions and is consequently an important contributor to anthropogenic climate change (Kern and Smith, 2008). Therefore, the current global energy system must overcome these key challenges by quickly moving to a low-carbon, energy-efficient and environmentally safe energy supply (Haas et al., 2008).

1.2 Thesis Contribution

This research explores the linkage between corporate innovation, sustainability and corporate performance with the objective to provide a better understanding of this complex and dynamic relationship. In addition, this empirical approach examines the effect of innovation and sustainability combined and separately on the firm's financial performance. The study provides insights regarding the nature of a firm's evolution process with respect to various dimensions of innovation and sustainability.

Among the most important contributions of this research is the empirical estimation of the correlation coefficients between Corporate innovation and corporate sustainability. The estimated correlation coefficient between corporate innovation and corporate sustainability is 24 percent while the estimated correlation coefficient between corporate sustainability and corporate innovation is 28 percent. Innovation can impact sustainability while sustainability can affect innovation. Furthermore, the estimated correlation coefficient between corporate innovation and the corporations' financial performance is 6 percent while the estimated correlation coefficient between corporate sustainability and the corporations' financial performance is 5 percent. The estimated correlation coefficient of both corporate innovation and corporate sustainability on corporate financial performance is 11 percent.

The research theoretical contribution implies that technological innovation is key towards a low carbon energy system. The research also proved sustainability to be the most important driver to innovation new frontiers in reducing greenhouse gas emissions. The research contributes to the current theoretical framework of the capability approach by providing empirical evidence to confirm that innovation is a dynamic capability and sustainability routines can be embedded in this innovation processes. Additionally, the research technical contribution lies in creating a special tool called "CiCs&FP," Corporate innovation, Corporate sustainability, and Financial Performance, an annual scorecard that can be used by energy and energy-intensive materials production firms to track their performance for all the indicators,

The originality and novelty of this research lies in building a sophisticated and comprehensible model that included three latent constructs (i.e., corporate innovation, corporate sustainability, and corporate financial performance), with 42 indicator variables to represent a complex and dynamic relationship using the maximum likelihood (ML) method to estimate different model parameters with the aid of PRELIS 2.30 to produce an exhaustible covariance matrix showing the pairwise relationship between different observed variables as well as the model exogenous and endogenous latent constructs.

As this study focuses on the North American energy sector, it leverages the NAICS, a short for, North American industry classification system and its details are attached in Appendix A, to isolate all energy-related codes (refer to Appendix B). Furthermore, to enhance the requisite breadth and depth of the study, energy-intensive materials production firms that require intensive use and consumption of energy in their production processes, and cause a substantial increase in CO_2 and other GHG emissions, are included in the research sample. In their study of sustainable materials, Allwood and Cullen (2012) concluded that CO_2 and other GHG emissions that result from production of steel, cement, plastic, paper, and aluminum account for over 20% of overall global emissions; therefore, the study's scope was expanded by including energy-intensive materials production sector firms within North America. The NAICS code was used to identify related codes for both sectors (refer to Appendix C). Reducing energy demand and consumption along with related GHG emissions in the production processes of these five key materials can have a considerable impact on the environment. Based on the argument that CO_2 emissions need to be reduced by 50% or more by 2050, energy-intensive industrial processes that cause environmental harm are considered a key contributor that cannot be neglected. Using the NAICS code and the equivalent Standard Industry Code (SIC), multiple sources including corporate sustainability reports and publicly financial data available from Compustat financial database, more than four hundred business establishments were identified along with their corresponding data points.

This research focuses corporate innovation and relation to corporate sustainability. The intersection between these two bodies of literature is studied for the first time, specifically the role of innovation and sustainability in the evolution of the energy and energy-intensive materials production firms and their consequences on future managerial practice. The research findings suggest that firms are required to follow an innovative path for energy transition and offer the premise of how revolutionary sustainable energy solutions can help create a low carbon economy. Based on the analysis, there are several carbon-free alternatives to conventional energy sources, and firms have been auctioning aggressively on these options. The research provides a theoretical framework and an empirical model that describes how firms evolve in light of the interrelationship among a firm's financial performance with respect to its innovation capability and sustainability approach.

This study clarifies our understanding of the evolution process where innovation and sustainability play a significant role. Understating the strength and direction of the different causal relationships between different variables revealed new insights on organizational performance and added a new theory for monitoring corporate behavior. While previous studies have correlated variables related to financial performance only, this study has advanced on the structural equation modeling technique to define this complex relationship between innovation and sustainability and their impact on performance using observed variables and multiple sustainability reported indicators. This research provides a basis for further examination with respect to the linkages between innovation, sustainability and business performance across different industries and nations. It will be possible to retest and extrapolate the study's findings on other sectors that contribute to overall GHG global emissions. Several important implications are revealed from conducting this research. For example, this research highlights the fact that support is needed for the firms under investigation as they pass through different evolutionary stages. Decision-makers benefit from this study's major findings because they highlight key strategic elements that produce success in diverse economic contexts. It also helps managers to determine the appropriateness of competitive strategies that ensure proper evolution.

To address a gap in our knowledge related to the role of innovation and sustainability in the evolution of energy sector firms within North America, this research answers three important questions:

1. How is innovation driving sustainability practices and altering the way firms think?
2. How are firms turning sustainability into innovation's new frontier to achieve a competitive advantage?
3. How are firms leveraging on both innovation and sustainability to increase their financial performance?

This study uses two separate samples of firms that have been isolated using NAICS, short for North American industry classification system. These codes are two to six digits long. Two-digit codes only indicate an economy's sector, while six-digit codes refer to a specific industry. The first sample is of North American energy companies (i.e., Canadian, American, and International companies that are actively present in North American Market). This includes portions of the following sectors: mining, and oil/gas extraction from NAICS code number 21, utilities from NAICS code number 22, manufacturing from NAICS code number 31 to 33 and transportation and warehousing from NAICS code number 48 and 49. The second sample is of North American energy-intensive materials production firms. Firms producing steel, cement, plastic, paper and aluminum products were isolated from the NAICS. The sample included Subsectors: paper manufacturing from NAICS code number 322; petroleum and coal products manufacturing from NAICS code number 324; chemical manufacturing from NAICS code number 325; plastics and rubber products manufacturing from NAICS code number 326; nonmetallic mineral product manufacturing from NAICS code number 327; and primary metal manufacturing from NAICS code number 331. The sample size obtained is well over 400 companies which account for approximately 50 percent of total GHG emissions in North American. Therefore, the study provides a comprehensible and exhaustive empirical approach for testing the relationship between innovation, sustainability and organizational financial performance.

Examining the literature on innovation, sustainable development and firms' financial performance indicates a causal pattern of inter-variable relations. The study outcome determines that the hypothesized theoretical model is consistent with current understanding. Behavioral science research uses structural equation modeling (SEM) tools more frequently in modeling complicated and multivariate causal relationships, using constructs that are measured involving multiple factors along with different data sets. Hair et al. (1998) and (2006) stated that SEM examines a path model that illustrates the relationship, and results in a measurement model that illustrates the strength of the relationship.

The SEM confirmatory technique determines the validity of the developed research theory and the analysis typically involves an exploratory element to formulate the theory. SEM focuses on corporate innovation, corporate sustainability and corporate financial performance (i.e., latent constructs) over the observed variables that measure them. An unbiased estimate was created using the SEM technique of the relationships between all three latent constructs through explicit modeling measurement error. We established a connection between each latent construct's multiple measures. A comprehensive path model was depicted illustrating the relationship between the three latent constructs. The SEM technique analyzes the constructed model to solve the research set of interrelated research questions. Conducting hypothesis testing using SEM technique produces the concurrent estimation of all unobserved constructs and their underlying linkages with several sets of observed variables. Using model data fit to evaluate consistency concludes the postulated network of relations among variables.

1.3 Thesis Organization

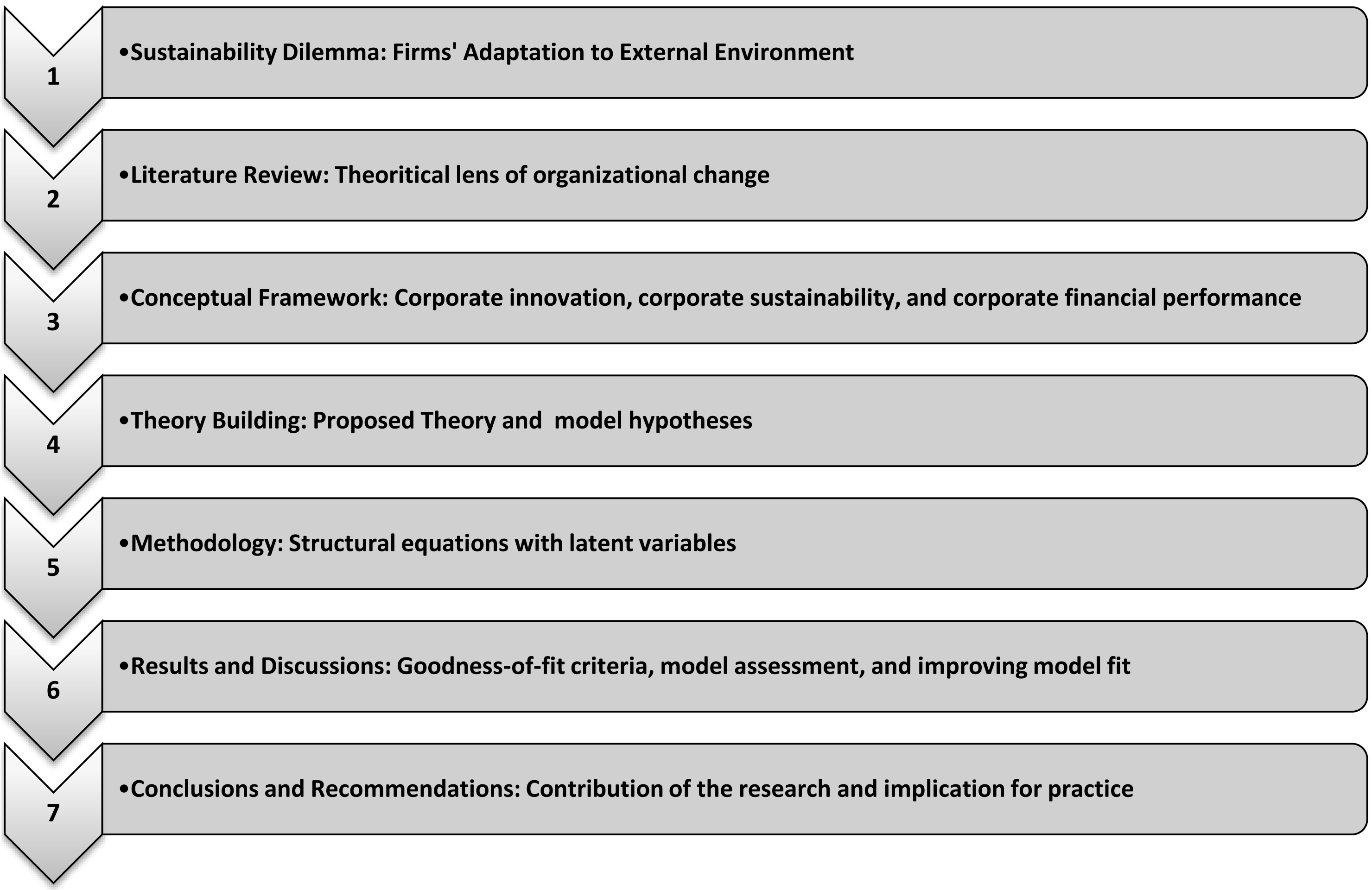
Figure 1.1 describes the structure of the dissertation. Introductory Chapter (1) highlights the research scope and contribution.

Chapter (2) reviews the literature in detail and revisits the five most important theories of organizational change perceived as the research building blocks. The first theory is the *Resource-based View (RBV)*, which mostly focuses on the firm's tangible assets including financial capitals, physical resources such as plant, property, machinery, and raw materials, intangible assets like goodwill, trade secrets, and political acumen, employees and personnel-based factors. The second theory is the *capability approach*, a standard framework for evaluating social arrangements and related political acumen that dictate proposed a social change in society. The third theory is the *institutional theory*, which looks at local actors – whether organizations or national states – as affected by institutions built up in much wider environments. The fourth theory is the *stakeholder's theory*, which deals with business conduct and ethical management for investor-owned corporations, which is the scope of our study. The chapter concludes with the *legitimacy theory*, which offers a powerful mechanism for understanding voluntary social and environmental disclosures made by corporations.

Chapter (3) presents a comprehensive examination of the proposed theory's three latent constructs. Several models of innovation are assembled to build the foundation for understanding the concept of corporate innovation. The second is corporate sustainability. The third is corporate financial performance. Chapter (4) presents the hypothesized theoretical model depicting the proposed linkages between a group of variables that defines the three latent constructs, which are corporate innovation, corporate sustainability, and corporate financial performance.

Different approaches to collect primary and secondary data are explained in Chapter (5), along with data analysis methods to test the research questions. This chapter discusses adequate tools for answering the research set of interrelated research questions in a solitary, methodical and inclusive analysis. In addition, the Six-Stage process for structural equation modeling is presented in detail. A comprehensive analysis of the research results is presented in Chapter (6), which include, but not limited to, model goodness-of-fit, as well as the ways, used to improve the model fit. Finally, the implications for theory and practice are discussed in Chapter (7).

Figure 1.1 - The structure of the dissertation



Chapter 2

Literature Review

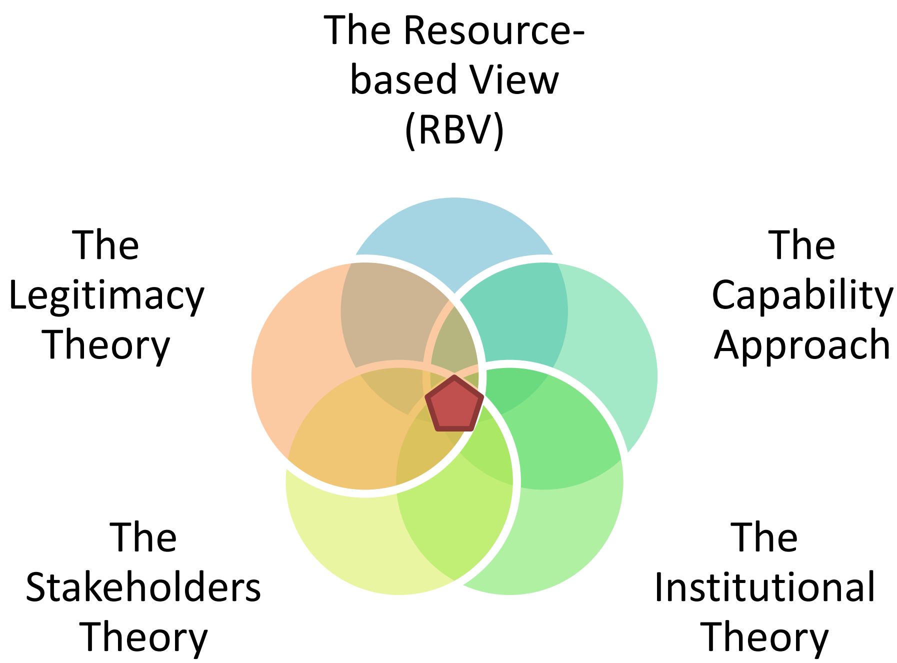
2.1 Theoretical Foundation

The main objective of Chapter Two is to establish building blocks to construct the theoretical perspectives that are central to answering the main questions posed in Chapter One. This chapter discusses the main theories and contemporary approaches that form the foundation for the research hypothesized model shown in Chapter Four. In presenting such key theoretical elements and perspectives, this chapter discusses the definitions of the key concepts that are important to the theoretical positioning of this research. Moreover, this chapter sets out how these concepts are used in the development of a conceptual model. This chapter is organized into five major sections.

The theoretical foundation of this research is established in the resource-based view (RBV), including related arguments like the capabilities approach and the dynamic capabilities concept. It is also deeply rooted in institutional theory as well as stakeholder's theory. Legitimacy theory is prominent in these types of research as it explains the importance of social influences on corporations. According to Ricardo (1817), applied microeconomic theories focus on efficiency rates for the basis of firm-level sustained competitive advantage. In RBV, people will make strategic decisions that involve continuous activities to increase rent (Mahoney and Pandian, 1992), which involve using an organization's existing resources and capabilities. The RBV approach emphasized the importance of a specific firm's asset base, instead of industrial structure (e.g., Porter, 1980) or environmental selection (e.g., Hannan and Freeman, 1977), as key determinants of a firm's competitive advantage. Technology advancements can emerge as organization capabilities change over time. Organizational capabilities can also become market-leading feasible improvements when they are demanding to substitute, duplicate or both (Barney, 1991).

On the other hand, the institutional theory describes organizational institutionalization as a result of the long-time business activity and the existence of similar organizations. This enables an organization to develop established rules that link all organizational tasks. Stakeholders theory states that organization's primary responsibility is to create value for its stakeholders (Freeman, et al., 2010). At last, the focus of legitimacy theory lies in explaining why organizations differ in their adoption of different social and community practices. Figure 2.1 illustrates the intercept of the five theories to position the research in its context.

Figure 2.1 - Important theories and contemporary approaches.



= Study Focus

2.2 The Resource-based View

Porter (1980) debated that external environment can determine a firm's success and its competitiveness. His study focused on a firm's resources within its institutional context. He argued that all resources are the same and can be purchased or sold in factor markets. Barney (1991) argued Porter's opinion and introduced the resource-based view, presented earlier by Penrose (1959) and then Wernerfelt (1984), emphasizing the role of internal capabilities in determining the firm's long-term viability. According to RBV, firms' resources vary within one industry and they are not even mobile. Therefore, bundling a variety resources and capabilities can determine a firm's competitive advantage (Barney, 1991; Amit and Schoemaker, 1993). Under RBV, resources currently owned or obtained by an organization can enhance its performance. Also, RBV describes the role of acquiring and exploiting exceptional resources in sustaining a firm's superior performance relative to other organizations in the same industry, which will eventually lead to outstanding performance. Any firm can own multiple resources, so it should endeavor to build its current capabilities, which will produce a source of competitive advantage to help achieve maximum performance. When considering a resource as a foundation of a firm's sustainable competitive advantage, organizational capabilities needs to be considered.

2.2.1 Assets, Usefulness and the Advantages they provide

According to Grant (1991), the RBV basic unit of analysis is its organizational assets or resources. Caves (1980) and Wernerfelt (1984) classified resources as tangible and intangible. Tangible resources include physical resources (e.g., plant, property, equipment, raw materials) and financial reserves (Russo and Fouts, 1997). Non-physical elements are referred to as intangible resources (e.g., patents, reputation, political posture, and culture). Also, human resources and personnel-based factors are considered intangible resources, such as training, expertise, loyalty, commitments (Wernerfelt, 1984). While corporate profitability depends on upon a firm's resources, they are not all productive on their own. A firm's activity depends on upon coordinating bundles of resources.

Christmann (2000) defined organizational capability or usefulness as the firm's capacity to deploy its currently owned or imminently obtained resources to execute and achieve a given task or goal. Capabilities depend on the effectiveness and method of the utility of a firm's resources. Darnall and Edwards (2006) added that resources and capabilities combined are the main sources of the firm's competitive advantage. These firm-specific capabilities are related to a highly informative, tangible and intangible resource that develops over a time period where there is a sequence of complex exchanges between the different resources of the firm.

Barney (1991) stated that a firm's sustainable competitive advantage can be achieved when implementing value-creation strategies that differ from the strategies employed by current and potential competitors. Teece et al. (1997) pointed out that when other firms cannot replicate the benefits of this value-creating strategy, this creates a long-term competitive advantage. Hart (1995) stated that firms can methodically get ahead of its rivals and competitors by accumulating scarce, irreplaceable, valued and irreplicable resources. Moreover, Collis (1994) indicated that administrative procedures and upper-level learning processes can provide firms with a unique improvement because they are not visible, they are not obviously apparent, they are not traded in favor markets, and they depend on long-term organizational actions and knowledge.

Since firms' resources have a lack of mobility, their capabilities might be integrated differently, and hence, their sustained competitive advantage cannot be duplicated to reap the same benefits. Therefore, RBV suggests that alterations in firm production can result from assets, capabilities as well as sustained competitive advantages.

2.2.2 RBV and Executive Reactions

Powell (1992) stated that management scholars have attempted to use RBV to apply organizational response to politics. Barney (1991) argued that RBV can explain a firm's active behaviors over external environments when they seek to a "secure" position over competitors. Scott (1995) debated that RBV does not agree with recognized institutional theory, which at its basis proposes that organizations should follow institutionalized principles or actions. DiMaggio and Powell (1983) indicated that firms abstain from adhering to external constraints, as they may employ various strategies to affect their external environments.

According to RBV, firms would attempt to change or manipulate public policy decisions when they would affect the profitability of the establishment (Hillman and Hitt, 1999). Keim, Hillman, and Schuler (2004) suggested that firms would promote policies that would not have a negative economic impact or interfere with policies that might affect their rents. Keim and Baysinger (1988) added that firms might support legislation or regulations that imposed antitrust decisions, importation tariff rules, or controlled rates if they advanced their economic standing. Likewise, RBV scholars argued that firms must make strategic use of partisan settings to gain and sustain an advantage (Bonardi, 2004; Oliver, 1991; Cramer, Schuler and Rehbein 2002; Shaffer, 1995; Grimm, Shaffer, and Quasney, 2000).

Hillman and all (2004) and Cory, McWilliams, and Van Fleet (2002) suggested that firm size, government dependency, uniqueness level, loose resources, firm commencement age and other firm-specific factors would engage firms to support or oppose policy-making. The firm size is the foremost factor as a substitution for firm resources, as larger firms have a higher probability of having their resources be initiated in public standard-making. For example, the major steel firms of the US affect strategy to gain the anticipated reimbursements from trade fortification or to delay the cost of downsizing (Schuler, Rehbein, and Cramer, 2002). Organizational slack is another key factor, as some scholars suggest that surplus resources enable firms to get more involved in political situations, whereas firms that do not have sufficient slack will be less involved in policy-making (Hill, 1990; Meznar and Nigh, 1995; Schuler, Rehbein, and Cramer, 2002).

RBV has helped with understanding a firm's miscellaneous logistic behavior within its executive environment as well as identifying the aspects that return responses. In spite of this, the resources that would lead a firm to follow specific political behaviors or determine its preferences are not context-specific. According to Priem and Butler (2001), RBV pays little attention to the contexts that determine which particular resources are more or less "valuable." Hillman and all (2004) and Cory, McWilliams, and Van Fleet (2002) stated that certain independent variables that were recognized in previous studies such as firm magnitude and firm subdivision, are not tied to specific issues and are entirely dependent upon context.

RBV has also been criticized for lacking operational validity. Priem and Butler (2001) argued that functioning legitimacy is a prerequisite for administratively applicable research. Groen, Kraaijenbrink, and Spender (2010) stressed the same point. Connor (2002) added that RBV requires directors to advance cherished resources, but it does not show them the method to do so. Miller (2003) claimed that it is very difficult for practitioners to provide their organizations with resources. According to Oliver and Holzinger (2008), one must develop a more unconventional RBV approach to identify explicit resources that would be valued in certain circumstances. Hillman et al. (2004) mentioned that subject-specific and circumstantially-relevant resources would enable managers to construct these resources and consequently form their administrative environments. Meznar and Nigh (1995) added that one must pay close attention to organizational capabilities.

Bonardi (2004) discussed the implications of RBV to corporate political behaviors. Schuler (1996) stated that scholars used to pay great attention to physical resources. However, these types of assets might not affect the firms' forceful choices in indeterminate exterior environments. Teece et al. (1997) debated that administrative or structural processes (e.g., integration or coordination, education, and reconfiguration) might have a greater influence over a company's policy responses. Schuler (2001) explained that the challenges related to identifying and operationalizing organizational capabilities might lead to a lack of focus when attempting to conduct empirical analyzes. As a result, it might be preferable to enter firm-level physical resources into statistical models (Hillman et al., 2004).

When it comes to climate change, firms might develop executive capitals and skills that will sustain climate guidelines during climate mitigation and adaptation activities. Berkhout, Hertin, and Gann (2006) suggested that a firm's economic reply to addressing change in climate is very similar to structural education processes, such as coordinating mechanisms and operational routines. Climate extenuation activities (e.g. process and product improvements or emissions trading,) may need firms to develop organizational procedures, an administrative philosophy based on becoming more energy efficient, and technology directed toward reducing carbon emissions. These efforts will lead to a competitive benefit, particularly in an economy that is carbon-low. Setting the target to withstand a viable plus may lead to a firm's backing for climate regulations.

2.3 The Capability Approach

Wernerfelt (1984) discussed how firms succeed in overcoming modern day challenges. Prahalad and Hamel (1990) presented several business conditions that must be in place for the effective implementation of proactive versus reactive strategies. Barney (1991) stated that these conditions are capabilities as described in conventional tactical administration and structural theory literature (Gold and all., 2001; Amburgey and Kelly, 1991; Teece and all, 1997; Zajac and Barney, 1994). According to Ansoff (1965), Eisenhardt and Martin (2000), Grant (1991), Kusunoki (1998), Porter (1985), Rangone (1999), Stalk et al. (1992), Smallwood and Panowyk (2005), Ulrich and Lake (1991), Ulrich and Smallwood (2004), and Wethyavivorn et al. (2009), administrative capabilities have been the point of emphasis of research in premeditated organization and organizational theory, although there are different definitions for the terminology. Barney (1991) and Collis (1994) stated that most research has found that organizational capabilities can lead to a sustainable economic advantage. Teece and all (1997) and Kusunoki and all. (1998) added that organizational capabilities are difficult to copy and replace. Porter (1985) argued that many deliberate management studies determined that methodology is required to meet corporate objectives and achieve this advantage.

Foss (2011) stated that recent literature has described business success using capability-based explanations. Schoemaker and Amit (1993) state from research that organizational abilities refer to the capability of the firm to use the organizational process to use all of its combined resources to achieve a specific result. Sarkar, Aulakh, and Madhok (2009) and Swaminathan and Moorman (2009) described an organization's capabilities as a source of value creation. Zahra and George (2002) suggested that the capabilities approach is now the primary method of describing heterogeneity and sustained competitive advantage with respect to inter-organizational collaborations. However, as Panowyk and Smallwood (2005) proposed, proficiencies enable shareholders to believe that an organization can develop enough to maintain its own strategy. Barney and Zajac (1994) stated that the material-based view of strategy emphasizes the importance of rendering firms capable of using organizational capabilities to plan, create, and apply strategies. According to Ulrich and Smallwood (2004), people have the utmost respect for organizational capabilities, as they represent the expectations of successful incorporations, and not their administrative structure or style.

Additionally, Ulrich and Smallwood (2004) and King (1999) indicated that research has shown that organizational capabilities are tied to leadership. Besides leadership, Hamel and Prahalad (1990) and Cockburn and all (2000) also suggested organizations must meet certain criteria to achieve specific missions and objectives; characteristics should include accountability, innovation, collaboration, efficiency, aptitude, swiftness, communal mindset and comprehensible individuality. Panowyk and Smallwood (2005) concluded that companies will identify an advantage when they have sufficient organizational capabilities to establish the requisite performance elements, such as competitive positioning, customer satisfaction, and most of all, results (Eisenhardt and Martin, 2000; Slater and Olson, 2001).

The dynamic capabilities perspective explains how companies adapt to their external environment's changing demands and opportunities while learning to manage their internal organizational systems' growing complexity. According to Teece and Pisano (1994), the dynamic capability view of the firm has been discussed in depth. It is an outgrowth of RBV and the firm's capability approach (Teece et al., 1997). Pisano, Shuen & Teece (1997) described dynamic capabilities as the firm's capability of addressing rapidly varying environments by building, integrating, and redesigning internal and external competencies. Martin and Eisenhardt (2000) updated the description of dynamic capabilities by including organizational processes, which refer to processes that use the firm's resources, including processes that integrate, expand, reconfigure, and release resources, for the purpose of satisfying and creating market changes.

Dynamic capabilities include administrative and calculated routines that enable companies to reconfigure their resources as markets evolve, dissolve, arise, combine and separate. Teece (2007) argued that new developments in the dynamic capabilities approach emphasize its micro-foundations. Helfat et al. (2007) added that dynamic capabilities theory can be applied to understanding how firms become an evolutionary fit with their external environment and adapt to a changing environment, as well as the nature of their constantly fluctuating inter-firm linkages. Teece (2007) debated a firm's ability to make use of subsets of their dynamic capabilities that involve identifying and shaping external opportunities and threats, as well as taking advantage of external opportunities, to explain their ability to navigate the innovation.

2.4 The Institutional Theory

There have been many changes in institutional theory over the past 50 years. The following literature review is arranged chronologically to illustrate how the theory has changed. Parsons (1960) defines institutions as global outlines of normality which highlight the different categories of allowable, forbidden and prearranged behavior in social relationships, for people in constant communicational interactions with each other as members of a society and its subdivisions. According to Parsons (1960), an organization is a system that produces an identifiable result upon reaching its goal. The organization's output is another system's input. In his early work, Parsons (1960) outlined an organization's hierarchical structure. He defined the lowest system (i.e., technical system) to perform the organization's daily tasks. The middle level (i.e., managerial system) to moderate relationships between the organization and members of its external environment, including customers and creditors. Finally, the highest level (i.e., institutional system) to idealize and implement the organization's goals and mission. A decade later, Perrow (1972) describes institutionalization as a process and a state.

According to Selznick (1948, 1996), several other factors describe organizational institutions, including, but not limited to, organizations tend to become highly institutionalized when their values are embodied rather than created. An organization's technical competency alone is insufficient, as they tend to acquire a distinct identity. According to Selznick (1948), organizations are more expendable than institutions. He added that to institutionalize an organization, a high degree of centralization is often necessary. However, as firm members become more homogenized, there is less need for centralization and management imposes a more decentralized locus of control. Organizations tend to support deviant factions within a formal system. These informal groups often become institutionalized within the organization, which results in the establishment of unwritten rules. These groups then begin to work together to strengthen the organization.

According to Selznick (1948), a social structure emerges when these factors combine to form a pattern. As the social structure continues to develop, the organization increases its value and becomes an institutional fulfillment of group integrity and aspiration. Institutionalized organizations offer more than technical proficiencies or expertise, as their value exceeds the technical requirements of the tasks that they are required to fulfill.

Perrow (1972) highlighted three major contributions institutional theorists have made, including: (a) The institutional theory unit of analysis is organization; (b) Institutional theory indicates that some organizations have their own life path; and (c) Institutional theory focuses on the firm's external/internal environment, which makes unique in its approach. Perrow (1972) states that non-institutionalized organizations operate solely on a "rational, means-oriented, and efficiency-guided" basis, whereas institutionalized organizations grow beyond rationalization to become "value-laden, adaptive, and responsive."

Meyer and Rowan (1977) introduced "new institutional theory," which is a slightly different approach from the traditional institutional theory that can help an organization to reach institutional status. Selznick focuses on inner forces (e.g., employee commitment, structure), while Meyer and Rowan state that external forces (e.g., societal values) are more impactful, stating that institutionalization comprises of certain processes that include social, obligatory, or actual sections that come to take on a regulatory status in social belief and action. Both authors also state that institutionalized organizations do not follow the demands of an individual participant or organization, and they are legitimately separate from assessments of their impact on work outcomes.

Meyer and Rowan (1977) argued that institutionalized organizations possess processes that can help them adapt new practices, structures, and procedures, which is called "isomorphism." Organizational isomorphism can result in several patterns within those firms. Meyer and Rowan's seminal article led to the shift in the institutionalization view. Perrow (1972) viewed institutionalization as a process, while Meyer and Rowan (1977) viewed institutionalization as a distinctive set of elements or properties. Isomorphism can lead to the incorporation of elements for the purpose of gaining legitimacy even though it may lead to compromising organizational efficiency and the use of external assessment criteria rather than internally generated assessment factors. Depending on externally fixed criteria, institutions can assist with reducing turbulence and maintaining stability. Organizations can become authentic, and use this legitimacy in order to improve its sustenance and ensure its subsistence.

The way to establish institutional isomorphism is to construct a shared, or common, organizational language.

Zucker (1987) argued that institutionalization can alter cultural persistence that dominates business practices. He mentioned that institutionalization does not simply exist or not. According to Meyer and Rowan (1977), institutionalization is treated as a variable that can change over time. According to Zucker (1987), as the degree of institutionalization increases so does the generational standardization of social acceptance, the ability to maintain deprived of influence from unswerving social control, in addition to the amount of opposition to change through personal effect. Euske and Roberts (1987) stated that, under the institutional theory, organizations will conform to environmental expectations by adapting certain “appropriate” (rational) structures and behaviors, and the environment will deem the organization to be legitimate and will provide the required resources (e.g., financial support, generalized acceptance).

Drivers of institutional change can be characterized as forced or imitative (Powell and DiMaggio, 1983). Political or legal pressure to increase legitimacy is one form of coercive isomorphism. DiMaggio and Powell (1983) illustrated that these pressures could result from government mandates that require organizations to follow pollution control regulations. Mimetic isomorphism occurs when administration's attempt to imitate the paths of other similar companies. DiMaggio and Powell (1983) explained that mimetic isomorphism can occur when members of an organization misunderstand technologies, face ambiguous goals, or must deal with excessive environmental uncertainty. Replicating the actions of legitimate organizations can increase an organization’s legitimacy. DiMaggio and Powell (1983) stated that organizations have a tendency to follow the actions of similar organizations it perceives to be more authentic or prosperous.

DiMaggio and Powell (1983) claimed that organizations are all becoming the same because governments and professions have pushed for homogenization for the purpose of efficiency. A number of powerful forces, including competition and the state, have compelled very different organizations that trade in the same marketplace to become similar to each other (p. 148). As previously described, there are three forces that drive isomorphism, as well as two types: competitive and institutional. With institutional isomorphism, in addition to challenging for capitals and clienteles, organizations correspondingly contest for institutional legitimacy, political power, and social and economic aptness.

According to DiMaggio and Powell (1983), institutionalized organizations can be characterized as follows:

(a) Organizations tend to become similar to their degree of dependence on each other increases;

(b) Organizations are expected to become similar as they leverage the same resource supply;

(c) Organizations tend to copy each other's' successes, which makes it easier to become similar;

(d) Organizations depending on the single source of revenue are expected to have a higher level of isomorphism;

(e) As organizations transact with agencies of the same status, there is an increase in the probability of isomorphism in that field;

(f) As technologies are uncertain within a certain sector, isomorphism within that sector increases.

DiMaggio (1988) argued that it is costly to create new institutions, as it requires a significant amount of interest and resources. He added that new institutions will arise after organizing their resources to realize an opportunity of interest. According to Zucker (1987), as institutionalization increases (1) the level of competency of its members (e.g., their craft, the social system or the professional subsystem) are anticipated to share their unique skills; and (2) the characteristics of exteriority and objectivity increase, which makes it that much more difficult to implement change. In theory, organizational tasks and skills length of history, the number of organizations within the same group, the degree of explicit codification in the form of work rules, promotion hierarchies, and the degree of embeddedness in a network of tasks will dictate the degree of institutionalization.

An organization becomes institutionalized when similar organizations exist and it has been in business a long time. A rich history allows an organization to create an established set of rules that connects all of its tasks. Greenwood and Hinings (1996) outlined a number of proscribed and prescribed practices that institutionalized organizations must follow; these practices limit which aspects of those organizations become institutionalized, as some organizational sectors are more subject to institutionalization than others. They maintain that institutionalization affects, and is affected by, the organization's domain (what it does), its form (how the organization is structured to carry out its functions), and its evaluation criteria (what determines the organization's success).

In addition, Eisenhardt (1988) discussed the institutional theory in a different context. He mentioned that most organizational practices are imitations from other organizations. Industry legislation, social pressure, and political forces push organizations to institutionalize their organization to conform to its environment. According to Eisenhardt (1988), socially acceptable business practices might not directly impact firm profits, but organizations will follow these practices to preserve organizational legitimacy. For example, a company will install pollution control devices even if there is no legal mandate to do so.

According to Tolbert (1985) and Tolbert (1988), once an organization has become established as an institution, it must share these institutionalized rules and behaviors with new members to ensure the institution's continuity. Tolbert in both articles argues that it is easier to transmit and maintain these rules, norms and procedures when new members have similar experiences and backgrounds as existing members, and will require less formal socialization. Euske and Roberts (1987) found that there is more frequent interaction between employees who more readily assimilate newcomers. Meyer and Rowan (1977) determined that highly institutionalized organizations will separate their technical and administration functions to avoid evaluation of their technical area. Weick (1969) calls this form of separation "loose coupling" and it helps organizations to survive crises. March and Simon (1957) also stated that institutions will detach their institutional and technical elements from each other.

Criticism of the institutional theory was raised by Scott and Meyer (1994) and Scott (1995) who claimed that it is in its adolescence, identifying four different sociological forms of the institutional theory. The first type is based on Selznick's (1948) view of the organization as adaptive creatures to its external environment. In his view, institutionalization is merely a process that instills value. The second form refers to Meyer and Rowan's (1977) and Zucker's (1977) views of institutionalization as a social process. In their opinion, social reality will be defined by organizational conformity to the way things ought to be done. The third realm was introduced by DiMaggio and Powell (1983) and Scott and Meyer (1994), who viewed institutionalization as a class of elements. They made a clear distinction between technical aspects and institutional ones. Scott and Meyer (1994) compared technical and institutional environments as follows:

a) A technical environment is one in which organizations sell or exchange their merchandise or service in a market where they are compensated for effectively and efficiently controlling their production system.

b) An institutional environment involves intricate guidelines and requirements to which individual establishments must obey to receive backing and legitimacy.

These two states coexist, which is why Powell (1991) instructs researchers to avoid treating "technical and institutional sectors as dichotomous alternatives. Organizations are governed by rules, norms, and requirements that must be followed to be seen by society as legitimate. Forces that impact the processes of institutionalization and its patterns could be coercive or mimetic. The last domain was introduced by Selznick (1948) and Friedland and Alford (1991) who looked at institutions as distinct societal spheres. They stated that different institutions have different social norms and patterns, which makes it difficult for people to agree which institution should be making the rules.

Scott (1987) and others criticized institutional theory by claiming it is in its adolescence, identifying four different sociological forms of institutional theory. The first type is based on Selznick's (1957) view of organizations as adaptive creatures to their external environment. In his view, institutionalization is merely a process that instills value. The second form refers to Meyer and Rowan's (1977) and Zucker's (1977) views of institutionalization as a social process. In their opinion, social reality will be defined by organizational conformity to the way things ought to be done.

The third realm was introduced by DiMaggio and Powell (1983) Meyer and Scott and (1991), who viewed institutionalization as a class of elements. They made a clear distinction between technical aspects and institutional ones. According to Scott and Meyer (1991), organizations in a technical environment create or interchange a product or service in a system that rewards them for efficiently and effectively controlling production, whereas organizations in an institutional environment must follow elaborate rules and requirements to receive support and legitimacy.

Jennings and Zandbergen (1995) employed an institutional lens to understand corporate environmentalism. Some researchers attempted to define the origins and growth of the environmental practices of organizations. Hoffman (2001) examined how environmental protection can progress within a body and how it can begin to react. In these instances, environmental protection does not simply imply the environment, it also becomes an issue of ethnic interests and beliefs as well as different managerial perspectives. Therefore, when firms face demands to get involved in environmental protection, their responses are culturally framed, and involves issues such as risk control and issue management, abiding by market demand, human resource supervision and corporate social duty, (Hoffman, 2001).

2.5 The Stakeholders Theory

The first to introduce one kind of stakeholder relationship was Barnard in 1938. In 1984, Freeman argued the interests of employees in consideration of the firm's decision-making process. In his book, Strategic Management: A Stakeholder Approach, he provided the foundation for defining and building stakeholder models, frameworks, and theories. Since then, stakeholder theory has become popular. Most studies involving stakeholders focused on maintaining a positive and healthy relationship with all firms' stakeholders to react to the ever-changing environment. Freeman et al. (2010) redefined business environment in light of its stakeholders. The framework is built mainly on the firm's ethical behavior.

Freeman (1994) and Freeman, Wicks, and Parmar (2004) stated that organizations serve their stakeholders, and executives are responsible for increasing the organization's value for stakeholders. In their study, they argued that organizations must combine business and ethics because the majority business decisions involve dimensions of ethical content or have an underlying ethical view. Freeman, Wicks, and Harrison (2007) discussed the role of managers who make accountable decisions for the business stakeholders such as suppliers, clients, contractors, employees, communities and shareholders. Three major aspects are used to differentiate between a firm's stakeholders. According to Preston and Donaldson (1995), the three aspects are normative, descriptive, and instrumental.

Preston and Donaldson (1995) discussed the descriptive aspect of the three-dimensional stakeholder theory. Using different time frames, they defined the relationships between different shareholders and the organization. Gibson (2000) described the importance and methodology of dealing with stakeholder relationships, such as how to manage stakeholders and determining whether managers consider stakeholders' interests. Jones and Wicks (1999) explained the instrumental aspect of the stakeholder theory in their study. Pesqueux and Damak-Ayadi (2005) assessed the relationship between different stakeholder approaches and achieving organizational goals. These studies determine that organizations that engage in stakeholder management will experience improved profitability, stability, growth, etc. when compared to their competitors. Donaldson and Preston (1995) explained that the normative approach to stakeholder theory describes ethical or logical guidelines for organizational management and operation. Fassin (2009) stated that this perspective's underlying supposition is that all stakeholders' interests have intrinsic value. He added that organizational decision-making must consider stakeholders' legitimate interests.

Donaldson and Preston (1995) indicated that after Freeman's work in 1984, a large number of research papers and articles have been issued in the shareholder field. Due to the diversity of studies on shareholders, literature from descriptive, instrumental, and normative approaches were examined due to their relevance to the objectives of this research. This section of the dissertation introduces academic key contributions to what is known now as the shareholder theory based on the three diverse approaches. There is currently no agreement regarding a clear definition of a firm's stakeholders among the literature.

According to Freeman (1984), stakeholders include any individual or group that can have an impact, or that can be impacted by, achieving an organization's goals. Agle and Mitchell (1997) and Wood Mitchell, and Agle (1997) stated that this definition is extensively quoted in shareholder literature. However, possible stakeholders can include any person. Mellahi and Wood (2003) defined stakeholders as all groups or people that have the possibility of being affected by a firm's actions. Another definition was introduced by Gibson (2000), which refers to stakeholders as the organization's formal group of individuals that interdependently interact with its different activities.

However, other views of stakeholders account for the individual's or group's direct relevance or importance to the organization's sustainability or its fundamental objectives. A memo originated from Stanford Research Institute was published in 1963 and cited by Freeman in 1984 states that stakeholders are groups that provide support to organizations in order not to stop their operations without that support; these stakeholders have an interest in the firm's to which they are entitled to (Clarkson, 1995; Holder, Langrehr, and Hexter, 1998). Savage et al. (1999) emphasized that shareholders have an attentiveness towards the organization's actions, as well as their ability to influence it.

According to Evan and Freeman (1990), Wartick, Thompson, and Smith (1991) and Jones and Hill (1992) described stakeholders as contract holders or those who are involved in a transactional exchange. Preston and Donaldson (1995) define stakeholders as individuals or a collection of individuals that possess an authentic interest in technical and/or functional aspects of the corporation's actions, whether or not the corporation has a corresponding functional interest. As it is apparent, different definitions of stakeholders tend to be inclusive. On the other hand, empirical studies claimed that an association can impact and be impacted by various entities. However, Mitchell et al. (1997) considered the limitation of the stakeholder theory. They added that managers need to deal with stakeholders.

The stakeholder relationship is a key aspect of stakeholder theory. With each stakeholder, there exists a relationship with the organization, as definitions of stakeholders include the terms "influence," "interest," "stake" or "contract." These relationships involve dynamic transactions, action influences, and moral responsibilities. Jones and Hill (1992) stated that the relationship between the firm and the stakeholder involves give-and-take. Researchers defined stakeholders using the "relationship" theory (Hill and Jones, 1992). Wartick et al. (1991) defined stakeholders as assemblies of people that have a business relationship with an organization.

Stakeholder relationship as a unit of analysis should be considered (Freeman, 1984). Berman, Wicks, Kotha, and Jones (1999) added that prior literature has used various factors to assess the quality of stakeholder relationships, including efficiency and fortitude. In addition, Ulmer (2001) argued that there are two types of characteristics of stakeholder relationships found in the writing. Murrell and Frooman (2005) explained that demographic features apply to the stakeholders while structural features encompass the relations between an association and its stakeholders and between each stakeholder.

Freeman (1984) stated that stakeholder interest is a defining characteristic of various stakeholder assemblies. In prior writings, Donaldson and Preston (1995) argued that interest and stakes can often be used interchangeably. Carroll and Buchholtz (2000) defined a stake as an awareness or segment in an undertaking. This can range from general or mild interest in an enterprise to a stock of ownership, and between these two limits the stake could be any sort of right. Stakes fall into one of three major categories: influence, economic, or equity stakes (Freeman, 1984). Different types of stakeholders can have varying kinds of stakes.

Moldoveanu and Rowley (2003) introduced the concept of stakeholder identity. they also argued that stakeholder groups each have a unique identity which is socially created and implanted, and involvement in a stakeholder group can be characteristic of an individual's identity because a group's individualities extricate its members from those who are nonmembers. A possible scenario could be where a member of an environmental activist group will adopt the identity of protecting the environment to conform to the groups beliefs.

Stakeholder size normally refers to a number of people and/or a capital financed which grant stakeholder's the right to take actions (Carroll and Buchholtz, 2000). Stakeholder theory attributes include (a) determination, (b) legality, and (c) control (Agle, Mitchell, and Wood 1997). Power is a structural characteristic while legitimacy and urgency are demographic attributes. Frooman (1999) built upon the structural method by concentrating on associations amongst stakeholders and organizations. Rowley (1997) argued that power is the most imperative quality, and is directly and inadvertently covered by prior literature.

Reed and Freeman (1983) labeled stakeholder power in three types. First and foremost is the formal or voting power. The second is the economic power. Finally, the political power which is the last on the spectrum. Wood, Mitchell, and Agle (1997) use the attribute of control to pronounce stakeholder connections. Preffer's (1982) explanation of control that performers have a relationship such that the first performer can get the second performer to do something that the second actor would not do under other circumstances. Foundations of power can be classified according to Graham and de Ven (1983) and Astley and Sachdeva (1984) to (i) network centrality, (ii) personal source, (iii) resource control, and finally (iv) hierarchical authority.

Laine (2010) defines the concept of contiguity proximity. The author argued greater proximity and its impact in increasing the chance of developing stakeholder relationships. Two entities can be proximate if they are physically close or share a similar notion or practice as well as being in the same field. Laine (2010) stated that proximity is evident in organizations that are contained in the same business or that share the same stakeholders.

Researchers have used different bases of power to describe the stakeholder connection. Rowley (1997) used network structure and position to analyze stakeholder relationships. Network concepts included network density and focuses on the significance of the focal institution. "Density" refers to the quantity of network ties that associate stakeholders; this determines the degree of power of the network of the stakeholder which allows a direct effect on the focal organization's activities. "Centrality" denotes the focal organization's situation in the network with respect to other stakeholders, which indicates the focal organization's power. Welcomer (2002) extended Rowley's (1997) analysis by strengthening the bond between the focal institution and its stakeholders. Frooman (1999) considered a relationship's resource dimension and described stakeholder-firm relationships based on who is dependent upon whom. From these points, it is clear to see that power is a central constituent within the stakeholder's theory.

2.6 The Legitimacy Theory

Suchman (1995) stated that "legitimacy" refers to an organization's efforts to advance the suitability of its actions within a distinct set of guidelines, standards, morals or beliefs. The actions of a legitimate business are seen as desirable or suitable within a socially created system of guidelines, standards, morals, beliefs and definitions. Scott (1995) emphasized how communal and cultural pressures influence an organization's practices and constructions. Suchman (1995) stated that within the containments of this research area, scholars challenge the belief that businesses are only interested in seeking incomes and their achievement depends on entirely upon their competitiveness. DiMaggio and Powell (1983) highlighted the institutional pressures that result in external legitimacy and organizational conformity. Scott (1995) stated that institutional influence can be described as regulative, normative or cognitive. North (1990) added that these characteristics are evident in so many different ways.

Zucker (1987) mentioned that some organizations are very noticeable and unswervingly coercive while others are unclear and overlooked. DiMaggio and Powell (1983) argued that the social legitimacy of a social organization is directly tied to their sustainability and long-term survival. Suchman (1995) emphasized that the institutional theory follows the concept that a firm's survival and success depends on upon the degree to which it complies societal rules, norms, and beliefs. Therefore, legitimacy is a central reason for administrative changes to institutional environments.

For the purpose of this research, we used Suchman's (1995) definition of legitimacy as the observation that an entity is necessary, appropriate, or suitable within a socially constructed system of guidelines, standards, morals or beliefs. However, Mitchell et al. (1997) stated that urgency is the point at which stakeholder claims require immediate attention from the institution. Therefore, legitimacy relates to the stakeholder or their claim, while urgency refers solely to the stakeholder's claim. Agle, Mitchell, and Wood (1997) claimed that the stakeholder's legitimacy can depend on upon an agreement, exchange, legal or morally right.

Peng, Lee, and Wang (2005) stated that legitimacy has become more important in amplifying the relevance of social influences on commercial strategic decision-making. Jennings and Zandbergen (1996) explained that legitimacy has been instrumental in discovering what influences practical corporate environmental enterprises and performances. Within the area of business environmental management, Delmas and Toffel (2004) argued that legitimacy has surfaced in two dissertations. Firstly, Hahn and Scheermesser (2006) stated that legitimacy was useful for elaborating upon the development of firms' environmental sustainability. Secondly, Khanna (2001) and Khanna and Anton (2002) elaborated on the reasons whereas to why a firm has a desire to achieve legitimacy.

According to Parsons (1960), legitimacy involves the appraisal of action with respect to mutual values in the setting of involving action in the social system. He also stated that legitimation links values as an internalized component of the individual's personality and the institutionalized patterns that define the structure of social relationships. Parsons focused on the institutionalization of patterns of behavior that society has deemed to be legitimate.

Prior scholars have researched the main performers that cause firms to react to environmental concerns. For example, Powell and DiMaggio (1991) indicated that organizational surrounding can involve the social external environment, the political arena, and economic welfare. There are diverse subpopulations that influence the prescription or articulation of environmental legitimacy concerns (Berry and Rondinelli, 1998, Roth and Bansal, 2000, Toffel and Delmas, 2004). Regulators or supervisors are viewed as most influential, as they have the capability to establish environmental laws (Verbeke and Rugman, 1998, Paulraj, 2008). Sardrsky and Henriques (1996) also established that government guidelines are the single most significant basis of pressure on firms with respect to developing environmental plans.

To pursue legitimacy, regulatory burdens under the Kyoto Protocol have spurred corporate carbon management practices (Adger, Paavola, Huq, and Mace, 2006). For example, as some energy-intensive industries in the EU have required emissions trading, regulatory compliance has motivated some firms’ engagement in the program (Kolk and Pinkse, 2007). There have been many federal- and state-level climate enterprises in the US that are designed to maximize possible energy efficiency and reduce greenhouse gas emissions (Prakash and Hsueh 2009). Although the US initiatives are charitable, these ecological programs have encouraged firms to manage their carbon emissions because they want to be viewed as institutions that abide by regulations

Legitimacy may also explain why certain firms continue to manage carbon emissions. Yet, this does not thoroughly explain the cause to why firms differently respond in an institutional setting. In supplementary words, some firms do not apply carbon management regulations even when faced with institutional pressure. Different firms react differently to institutional pressures from constituents, especially when firms’ motives for competitiveness are different. Therefore, one must consider both competitiveness and legitimacy when attempting to explain the different approaches to adopting carbon management practices that organizations take.

2.7 Deduction

The main purpose of this Chapter was to represent the building blocks for the theoretical perspectives that are central to answering the main questions posed in Chapter One. The resource-based view (RBV), including related arguments like the capabilities approach and the dynamic capabilities concept, were discussed thoroughly. The institutional theory, as well as stakeholder's theory, were presented as complementary views. Legitimacy theory was introduced to explain the importance of social influences on corporations. In conclusion, the five views are relevant to the research and key in building the proposed theory for the interpretation of the linkage between innovation and sustainability. It is also critical in explaining their combined effect on corporates’ financial performance.

Chapter 3

Conceptual Framework

3.1 Innovation

Thinking about the novel and improved ways of doing things and trying them in practice seems to be a natural tendency in humans (Fagerberg, 2003). This bent is as old as mankind and the common name for this phenomenon is "innovation," which usually refers to the first commercialization of an idea. Invention and innovation are not synonymous, as some might think as there is often a time lag between the two and innovation typically requires a variety of skills, facilities, market knowledge and financial resources (Fagerberg and Verspagen, 2009). The invention includes new concepts or products that are the result of an individual's ideas or scientific research. However, innovation involves the commercialization of the actual invention. One can conclude that there are as many definitions of innovation as there are reported experts in the field.

Schumpeter (1934) argued that innovation could involve: (1) a new product development or a significant change in an existing product, (2) the institution of a new process that will improve an organization's overall performance, (3) the creation of new markets, or (4) the development or use of new raw material sources of supply and other new organizational inputs. He also stated that innovation typically results in a continuous struggle between entrepreneurs and social inertia Damanpour and Evan (1984) stated that innovation is a commonly understood concept and that one should define the term to reflect the requirements for a particular study. Therefore, different definitions of innovation are introduced in the next section.

Thompson (1965) indicated that innovation generates, accepts, and implements new ideas, processes, products or services. Mohr (1969) stated that innovation describes the degree to which new changes are implemented within an organization. According to Downs and Mohr (1976), innovation is a characteristic of a social organism. Zaltman (1973) explained that innovation refers to a notion, drill, or material artifact viewed as a novel by its adapter. Drucker (1985) defined it as a change that creates a new dimension of performance.

Kline and Rosenberg (1986) stated that innovation is an organized, interactive process that includes a number of commercial and technological functions. Amabile (1988) pointed out that commercial success cannot be the sole indicator of creativity since many of the variables influencing commercial success are independent of creativity. According to Damanpour (1991), innovation leads to the creation, development, and use of new ideas within a firm's function. Nohria and Gulati (1996) stated that innovation relies on an organization's views on the novelty of a policy, structure, method or process, or a product or market opportunity. Amabile et al. (1996) described innovation as the successful integration of creative ideas into an organization, adding that commercial success is not the only determining factor of creativity as several influencing variables with respect to commercial success are independent of creativity. Cumming (1998) emphasized how innovation must achieve some level of successful commercialization, which means more than universal acceptance of a new idea and/or concept.

Schmittlein and Mahajan (1982) argued that innovation involves more than creating and adding a new product to the marketplace, as it can extend to market processes and approaches. Merrifield (1988) stated that the innovation process consists of three stages: invention, translation, and commercialization. Schumann and Ransley (1995) examined innovation from the resources point of view, stating that it involves using creativity to transform an enterprise's resources into new resources. Boer and During (2001) stated that innovation involves the simultaneous development of a new product, market, technology, and organization. Drucker (2002) indicated that most innovation is not the result of a "eureka" moment, but rather the end result of focused and purposeful hard work. Cabral (2003) defined innovation as the introduction of a new element into the network that affects the transaction costs between two or more network actors, elements or nodes. According to Campos (2004), innovation includes the ability to provide a customer with new value. Freeman and Engel (2007) described innovation as a process that begins with a novel idea and ends with a market introduction, where the central elements include movement of resources and alignment of incentives.

The Canadian professional board on the socioeconomic influences of innovational investments defined innovation as the engine behind new and/or improved products and processes that drive organizational competitiveness by generating income to sustain its existence. The panel added that the dynamism within the innovation ecosystem is the result of solving or creating technical and/or social problems (Council of Canadian Academies, 2013). The Canadian expert panel on business innovation stated that innovation is a novel or different way of doing things that add value. It is not limited to product or process, but it also includes, for example, business model (e.g., new web-based business model) or assembly line (e.g., Ford's Model T assembly line). On the other hand, the panel stated that invention is not an innovation until it's implemented widely. It also distinguished between radical and incremental innovation. According to the report, radical innovation (e.g., steam engine and transistor) creates new markets, while incremental innovation is perceived as a continuous improvement endeavor on existing goods and services (Council of Canadian Academies, 2009).

The 2012 Canadian professional board indicated on the state of science and technology (S&T) that innovations typically have economic impacts; however, there is a lag in innovation that results in a significantly lower environmental and social footprint. The panel employed the corporate enterprise spending on research and development indicator (BERD) to measure innovation trends within a specific sector. The report stated that BERD is correlated with patent activity measured in patent numbers recorded in USPTO, stands for United States Patent and Trademark Office, which is selected by researchers to be the primary quantitative indicator of innovation. USPTO is also used by Canadian patent filers and considered an important venue for patent and trademark registration outside Canada. This report also indicated that patent analysis is effective in evaluating research marketing, technological developments, and adoption of improved methods of practice.

Based on all relevant academic research and authoritative innovation publication bodies, two things are certain: first, the most important outcomes of innovation should be a social benefit (e.g., the generation of capital, and economic growth); second, technological invention alone does not equal innovation. Without commercial efforts, even an excellent new innovation will die on the shelf without generating economic value or social impact. It has been historically proven that new scientific discoveries and technology will drive industrial revolution. In the past, most business economists have looked at innovation from a management perspective. However, it is critical to identify different factors that can promote innovations so that organizations can decide where to invest resources (Phaal, Farrukh, and Probert, 2004).

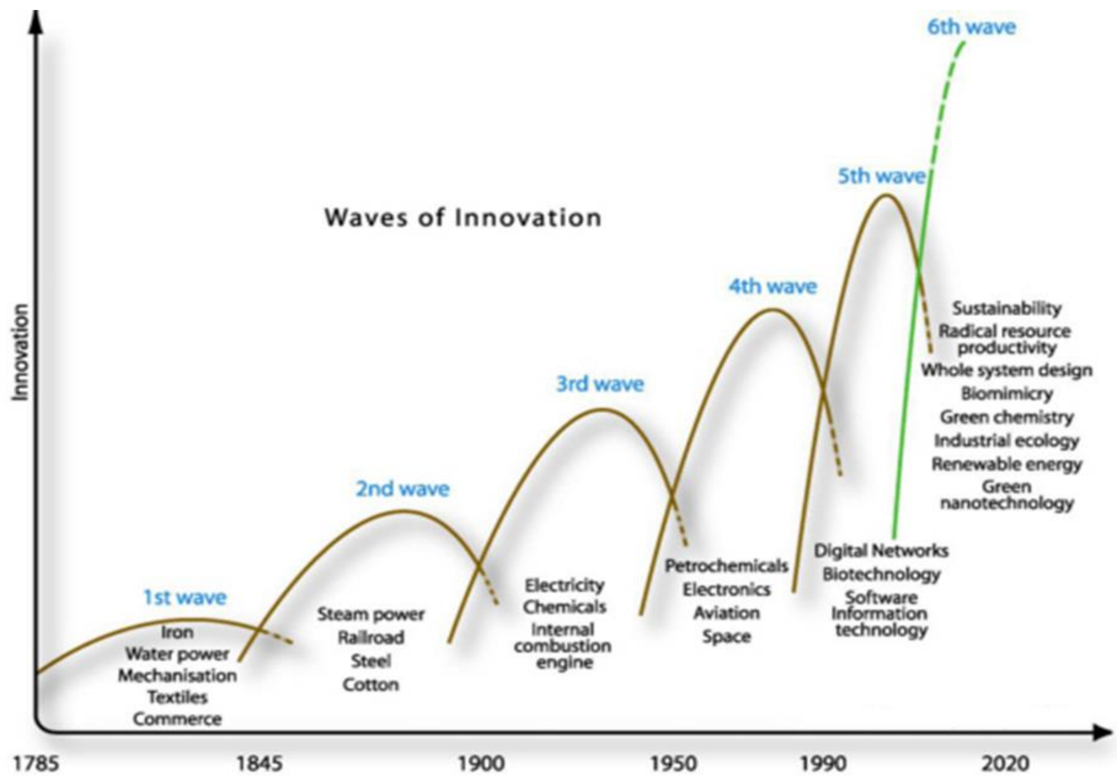
Several models of innovation can serve as a foundation for understanding the concept of innovation and how the firm and the society can capture value from a particular innovation. These models include: (a) Theory of innovation cycles by Schumpeter; (b) Product and process innovation model by Abernathy and Utterback; (c) Innovation diffusion, technological trajectories and technological substitutions 'S' curves; (d) Innovation diffusion model by Teece; (e) Innovation theory by Clark and Henderson, and (f) Disruptive and sustaining innovation theory by Christensen.

3.2 Theories and Models of Innovation

3.2.1 Schumpeter's Theory

Schumpeter (1934) stated that innovation is a driver of economic development and market competitiveness, and firms must innovate to increase profits. He argued that significant technological changes have occurred in clusters rather than being evenly distributed across time or industries. Schumpeter's book Business Cycles (1939) introduced the concept of long wave curves, which are not uniformly shaped and last approximately 50 years. As time passes, the innovation's complexity will increase, so each curve becomes shorter, as shown in Schumpeter's proposed model (see Figure 3.1).

Figure 3.1 - Schumpeter's Waves of Innovation



He stated that innovation involves a transformative process that constantly changes the economic structure from within by destroying the existing model and replacing it with an updated or newer version. Innovation involves carrying out new combinations of resources within our reach, which results in the emergence of economic development. Another important insight from Schumpeter's model is that innovation can be seen as waves of "creative destruction" that restructure the market in favor of new ideas that more quickly grasp discontinuities. Schumpeter arranged the innovation process has three components: invention, diffusion, and imitation.

According to his theory, innovation involves drawing upon inventors' discoveries to create new opportunities for growth, investment, and employment. His analysis determined that the invention phase impacts the process less significantly than diffusion and imitation with respect to the economic state. With respect to economic growth (i.e., investment and employment), innovation matters less than the actual diffusion of innovation, this occurs when imitators discover the potential profitability of the product or process and begin investing in it. Schumpeter's work is very heavily cited in the literature as it sheds light on the social benefits of innovation.

In his argument, he stressed that profits resulting from this evolutionary process over time can be best described as the outcome of profit-seeking activities rather than the outcome of restrictive profit-maximization practices. In other words, profit-seeking activities are directed toward a specific technology at a specific time period. Schumpeter's dynamic and systemic aspects of innovative profits theory can be viewed as the firm's driving forces to use new technological opportunities to create value-add for society and not simply secure temporary monopolistic profits and subsequently create new wealth for the economy through market power (Phillimore, 2001). Such activities can help firms to restructure their established circular flow of income (Cantwell, 1989).

However, the profit benefits of innovative activities do not automatically accrue to the "first to discover" or the "first to commercialize" a groundbreaking technology, but rather to firms that can continually uncover new fields of application and apply these promising activities to novel contexts (Cantwell, 1989). Schumpeter focused his research on how creative destruction resulted in the development of radical innovations and showed how they influenced above-average rents in an endogenous economic system. However, future research focused on establishing theoretical and empirical foundation connected to incremental innovations that can lead to the development of technological change (Phillimore, 2001).

It is important to note that scholars have extended Schumpeter's arguments by suggesting that labeling innovations as "radical" and "incremental" are the extreme edges of the technological impact continuum. According to Durand (1992), radical innovations start the cycle of technological change; over time, incremental innovations are introduced to the marketplace, while synthetic innovation provides an interim category of innovation impact between radical and incremental innovations (Tushman and Nadler, 1986).

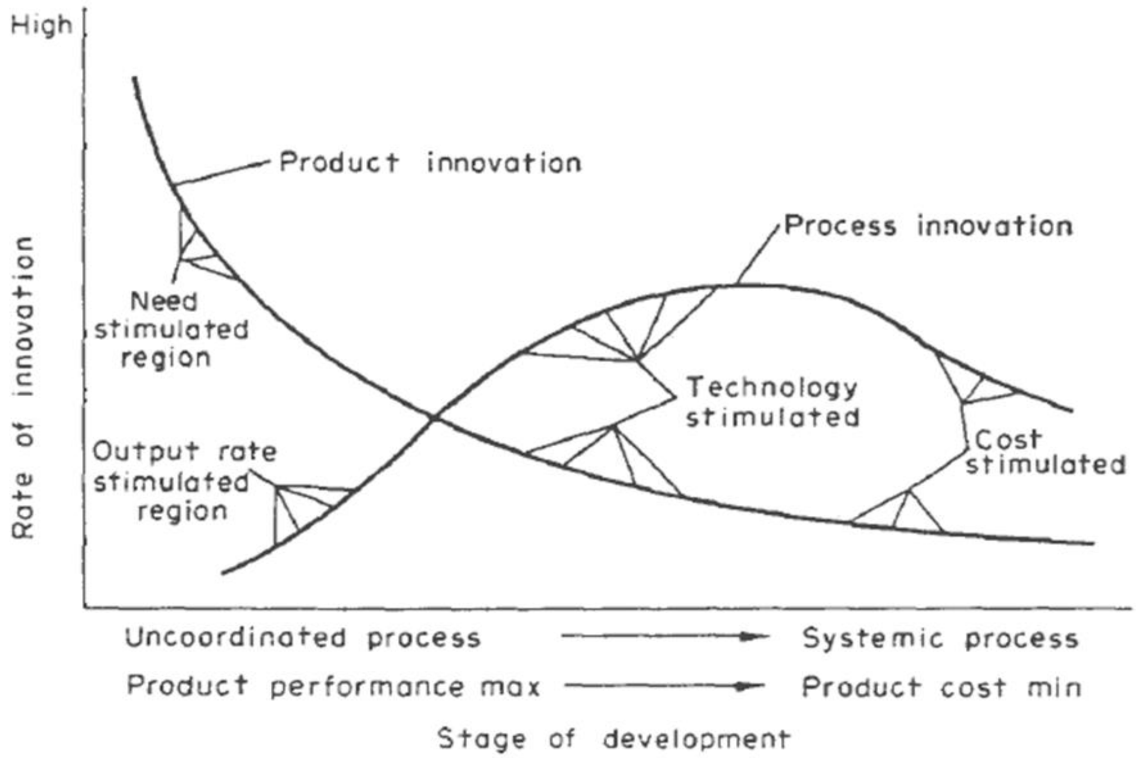
Most of the research focuses on the two polar extremes of innovation because they are easier to interpret and measure (Dewar and Dutton, 1986). The degrees of innovation impact can be further divided into two categories: product innovation and process innovation. Product innovations involve changes in products and/or services introduced by the company to meet a new need in the marketplace. Process innovations are improvements (e.g., cost minimization, product standardization) a firm makes to its products and/or services (Abernathy and Utterback, 1975).

3.2.2 Abernathy and Utterback Model

The Abernathy and Utterback model also referred to as the AU model, has significant impacts on innovation studies. The AU model of innovation focuses on the development of product and process revolution and was formulated through the accretion of three principle works (Abernathy and Utterback, 1975, 1978). Utterback and Abernathy (1975) is considered to be the first study that shifted the focus from only looking at radical innovations at large and how they are guided to studying product and process innovation. Utterback and Abernathy (1975) looked at the rate of change of the innovation in reference to the stages of its development for both products and processes.

According to their view, radical innovations are most likely generated in the early stages of development within the unconnected stage. As shown in figure 3.2, product innovation in its early stages of development is market stimulated with a high degree of uncertainty about its potential. Technology plays a critical role in it success and performance. The curved line depicts that the rate of product innovation diminishes over time. On the other hand, process innovation starts by uncoordinated activities and reaches its peak as it becomes systematic. The curved line starts at a low rate of innovation and increases over time. Again, technology plays a significant role in the process innovation and as time goes, incidence rates for process innovation decrease again. Both product and process innovation curves will be stimulated by cost at this development stage.

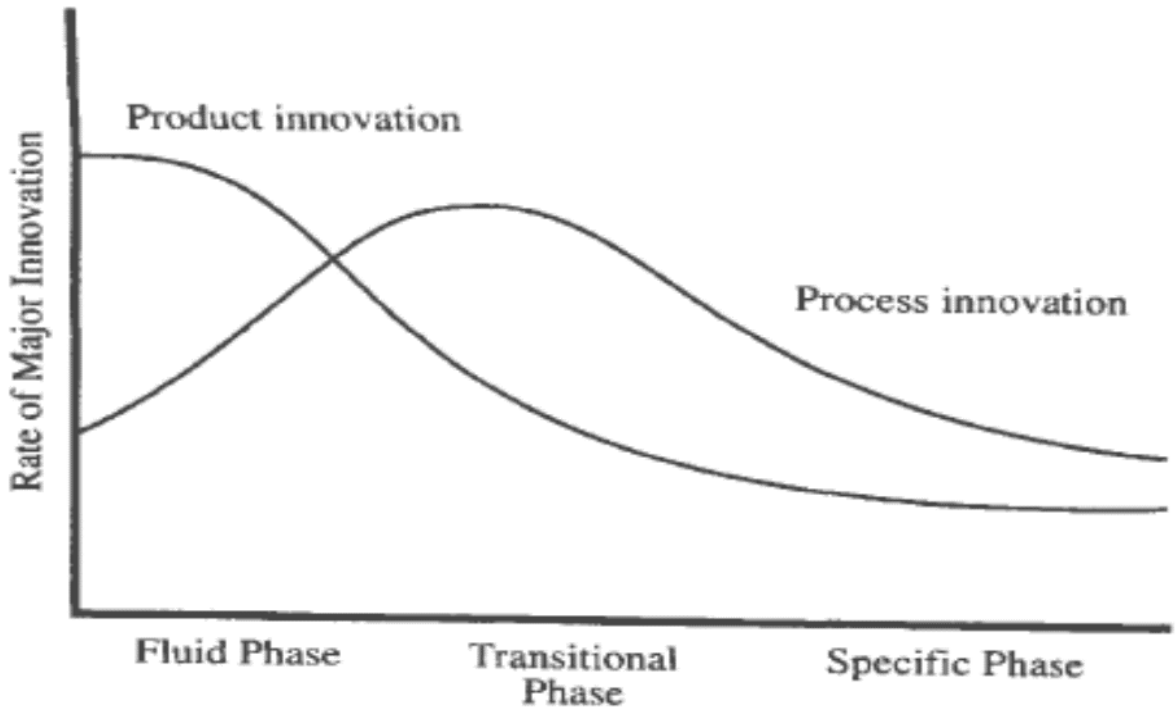
Figure 3.2 - A U model in Utterback and Abernathy (1975)



The model proposed by Abernathy and Utterback (1978) frames the behaviors of product and process innovations, which includes three phases: fluid, transition and specific. The fluid phase applies to early-stage innovation, which includes high rates of innovation because development requires many designs and operational factors. In the evolutionary phase, innovation touches near full adoption; the rate of the products innovation declines rapidly while the rate of process innovation gradually increases. Their proposed model is depicted in Figure 3.3.

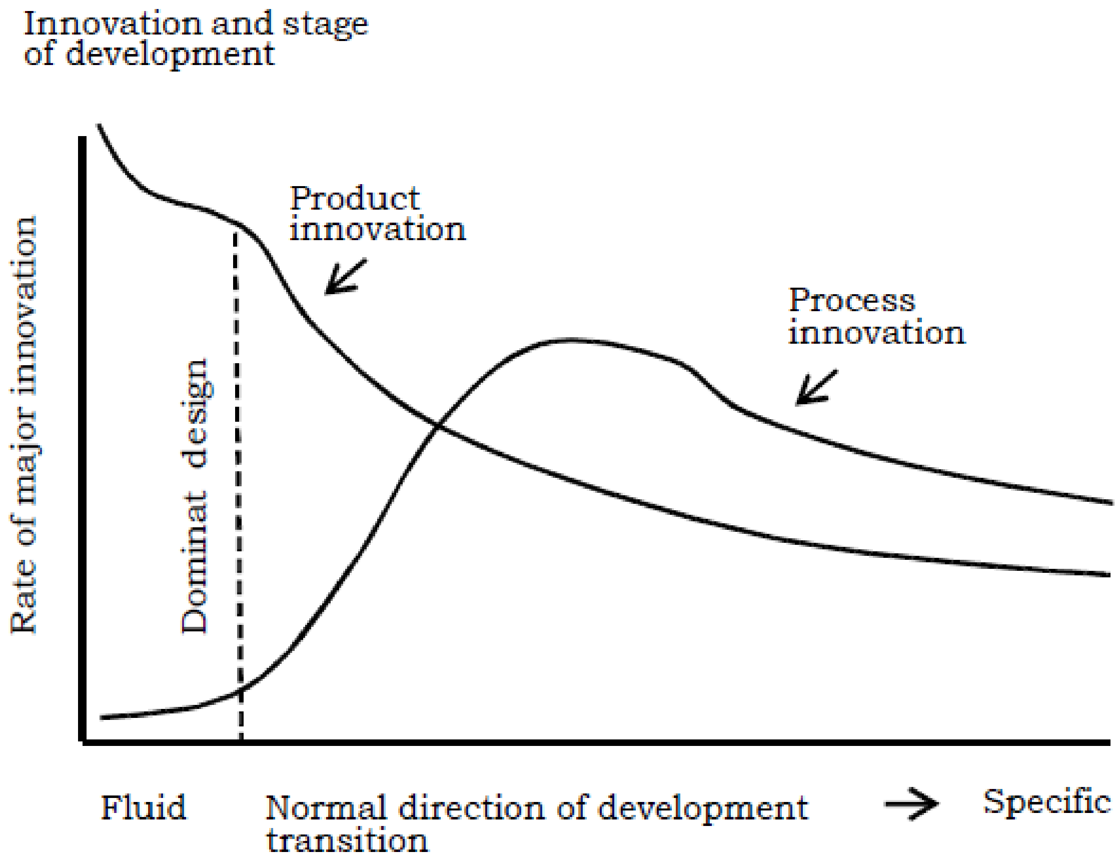
As seen in this model, during the introduction and growth stages, many firms enter the market and compete to establish the dominant design or product standard. The time required to establish this design or standard depends on whether the innovation improves or destroys the current knowledge base. Revolutionary innovations that destroy the industry's knowledge base typically require a longer time period to develop.

Figure 3.3 - A U model in Abernathy and Utterback (1978)



Abernathy (1978) focused on the development of a new dominant product design emerging in an industry. The product over time enters the maturity stage where incremental or small changes make up the majority of innovative improvement. The primary competitive focus of firms, during this particular stage of product development, is on key issues such as price, product quality and segmentation. The AU model recognizes that as the dominant product design becomes more standardized the focus of technological innovation shifts to processing innovation (see figure 3.4).

Figure 3.4 - A U model in Abernathy (1978)



According to the AU model (Abernathy and Utterback, 1975, 1978), (1) this evolutionary process of technology development moves from a more fluid and discontinuous (radical) state to a specific (incremental) state; (2) incremental innovations improve new-to-world products or radical innovations; (3) radical innovations compete for dominance during the growth stage; and (4) once the industry decides upon and accepts a dominant design of a particular product class, it is capable of reaching significant production volume.

3.2.3 Innovation 'S' curves

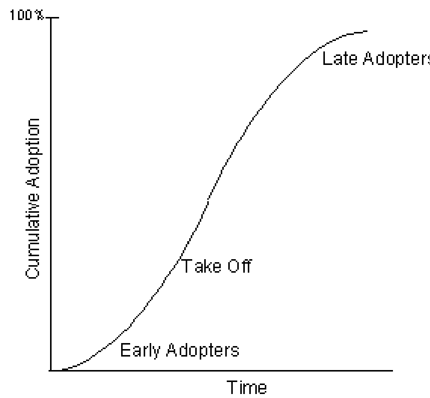
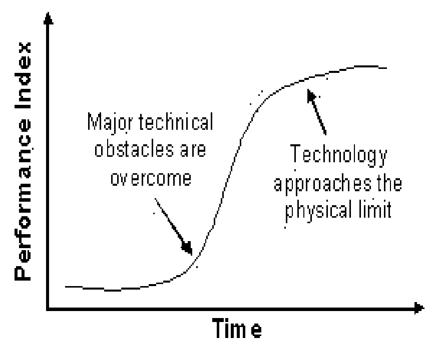
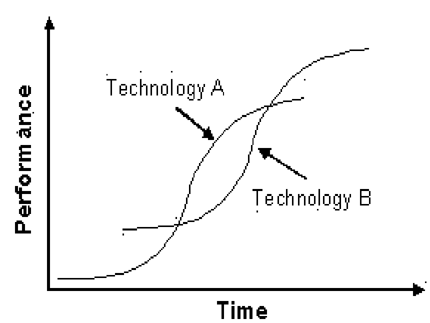
The 'S' curve of innovation enables a better comprehension of the nature of the innovation and its expected progression. It aids in explaining the diffusion of innovations, technological patterns, and technological replacement. Rogers (2003) stated that diffusion ‘S’ curve analyzes how an innovation diffuses through a social system. These models use variables from the industrial market structure that supports the diffused innovation, and they include other aspects of the economic environment. Rogers (2003) stated that diffusion enables communication of an innovation through specific time frames between different social players.

The ‘S’ curves of technological trajectories indicate that a new technology creates a turbulent period, which leads to improvement, gradually diminishing returns, and eventual displacement by a new technological discontinuity (Utterback and Abernathy, 1975). This discontinuity can upset an industry’s current competitive structure, which leads to the imposition of new market leaders and market quitters. This is known as “creative destruction,” which drives economic development (Schumpeter, 1942).

When a new technology enters the market, society expects that things will improve, while incumbents believe that good things are about to end. Innovation literature has always focused on technology substitution (i.e., Schumpeter, 1942). According to Foster (1986), ‘S’ curves represent the technology life cycle and competing technologies. The ‘S’ curve shows that during the early stage of a specific technology development, the level of performance improvement for a fixed unit of effort or time is relatively low. As people begin to better understand the technology, performance improvement increases until the technology reaches the maturity stage; at this point, the technology reaches its limit and there are decreasing returns on attempts to improve it. With respect to competing for technologies, Foster (1986) determined that the substitution threat applies when a new technology surpasses the development stage; substitution occurs when the new technology becomes more effective than the old technology, which is where the new and old ‘S’ curves intersect.

Christensen (1997) determined that substitution can occur when the new technology is less effective because consumers could move to the new technology when they are over-served on the original technology’s main performance dimension and the new technology provides better performance on new options. Adner (2002) determined that price and cost asymmetries can explain these disruptive dynamics. Substitution takes place when consumers drop old technology to choose newer technology. As a result, one must consider the performance trajectory of both technologies. The diffusion of innovations, technological trajectories, and technological substitutions are all represented, as shown in Table 3.1, by ‘S’ shape curves.

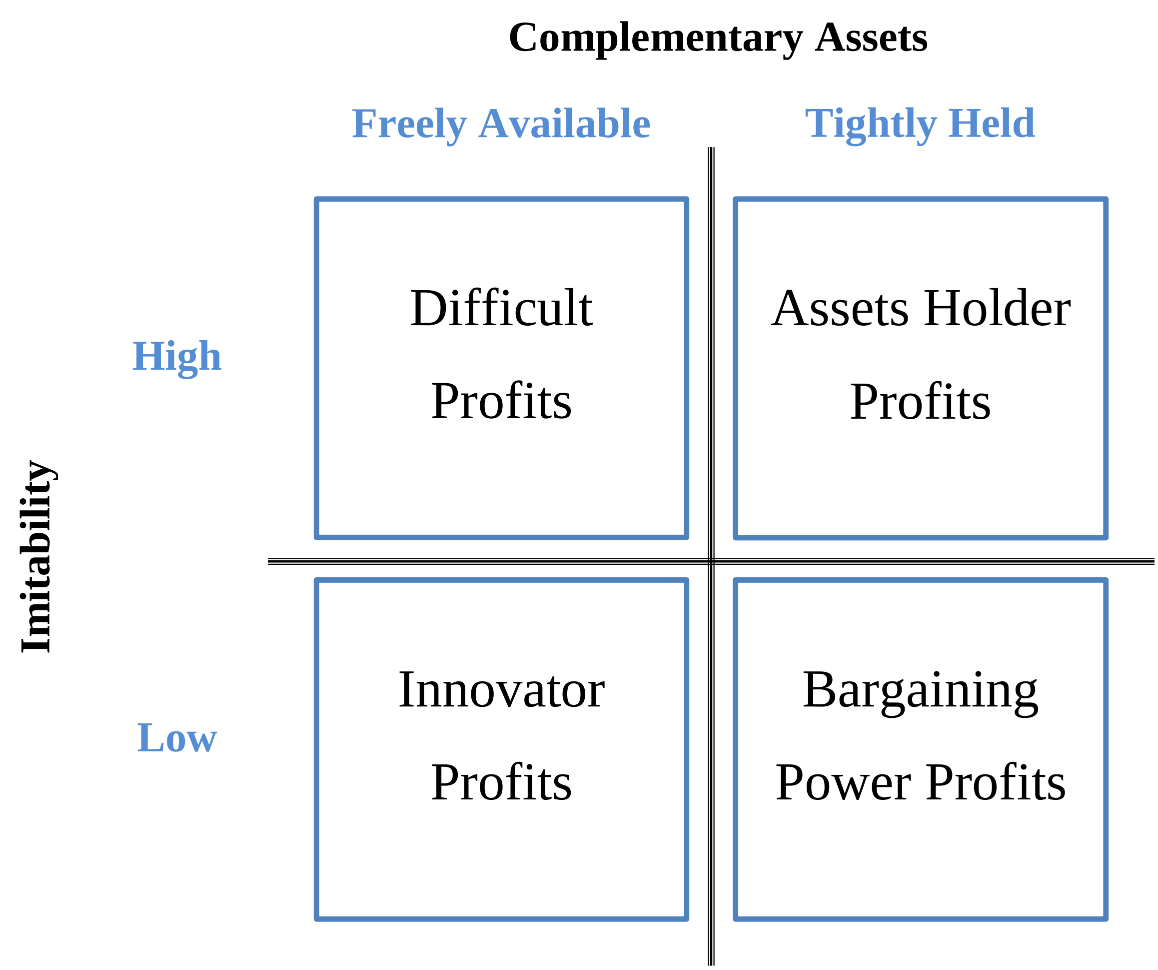
Table 3.1 - Diffusion of Innovations, Technological Trajectories, and Technological Substitutions S-curves.

Phenomenon	Underlying dynamics	Graphical S-curve of the:	
Diffusion of Innovations	Innovation is adopted through a social system	Cumulative adopters (reaching saturation)	
Technological Trajectories	Improvement in the performance of a technology	Performance path (reaching upper limit)	
Technological Substitutions	Switch from one to the other	Relative market share (reaching dominance)	

3.2.4 Teece model

The Teece (1986) model of innovation provides an understanding of capturing value from a particular innovation. According to the model, there are two factors that influence innovation profit. The Teece model employs a quadrant approach to rank an asset's imitability and the availability of complementing assets (see figure 3.5). For example, an innovation that is difficult to imitate and that is not available to competitors (i.e., the organization completely controls the assets) results in a situation that could produce the greatest profits. However, if others can easily imitate the innovation and have complete access to complementing assets, then it will be difficult to generate profits from the innovation.

Figure 3.5 - Teece Model of Profiting from Innovation



According to Teece (1986), there are three key factors that influence profit distribution from innovation. The first factor is industry evolution, which determines whether the market will accept a new innovation's specific design (Abernathy and Utterback, 1978). During an industry's early stages, different product solutions could enter the market without a clear preference. Once the market chooses a product solution, designs will become more homogenous and the price will determine competition. Competition between standards commonly occurs during the early phase, as different companies will promote their product option to develop a market presence and become the dominant player in that market.

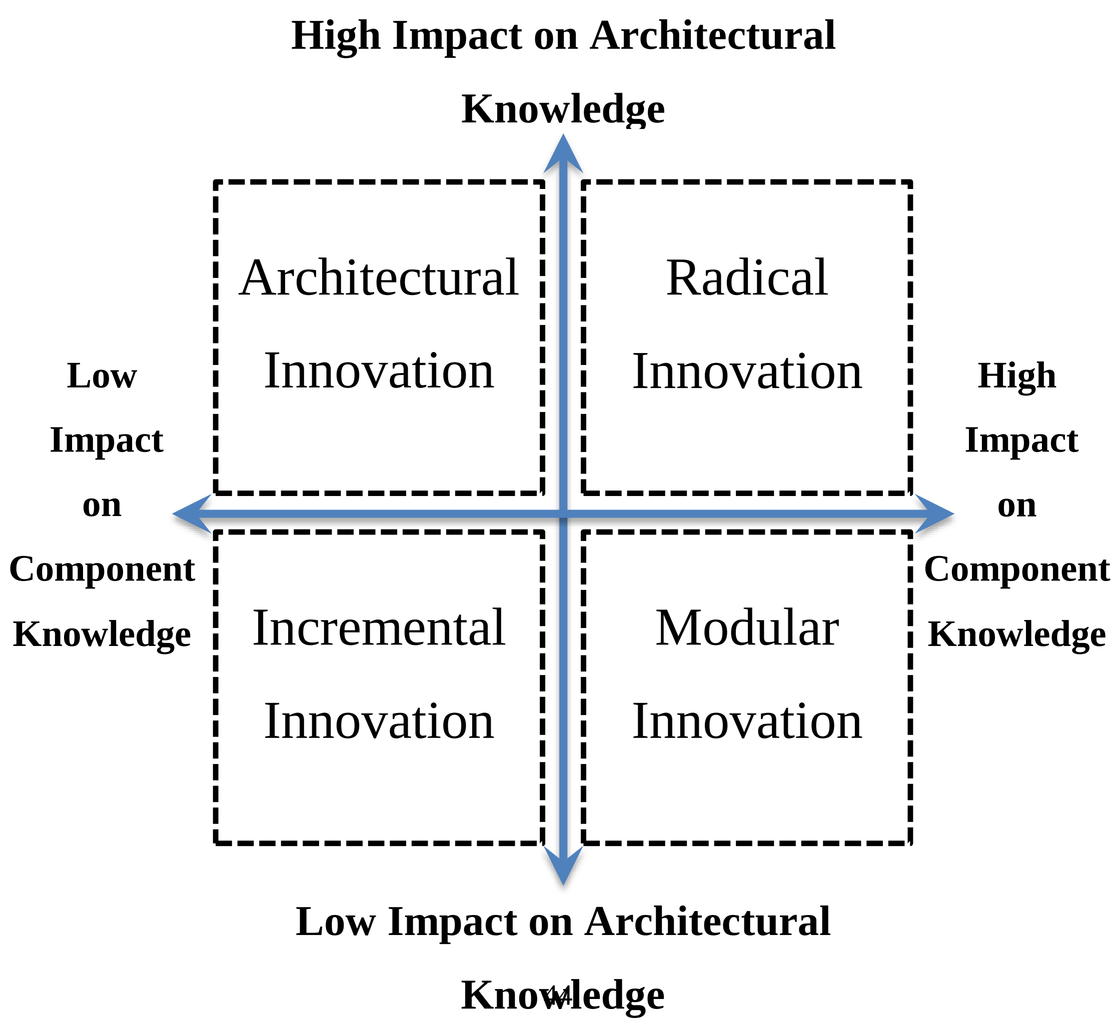
Teece (1986) defines the second factor, which is appropriability, as any environmental factor other than the external market structure that can help the innovator to reap profits from the innovation. Appropriability is determined by the technology's characteristics and the legal tools that an innovator can use to protect the technology. This factor involves corporate strategy and using organizational structure to produce value from the innovation. The third factor is complementarity, which refers to the ability of innovators to work with different firms, including competitors, to ensure that they can access enough compliments for total value proposition maximization. It becomes crucial for the innovator to find ways to capture the most value from the existing network.

Standards produce the link between dominant design, appropriability, and complementarity. A dominant design is often the result of either a market-based or industry association standards. Political mechanisms normally play a vital role in shaping these standards. In general, standards differ based on many factors, for example, technical openness and licensing availability. It normally determines the appropriability of the element. Different aspects of the product architecture can affect a product's key standards when a modular supply chain manufactures it, and when competition prevents the control from moving to other areas.

3.2.5 Henderson and Clark model

Henderson and Clark (1990) arrived at their innovation theory by evaluating the differences between incremental and radical innovations. They also examined the elements that lead to different innovations, including high levels of disruption or incremental stages of implementation. The model uses a diagram of quadrants that include four types of innovation: architectural (first square), radical (second square), incremental (third square), and modular (fourth square). Figure 3.6 graphically demonstrates the four cases. Henderson and Clark's innovation theory involves a close examination of innovation architecture and components knowledge-based system. According to the model, when organizations create new concepts that significantly affect architectural and component knowledge-based system, it results in radical innovation (Henderson and Clark, 1990). However, when new developments have little to no effect on architectural and component knowledge-based systems, it results in incremental innovation. Architectural knowledge-based system high impact combined with component knowledge-based system low impact results in architectural innovation, while architectural knowledge-based system low impact combined with component knowledge-based system high impact results in modular innovation.

Figure 3.6 - Henderson and Clark Model on the linkages between knowledge of components and architecture Source: Henderson, Rebecca M., Clark, Kim B., "Architectural Innovation: The Reconfiguration of Existing Product Technologies and the failure of Established Firms" Administrative Science Quarterly, Vol. 35, No. 1, Special Issue: Technology, Organizations, and Innovation. (Mar., 1990), pp. 9-30.



In the aforementioned model, developing products requires knowledge of a product's elements, as well as the links between components, which is architectural knowledge. This knowledge changes how the product components are linked with each other and does not touch on the core design, which is the basic knowledge, embedded the components (Henderson and Clark, 1990).

Henderson Clark model of innovation looked at the system as a whole (i.e., product) and its components (i.e., parts). They looked at the product as a system that includes the core design features while components refer to parts that have specific functions. The four types of innovation that Henderson and Clark (1990) proposed are as follows: (a) innovation that enhances both architectural and components knowledge is known as 'incremental innovation', (b) innovation that destroys both architectural and components knowledge is known as 'radical innovation', (c) innovation that enhances architectural knowledge and destroys components knowledge is known as 'modular innovation', and (d) innovation that destroys architectural knowledge and enhances components knowledge is known as 'architectural innovation.'

3.2.6 Christensen's Theory

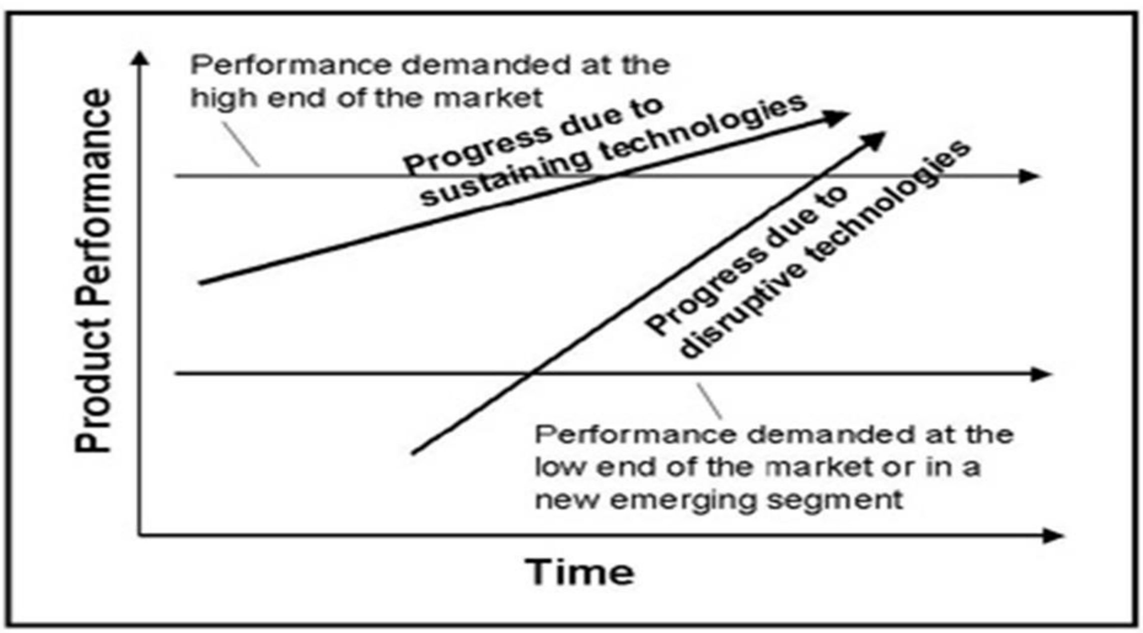
Christensen (1997) uses the term "disruptive innovation" to explain the interaction between disruptive and sustaining technologies. Sustaining technologies enhance customer and product value propositions while disruptive technologies are significantly different from current systems (Christensen, 1997). He highlighted the fact that it can be fatal to ignore technologies that do not obviously address customers' needs when there is an interaction between two paradigmatic trajectories of progress. Christensen uses the notion of "value network" to explain the impact of the disruptive technological paradigm. This network refers to customers' needs, environmental issues, input resources, rivalries' competition and profit seeking (Christensen, 1997, p. 39).

Consumers' demands of a value network increase over time, leading to an increase in the performance provided within a technological paradigm. Disruptive and sustaining technologies often have different trajectories. When performance provided surpasses performance required, and the trajectory slopes vary, disruptive technologies that were performance-competitive in remote value networks might migrate into the lower end of other networks (Linton and Walsh, 2004). The result provides innovators with access to new customers, who would have previously considered the innovation as substandard, and enables them to provide a new set of more relevant performance value attributes to established mainstream markets.

Christensen's (1997) thesis of disruptive technology includes two key premises. The first premise deals with a disruptive technology's performance path while the second deals with the impact on dominant players that ignore disruptive technology trends in favor of current consumers' requirements. Christensen (1997) stated that companies fail to take advantage of disruptive innovation opportunities because they prefer to sustain innovation customers' needs and investors' influence. Organizational leaders must often find ways to manage a disruptive innovation's initial low financial return on investments (ROI) and the inability to determine how it will affect established technologies.

This uncertainty can overtake financial investment concerns. Organizational leaders might also be concerned about destroying core competencies and leading the organization in a new direction without a plan. Tellis (2006) stated that new inventions could either advance or abolish a company's technical proficiencies. According to Christensen et al. (2006), disruptive innovations will ultimately achieve greater performance levels after sustaining these novel innovations. Established organizations often make decisions based on risk aversion and adopting new technologies. Christensen's model of disruptive and sustaining technologies is depicted in Figure 3.7.

Figure 3.7 - Christensen's theory concerning disruptive and sustaining innovation.



3.2.7 Models' Commonalities and Intersections

Schumpeter stated that innovation is dynamic and systemic and that waves of innovation and technology substitution are closely interrelated. The innovation transformative process (also known as the concept of long wave curves) involves activities that are directly involved in coordinating activities for a specific technology during a particular time period. The resulting profits from this evolutionary process are the result of profit-seeking activities as opposed to restrictive profit-maximization practices. The effects of this theory's dynamic and systemic aspects on innovative profits explain how markets are restructured to support new ideas that better integrate discontinuities (e.g., technology A versus technology B).

While Schumpeter focused on how creative destruction results in radical innovations, Utterback and Abernathy stated that the start of the innovation cycle during radical innovation is product innovation-oriented; as this technological trend progresses, more process-oriented innovations are introduced. The time required to introduce a dominant design in technological innovation depends on whether it improves or destroys the current knowledge base. A revolutionary innovation that destroys the industry's current know-how usually takes longer to develop. The technological trajectory 'S' curve clearly demonstrates a technology's significant technical obstacles, which leads to improvement, diminishing returns, and eventual displacement by a new technological discontinuity.

During this stage of product development, firms' competitive focus is on profits, which Teece expressed in his model of innovation on capturing value from a specific innovation. Henderson Clark's innovation theory also examined innovation and knowledge-based system components and architecture. We can use the technology diffusion 'S' curve to represent both theories, as it analyzes how an innovation spreads through a social system (high disruptiveness, incremental implementation, architectural and component knowledge). Disruptive and sustaining technologies often have different trajectories; yet, there is an interaction between the two paradigmatic trajectories of progress. Christensen's theory explains the interaction between disruptive and sustaining technologies with the concept of "value network," which describes the effect of the disruptive technological paradigm. He concluded that failure to take advantage of disruptive innovation opportunities occurs as a result of maintaining customers' needs and investors' influence. However, disruptive innovation's initial low returns will eventually surpass performance level of sustaining innovations. Figure 3.8 is a roundup of the theory of innovation.

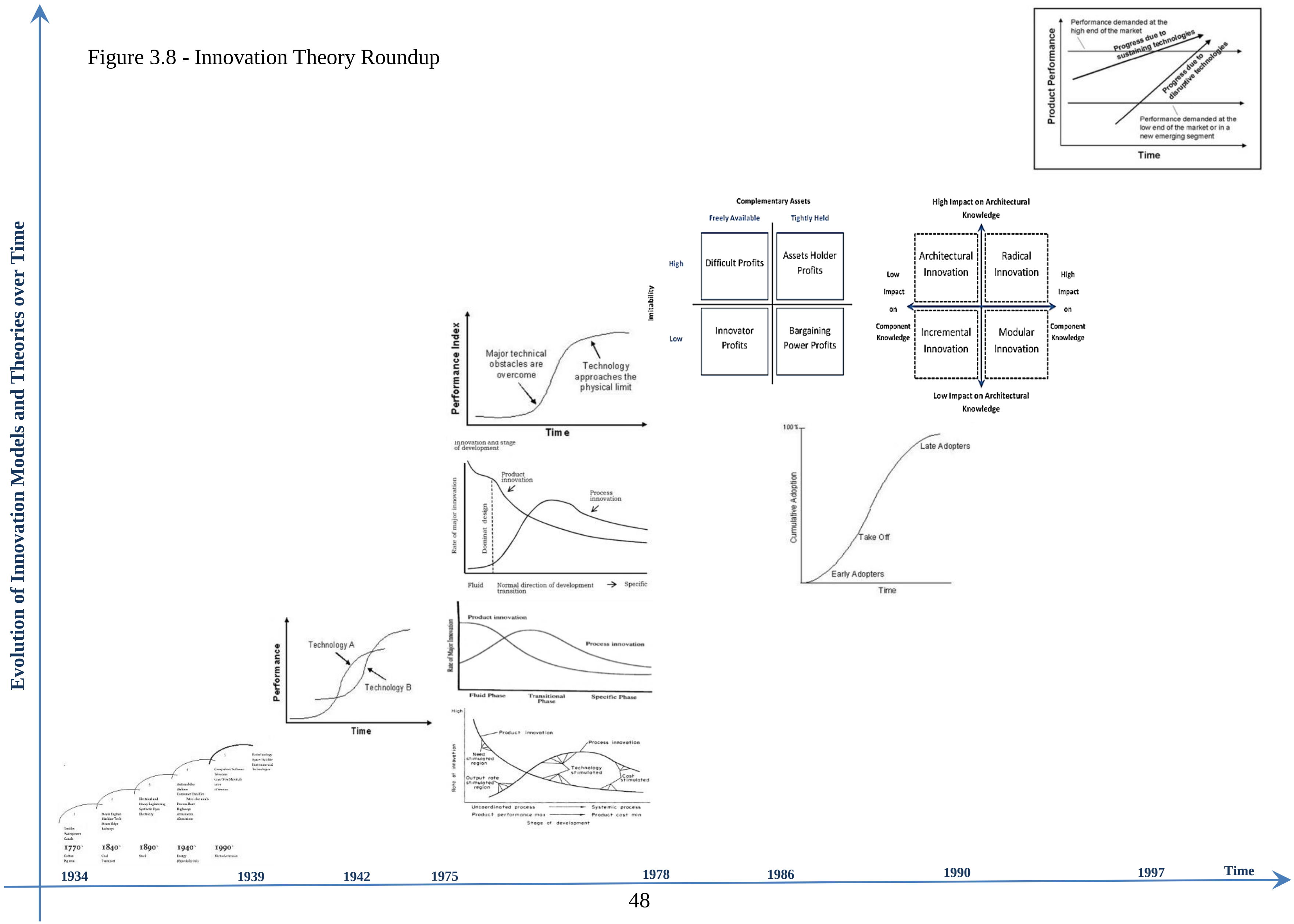


Figure 3.8 - Innovation Theory Roundup

3.2.8 Summary

In this section, the innovation literature was synthesized and organized to develop a more comprehensive understanding of innovation. The review began by presenting different definitions of innovation followed by discussing key innovation theories, models, and frameworks. Innovation in its broadest sense involves some degree of newness. The earliest and most-cited work of innovation in the literature is derived from the work of Joseph Schumpeter where innovation is a process of creative destruction opening up opportunities for new market domains. It's the new combinations of resources that promote economic development as a result of these discontinuous combinations. Schumpeter described innovation as profit-seeking rather than profit-maximizing.

The Abernathy Utterback view of revolutionary innovation involves the destruction of the industry's existing know-how. They believe that technological innovation shifts to processing innovation when the dominant product becomes standard. The 'S' curves are a well-known tool that describes innovation diffusion, different trajectories, and substitution of technology. They become the canonical representations of the technology life cycle and competing technologies. When a new technology emerges, society believes that there better things to come, while incumbents fear that things coming to an end. The Teece model is a simplified representation of the imitability and complementarity of assets. His model states that one can realize the highest profits from innovations with low imitability whereas innovations that are easy to imitate with readily available complementing assets will have difficulty producing profits. Standards form a common thread linking dominant design, appropriability, and complementarity.

Henderson and Clark researched innovation by combining knowledge concerning system elements and architecture. Their theory describes the aspects that lead to different types of innovation, which illustrate the contrasting features of incremental and radical innovations. Christensen's "value network" concept described why companies do not take advantage of disruptive innovation opportunities. Sustaining innovation can still prevail as investors are concerned about the initial low ROI, stands for return on investment for novel innovations which are disruptive in nature. Also, customers' illiteracy about the established firm disruptive technologies. These aforementioned theories and models helped to provide critical support in determining how to expose more innovative (and breakthrough) product ideas to the market; the research supports the premise that companies are more likely to develop these types of products.

3.3 Sustainability

In the 1960s, Rachel Carson's book, Silent Spring, inspired a global social movement that focused on environmental concerns. Meadows et al. (1972) argued that the newly founded Club of Rome's seminal report "Limits to Growth – A blueprint for our common survival" reinforced the movement in the mid-1970s. Stockholm Conference on Environment and Development was then founded by the United Nations in the same year, and its assigned UN Environment Programme. In 1982, the UN's General Assembly established an assembly called the WCED, stands for World Commission on Environment and Development. WCED is a dedicated team of expertise experts and officials from different world governments chaired by Mr. Brundtland, Prime Minister of Norway at that time. It took the commission several years to establish a worldwide long-term environmental program for realizing sustainable development in the year 2000 and for the future (WCED, 1987).

Following three years of public hearings, WCED published a report in 1987 entitled "Our Common Future," the sustainable development most commonly cited documents. In reconciling environmental interests, WCED introduced the phrase "sustainable development." Although the phrase and its definition date back to the 1960s, Brundtland's work made sustainable development a popular catchphrase. The report also provided guidance on integrating sustainable development at the industry/firm level and in public policies, which included requesting more development, preserving and emerging the resource base, ensuring a maintainable population level, reorienting the technology, integrating environmental issues into decision making, as well as improving international cooperation (WCED, 1987).

Sustainability, or sustainable development, is a broad dialectical concept that relates to improving every person's life quality without increasing the use of available natural resources beyond the environment's ability to provide those resources indefinitely (Elkington, 1994). The most frequently cited definitions for sustainable development come from the WCED's Our Common Future (1987, p. 54): Sustainable development is achieving the needs of contemporaneous time without conceding the capability of upcoming cohorts to have the necessary resources to meet their needs as well. The WCED also offered a slightly more descriptive, though less often quoted, definition of sustainable development (p. 57): [Essentially, sustainable development is a dynamic process in which the taking advantage of resources, the route of the investments, the orientation of technological advances, and institutional changes are all in accord and augment the ability for both current and future generations to meet human needs]. Nonetheless, the collected works on sustainable development are very broad and is expanding rapidly. It looks at different issues, the main ones being alleviation of poverty and economic growth, population control, environmental protection, and social equity and justice (WCED, 1987). This wide range of issues is often loosely grouped into three broad and overlapping domains: environmental, social, and economic (Elkington, 1998).

The WCED (1987) first expounded on the role of business in sustainable development in Our Common Future. Chapter 8, which is entitled "Industry: Producing More With Less," establishes the premise that businesses are essential to society because [the most indispensable human needs can be met solely through the marketing and production provided by the industries today] (WCED, 1987, p. 206). On the positive side, the industry provides employment and basic goods; on the negative side, unbridled or unmonitored industrial activity can result in pollution, over-extraction of resources and harm to human health (these impacts were first raised by Carson (1962) and the Club of Rome (Meadows et al., 1972). According to the WCED, the issue is not that we should stop industrial activity, but that industry must become more efficient and cleaner while continuing to generate the employment and goods compulsory to meet the necessities of present and future generations. To achieve this, the WCED called for the following "sustainable industrial development" strategies (1987, pp. 219-232):

a) Set local and international environmental goals, regulations, incentives, and standards that address international environmental issues.

b) Become more efficient in the use of economic instruments, which includes internalizing environmental costs and reworking government tax and subsidy programs to encourage and financially support environmentally friendly activities, as well as punish and discourage harmful activities.

c) Broaden environmental assessments from localized projects to programs and policies.

d) Encourage industries to strive for performance beyond the minimum required by laws and regulations.

e) Increase ability to overcome industrial hazards due to chemical exposure, hazardous wastes, and industrial accidents.

It is widely accepted that business activities have contributed to core environmental and social problems through over-extraction of resources and excessive pollution (Epstein and Wisner, 2001). Therefore, corporations have an ethical responsibility to address the problems they helped to create and to account for their actions. It is understood that corporations tend to have better access to resources, specifically money, skilled people, and technology, which are necessary to address sustainable development than governments and civil society. Corporations will typically act in self-interest, and there is evidence to suggest that corporations' sound, innovative, environmental and social performance is good for business. A company must acknowledge, consider, and accept three arguments when deciding whether it can and should commit to the principles of sustainable development: the company has the capability and resources to do something (i.e., the company can make a difference); the company has an ethical responsibility to do something (i.e., the company should make a difference, for ethical reasons); and there is a business case for doing something (i.e., the company should make a difference for business reasons). The second argument is based on at least four major underlying philosophical theories, which are: (1) social contract theory, (2) social justice theory (fairness theory), (3) rights theory and (4) deontological theory.

3.4 Theories of Sustainability

3.4.1 Social Contract Theory

According to social contract theory, the combined need for social order and various inherent constraints could form the basis for morality. Since people have been living together, there has been the incentive within the social system. People have a natural need to treat others with basic respect and follow basic rules. People find it most advantageous to create a social contract that will form the basis for their lives and enable the formation of moral judgments. However, social contracts come with a price, as we must be willing to exchange some level of liberty to secure stability. Social contract theory states that morality consists of rules that determine how people should treat each other. Rational people agree to follow these rules to achieve a mutual benefit only if others agree to follow the same rules. The philosophies of Hobbes, Locke, Hume and Rousseau form the foundation for this theory, which explores whether a social contract truly explains our moral obligations.

According to Palmer (2001), the central tenet of social contract theory is that society is built upon mutually agreed-upon agreements among companies and their external environment. These contracts are developed in order for companies know their social obligations towards people and governments to yield peace. Hobbes' theory states that corporations from social pacts with members of society and institutions. Carroll and Buchholz (2000) described the social contract as mutual understandings that outline institutional relationships. Laws and regulations partially describe the social contract between business and society, as the latter established these rules to produce a framework within which the former must do business and shared understandings that explain one group's expectations of the other. According to Belkaoui and Pavlik (1992), social contract theory requires firms to act as if they have a social contract with society to protect social welfare. These actions can be either legally mandated or voluntarily performed based on societal norms and expectations.

3.4.2 Social Justice Theory

Social justice theory builds upon social justice with an emphasis on its primary goal toward change at multiple levels, including individuals and groups. Social justice theory, implicitly or explicitly, posits that action is taken to ensure that opportunities and resources be fairly distributed. Toporek and Williams (2006) argued that this socially responsible model insists that action or social protest be taken by every member of society to counter unjust systemic and institutionalized practices. Kohlberg (1981) emphasizes justice as the essential feature of moral reasoning. Individuals have certain basic rights that must be respected by others. Kohlberg's views stem from the assumption that humans are socially interactive and capable of reason; they want to understand others and the world around them. This morality distinguishes between acceptable and prohibitive actions (Kohlberg, 1981). On the other hand, care, relationships, and connections are emphasized in within this research domain. Individuals have responsibilities to care for others. This morality requires people to discern and alleviate the suffering of others (Donaldson, 1982).

Social justice theory determines that individuals must follow social systems to provide some level of agreement on the norms and principles that drive relationships. One universally demanded a solution to the issue of social regulation involves focusing on fairness and justice. The objective is to reach total and equal involvement of all society's groups that is designed to meet their collective needs. Social justice's goal is to achieve equitable distribution of resources and the physical and psychological safety and security of all members. According to the theory, in a socially just society, every person is both self-identifying (i.e., they are able to develop their own full capacities) as well as being mutually dependent (i.e., they are able to democratically interact with others). Participants understand their own intervention and a sense of social accountability towards others and society overall.

Rawls (1971) states that justice requires fairness, which means that everyone has an equal opportunity and right to societal goods (i.e., wealth, authority and freedom). Only a society that distributes societal goods based on equality can be seen as fair, which is acceptable to a rational person. Rawls' argument is based on two key principles: (1) every person has an equal right to basic liberties that are compatible with other people's liberties; and (2) social and economic inequalities must fall within the reasonable expectation of being advantageous to everyone and available to all applicants for every position. This argument will determine whether society is just. Rawls also states that it is not just that some people should have less for others to prosper, even if it is more expedient to do so. According to social justice theory, a firm should ensure fair distribution of benefits from its operations to everyone, and should not simply seek maximization of profits for the company's owners (Toporek and Williams, 2006).

3.4.3 Rights Theory

According to Breazeale (1993), Fichte's theory of rights was published in 1796 and presented in the Foundations of Natural Right. There is no doubt that this theory received a great deal of attention at the time. Fichte explains what it means for a person to exercise free will. He establishes that true freedom can be exercised only in a society that is structured around the rights of persons. Fichte's theory separated rights from morality. He articulated this separation by stating that "the concept of right has nothing to do with the moral law and it is derived without it." Fichte was not the first to think of this separation. Thomas Hobbes also kept his account of rights separate from morality. He did so because he doubted the possibility of an objective morality. Fichte upheld the separation thesis rather because he thought rights and morality rest on two distinct kinds of volition and legislation: rights and morality are separated from one another "originally and through the reason."

The rights theory states that rights established by society must be protected and given the highest priority (Shaw, 2010). The best way of dealing with ethical issues is to create a foundation of obligations to justify each person's entitlement to rights. When endorsed by a large population, rights become ethically correct and valid. Applying this theory on a large scale produces a significant complication since one must determine the characteristics of a right in society. Society must determine which rights to uphold and provide to citizens. To determine which rights to enact, society must identify its goals and ethical priorities. To be truly useful, rights theory must be combined with another ethical theory that consistently explains society's goals.

Rights theory suggests that people have justifiable claims or entitlements to certain societal goods. These rights might be legally recognized (e.g., enshrined in law) or normatively recognized (e.g., not recognized by law but still recognized by society). Carroll and Buchholtz (2000) stated that rights are important and can be defined as justifiable claims or entitlements. One component of rights theory is the concept of human rights. Human rights refer to the natural rights that belong to every human being (Shaw, 2010). Human rights can also be defined as either positive or negative rights. Positive rights are obligations imposed upon people to provide goods and/or services to other people, whereas negative rights are obligations that prevent people from interfering with other people's freedom to act. Rights theory includes the concept of property rights, which entitles owners of property to use that property to their advantage (Donaldson, 1982). Rights theory is typically raised when discussing the limitations of a business's rights (i.e., although businesses are owners' property, they do not have an unlimited right to do what they want with this property). Property rights do not override fundamental human rights, or other people's right to quality of life or enjoyment of their property (Donaldson and Preston, 1995).

3.4.4 Deontology Theory

Rawls (1999) also stated right and good are the two main concepts of ethics. The ethical theory's structure is primarily determined by how it defines these two basic notions. Deontology is a normative ethical theory on the morally right action. According to Nagel (1986), deontological reasons constrain us from doing certain things. We avoid doing things not because doing them would be objectively worse than not doing them, but because we might have a duty to not mistreat others when dealing with them. Deontology describes how someone should determine whether an act is right or wrong (i.e., how people should behave in general rather than in specific situations). People use principles or arguments based on general principles and apply them to specific situations.

Most works in deontological ethics come from two theories that are based upon the work of Kant (1785) and Ross (1930). Immanuel Kant founded deontology theory with the statement that an action is defined as ethical if everyone accepts it as a universal law (Makkreel and Luft, 2010).

Deontology includes a group of ethical or moral theories that define a right action based on duties and moral rules. It focuses on the rightness of an act, not its results. Kant (1785) stated that morality must follow a set of rules without exception. Deontology theory examines categorical principles that are derived from imperatives and instructions that indicate how one must act. This is Immanuel Kant's deontological theory (Gibson, 2000), which states that everyone has equal ethical worth, and we must all treat each other as an end in themselves rather than the means to the end. Carroll and Buchholz (2000) say this concept is known as the Golden Rule which states that treat others the way you want them to treat you.

Kant (1797) stated that we must treat each other with respect, and we should not use others as a means to an end. Therefore, organizations must follow certain maxims to determine whether their actions are ethically right. One such maxim is a plan of action, which provides an ethical test for intended actions (i.e., to be used before we take that particular action). Its purpose is to encourage endorsement of the "universal" acceptability of the purpose behind the actions. Non-universal actions produce logical contradictions or "disharmony" when tested against a categorical imperative. The theory states that people should meet obligations and duties when they engage in ethics-based decision-making. For example, a company should follow societal obligations because upholding its duty is ethically correct. As a result, business leaders must intrinsically value all people, and avoid doing anything to others that they would not want to be done to themselves.

3.4.5 Summary

Schmidheiny (1992) stated that, once corporations accept these ethical arguments, they must make a sincere commitment to achieving sustainable development. Wheeler and Sillanpaa (1997) argued that a firm's commitment to sustainable development cannot be based only on making the best business case. Corporations must acknowledge an ethical responsibility to sustainable development because there they will eventually need to make financial sacrifices for the purpose of achieving greater societal goals. Nattrass and Altomare (1999) define this as developing a "strategic vision" (p. 25). When a company makes a commitment to sustainable development, which should filter through the organization from ownership/top management down, then it will have a greater chance of improving its environmental and social performance. In other words, a corporation's sustainability should not be their sole concern, but they should also work toward rectifying current ecological and social problems. Firms must also be concerned about planetary sustainability and seek out solutions to environmental and social problems. Therefore, its approach to sustainable development should combine both self-interest and social interest.

Welford (2000) stated that, although businesses seem to understand the need to improve, there has been no radical shift in business practices. According to Costanza et al. (1997), inherent laws in the economic infrastructure that support growth also support overuse of resources. Policy makers have focused on implementing sustainable development into business activities (Jacobson et al., 2013). Organizations have taken different paths to making sustainability or sustainable development a key issue: it could be part of the company's mission statement and the foundation for its funding priorities; it might be the result of different goals and projects; it could result from amendments in regulations or industry standards; it might derive from a competitive advantage; and/or it could follow from an unforeseen crisis that paints the company as a polluter or social oppressor. When any or all of these factors occur, organizations will seek to determine how their products and processes impact social and natural environments. Developing this awareness and sense of responsibility for protecting natural resources can encourage individuals and companies to recognize that we all share a global and local "commons" that determines whether we all succeed or fail. Business operations will then become more socially responsible and engage in more sustainable development (Law and Gunasekaran, 2012).

Corporate sustainability is an emerging business approach that functions as an alternative to the old-fashioned income maximization business model. Companies have not universally adopted this new approach, but evidence of its existence and increased popularity can be seen in the growing body of literature, academic interest and research, high-profile attention from international business organizations, and corporations' active measurement and reporting on sustainability performance. Increasing corporate adoption of this sustainability paradigm should produce newer approaches to business, which includes creating policies and programs that affect the company's economic, social, and environmental performance, and enable performance measurement and reporting to stakeholders. While it is important that companies recognize, and act on, their responsibilities in the area of sustainable development, they are not solely responsible for achieving planetary sustainability. Other actors in society (e.g., governments, academia, non-government organizations, civil society) also have a role to play. However, corporations might be identified as taking a lead role for three reasons: 1) industrial activity has contributed to environmental and social problems that now must be addressed, and therefore they have an ethical responsibility to take action; 2) corporations have greater access to the resources that are required to address these issues; and 3) corporations might determine that it is in their best interest to address the problems because an increasing number of stakeholders – including investors and customers – consider corporations' social and environmental performance when making investment and purchasing decisions.

3.5 Financial Performance

According to Barney (2002), when human, physical and capital productive resources are utilized by a voluntary association with the goal of achieving a shared purpose, that is a typical definition of an organization. Barney (1991) stated that different organizations have varied assets and capabilities, and there exists a variance in how or when these resources can be used. Since organizations respond to environmental factors in different ways (Miles and Snow, 1978), industrial and environmental context influence performance results and moderate their impact (Hawawini et al., 2003). Specific performance results are tied to specific firms. Based on their strategic choices, firms can choose which performance measures to employ in evaluating their performance.

Various disciplines identify organizational efforts to achieve specific outcomes, for example, organization behavior (e.g., Venkatraman and Ramanujam, 1986), financial analysis (e.g., Henri 2004) and economic accounting (e.g., Callen, 1991). These research domains recognize these efforts, which is essential in evaluating organizational actions. Based on the literature, organizational outcomes can be looked at from three different perspectives: (1) Accounting perspective (e.g., profits, net earnings); (2) market perspective (e.g., return on assets) and (3) mixed perspective (e.g., economic value added). Performance measurement depends on the creation of value. Assets will continue to exist if it creates value. The problem is that this value has to be greater or at least equals the expected value set by assets providers. Therefore, from the resource provider's point of view, an organization's most important overall performance criterion is value creation.

The literature includes two approaches to measuring organizational performance. The first approach involves adopting one measure that depends on how the measure relates to performance (Hawawini et al., 2003). The second approach involves using numerous procedures to compare analyzes with the same constant dependent and different independent variables (Wally and Baum, 2004). The validity of using these approaches depends on upon whether they satisfy the assumptions. The following sections examine organizational performance from accounting, market-based, and mixed market/accounting perspectives.

3.6 The Three Perspectives of Corporate Performance

3.6.1 Accounting Perspective

Most of the accounting research literature use a company's financial in order to evaluate its performance. Long-standing accounting rules and procedures ensure that the information in organizational financial statements is relevant and can be compared over time and between firms. One key focus of research involves earnings data and their relationship to organizations' valuation (Lev, 1989). The literature on performance measurement from an accounting research perspective has evolved over the last two decades. Instead of evaluating corporate policies and processes using these measures, a shift to evaluating the consistency levels between publicly traded equity, security returns, and earnings information is becoming the focus (Lev, 1989). Researchers will use these types of questions when examining market return proxies or shareholder value creation.

By consistently applying Generally Accepted Accounting Principles (GAAP), organizations create materially accurate financial reports that are comparable across the industry. These reports contain data on the company's historically realized and retained value creation. Accounting perspective looks at the organizational historical performance which is a direct outcome of managerial decisions. These reports do not consider future opportunities for the firm and cannot even predict it based on the gains due to the conservative approach that is taken by the proficiency itself.

The accounting reports generated do not distinguish between shareholders, venture capitalists, and regulatory bodies. The accounting multi-dimensional approach taken till date was designed to provide a generally accepted performance measures with can cater the needs of the majority of stakeholders. While GAAP is designed to report performance, it constantly changes due to organizations' dynamic nature and experience with performance reporting standards. However, accountants follow certain rules to direct firms on presenting performance data. Financial statements are normally used to calculate different measures related to company's efficiency, liquidity, profitability, and growth.

Profitability measures use net income or its elements to calculate different ratios (e.g., operating income, earnings before interest and tax). Organizations provide returns to equity capital providers by generating profit after converting it into liquid assets. When profits do not exist or appear to be unlikely, providers will withdraw equity capital from the organization and re-invest it in other companies for better chances at positive returns. Growth measures include values and ratios that indicate organizational growth, which can apply to resources and business operations. Growth performance measures use total assets and expenses to obtain absolute or percentage change.

Meeting monetary obligations within a given time frame reflects firm's financial ability. Providing capital with cash returns can be measured by leverage, liquidity, and cash flow using values and ratios. The ability of the firm to meet its financial obligations and produce cash flow to cover its liabilities is measured by current assets over current liabilities. Previously, these ratios are based on historical data that do not look at the future performance of the company. It is used for comparison purposes. Another measure that looks at the Firm's efficiency in utilizing its resources can be measured using ratios like sales per headcount, assets turnover. Table 3.2 summarizes the most popular accounting measures.

Table 3.2 - Most Commonly Used Accounting Measures

Earnings Before Interest and Taxes (EBIT)	**Operating profit equals (revenues –COGS)**
Net Operating Profits (Firm's Net Earnings)	Firm's net earnings equal (total revenue – GOCS)
Sales	Revenue
Sales Growth	Sales change over period
Profit Margin	Operating profit over sales
Return on Assets (ROA)	Operating profit over firm's assets
Return on Capital Employed (ROCE) or Return on Capital (ROC)	EBIT divided by capital
Return on Equity (ROE)	Profit divided by shareholder's equity
Return on Investment (ROI)	Operating profit divided by assets book value
Return on Invested Capital (ROIC)	NOPLAT divided by firm's invested capital
Return on Sales (ROS)	Operating profit divided by sales

3.6.2 Market-based Perspective

Another approach for evaluating the organizational performance within the literature is the market-based perspective. These measures are forward-looking (e.g., Lev and Radhakrishnan, 2005) and are more effective in incorporating intangible assets than accounting data (Lev, 2001), which is more useful to those who looks at assets and knowledge within the firm. In spite of this, the relationship between market dealings and the firm's performance depends on the amount of income paid by shareholders and the market's informational effectiveness. These measures are usually justified because firms are shareholders' instruments (see Table 3.3).

According to Jacobson (1987), market-value- based measures are useful when it comes to the inclusive performance of the firm. However, when the intention is to measure the firm's performance by product or process, it is not effective. Market-value-based measures have their own limitations. Robinson (2000) stated that these measures cannot predict the performance of different activities within the firm. In order to calculate these measures, market valuation of the firm is necessary. Market-based performance is based on ratios that use the market value of the firm. It includes, but not limited to, market value added, return on assets, return on equity, and stock earnings.

Firm valuation is based on the cost of its assets. The best estimate is based on the market price that is determined by the financial markets where the firm is listed. According to Maliene et al. (2010), it is harder to value a non-listed firm. There are different concepts of value such as (a) book value and (b) market value. The book value refers to the equity of the firm (Haugen, 1986) while market value is based on the traded share price of the company. Book value is expressed as the total liabilities over total assets (Ohlson, 1995). Book value does not account for the future growth of the firm. On the other hand, the economic worth of the assets is calculated by means of the present value and that of the future expected cash flows (Vogt and Vu, 2000). The economic value is corresponding to the market value of the firm. Simply put, the price that an investor is willing to pay for the company's shares is equal to the price that has been paid to purchase the firm's assets.

Table 3.3 - Market Value Based Measures

Stock Price	Common stock
Earnings per Share (EPS)	(Operating profit - dividends) divided by common stocks
Market Value (or Market Capitalization)	Total value of the common stock
Price-to-Earnings Ratio (P/E Ratio)	Stock price divided by earnings per share

3.6.3 Mixed Accounting and Market Perspective

Mixed measures are usually used to overcome the deficiencies inherited in both accounting and market measures. Accounting measures overlook risk in general while market measures overlook operational risk in particular. The hybrid measures are mainly used to balance risk issues that are not covered by both measures. Tobin (1961) introduced his commonly used measure. it is arbitrated to the percentage of the firm's assets market value to these assets replacement cost (Tobin, 1969). Tobin (1974) mentioned that the replacement cost is also equal to the assets book value. Tobin (1982) also mentioned that the historical cost of assets might be used as well. Perfect and Wiles (1994) run a comparison between the two costs and found them almost identical.

Stern (1994) and Lehn and Makhija (1997) argued that another commonly used mixed measure is the EVA or Economic value added. The measure is described as the relation between the firm's overall returns relative to the cost of equity (O'Byrne, 1996). EVA is perceived as a good predictor compared to the earnings per share (EPS). According to Milunovich and Tseui (1996), it is more useful than the EPS growth. Lehn and Makhija (1997) confirmed that it is even better than the return on equity, return on sales, and return on assets. Chen and Dodd (2001) argued that mixed measures have higher explanatory power than accounting measures.

Table 3.4 includes a number of commonly used mixed (market/accounting) measures. Among these measures are the cash flow per share, market-to-book value, and market value added.

Table 3.4 - Mixed Market/Accounting Measures

Cash Flow per Share (CFS)	(Operations cash flow - preferred stock) / outstanding common shares
Market-to-Book Value	Assets market value / assets book value.
Tobin's Q	Assets market value / replacement cost.
Weighted Average Cost of Capital (WACC)	The cost paid for capital
Discounted Cash Flows (DCF)	The present value of future cash flows
Economic Value Added (EVA) or Economic Profit	NOPLAT – (WACC x Invested Capital).
Market Value Added (MVA)	Excess value / capital used

3.6.4 Summary

Each of the measures discussed in the categories above comes with various advantages and disadvantages. While each one measures performance from different points of view, they cannot be used to measure every organization in all categories. Individual researchers must select the most appropriate measures based on their study's particular environmental circumstances to properly capture and represent their subjects' organizational performance.

Chapter 4

Proposed Theory and Model Hypotheses

4.1 Introduction

According to Schumpeter's (1939) proposed the concept of long wave curves, the world is moving toward an era of sustainability (refer figure 3.1 - Schumpeter's Waves of Innovation). Firms are gradually moving away from the creation of financial value alone to the simultaneous creation of ecological, social and financial value, which is a new kind of value creation. This new driving force is creating a demand for innovations across all the industry sectors. In addition, the sustainability revolution creates different needs that offer important opportunities for innovation. Because so many aspects of business are changing at once, innovation and sustainability are becoming essential to effective transformation.

Innovation is needed to ensure that the shift to sustainability succeeds and sustainability practices are essential in shaping future innovations (Pinkse and Kolk, 2010). In trying to understand this complex reciprocal relationship, the objective of the research is to expand the existing knowledge of corporate innovation and corporate sustainability and whether they have a significant relationship with each other. It also provides an empirical assessment to contribute to closing the gap regarding the impact of innovation and sustainability on a firm's success rate. The study adds to research and practice in multiple ways.

Lumpkin and Dess (1996) defined innovation as the firm's inclination to pursue or employ new ideas, methods or behaviors that result in new products or processes. It involves creating and using new combinations of resources at the firm (Lumpkin and Dess, 2001). Some researchers (e.g., Drucker, 2002) stated that innovation improves corporate financial performance. Therefore, this research will explore the consequence of innovation on a firm's financial stability from within the energy sector. Cohen and Levinthal (1990) argued that creating a sustainable society requires a combination of incremental and radical societal innovations. There is growing research on how sustainable development influences innovation (e.g., Freeman and Soete, 1997).

While there is a clear agenda for making sustainability an integral component of the innovation process, there is no significant effort to study whether it is, or should be, managed differently (Smith, Voß, and Grin, 2010). Therefore, it is important to look at different sustainability practices that inspire innovation. Sustainability is currently viewed as a key component of innovation and should become a significant factor in improving how innovation works. According to Pinkse and Kolk (2010), existing literature on innovation has overlooked the role of sustainability as a means to explain and predict corporate innovation. Consequently, the goal of this research is to look deeper as to how sustainability can foster and promote innovation which was not addressed empirically before in any research.

Over the last ten years, companies have been facing increasing social and environmental pressures. As enterprises are extending their spheres of operation and influence into diverse societies, it has become imperative to take more responsibility for environmental and social impacts to create long-term business success. As more companies seek to integrate corporate social responsibility, which is derived from the concept of sustainable development into core business activities, its impact on corporate performance must be measured (Keeble et al., 2003; Turker, 2009; Lee, 2008; Lockett, Moon and Visser, 2006; Windsor, 2006; McWilliams and Siegel, 2001). Researchers argue that progressive organizations can take advantage of the opportunities created by these new demands, and they can use innovation to achieve sustainability goals (Seebode, Jeanrenaud, and Bessant, 2012). However, less attention has been given to understanding the impact of corporate innovation on sustainability initiatives at the corporate level.

Innovative behavior can enable corporations to take the right actions toward sustainable development. Most sustainability research has been relatively conceptual. No empirical investigations using key hypotheses that could have helped closing many of the gaps in the literature were made (Hart and Dowell, 2011). There is no prior research that tried to explore the relationship between corporate innovation and corporate sustainability. Managing business sustainability necessitates examination of the effect of innovation on its social and environmental enterprises, which in turn leads overall corporate profitability and value creation. Innovation is now perceived to be the key driver of sustainability and is believed to considerably improve our understanding of sustainable development. Therefore, the purpose of this research is to educate how innovation can foster and promote sustainability which was not addressed empirically before in any research.

4.2 Proposed Theory

In an attempt to model the linkage between innovation and sustainability and their impact on corporate performance, the proposed research model is shown in figure 4.1. The figure depicts the three main constructs, which are (1) corporate innovation, (2) corporate sustainability, and (3) corporate performance. It also portrays different variables used to operationalize each construct. This particular model is assembled after intense reviewing of related studies.

Several empirical studies demonstrate a relationship between innovation and firm performance (e.g., Aboody and Lev, 2000; Li and Atuahene-Gima, 2001; Koc and Ceylan, 2007). Also, more studies findings a positive and strong linear relationship between innovation and business performance (e.g., Forsman and Temel, 2011; Love and Mansury, 2008; Klomp and Van Leeuwen, 2001; Soni, Lilien, and Wilson, 1993; Damanpour, Szabat, and Evans, 1989; Damanpour and Evan, 1984). In general, research has demonstrated that innovativeness can be tied to organizational performance when measured according to profitability, return on investment, market share, and growth rate. However, innovation does not always positively impact firm performance.

Several researchers have investigated firm value when it has involved different firm's attempts to take social and environmental responsibility. Salzmann, Ionescu-somers and Steger (2005) and Willard (2005) stated that corporate sustainability pays off for corporations. A socially responsible company can use sustainability to produce short- and long-term financial benefits (Manning, 2004). Several studies found a negative affiliation (e.g., Ameer and Abu Bakar, 2011; Huang and Kung, 2010) between corporate sustainability and organizational performance. While other studies, for example, Li and Zhang (2010) and Cheung et al. (2010) found no significant relationship. Gabriel and Nathwani (2014) argued that there is growing evidence that suggest there exists a positive relationship based on other researchers such as Branzei et al. (2004), Ben Brik et al (2011), and Fujii et al. (2013).

It has been established that burning fossil fuels contributes to global warming, and there is growing concern that climate change has the potential to create havoc (Ash et al., 2013). Corporations are well aware of the serious long-term impact of emissions on the environment (Wilkinson, Hill, and Gollan, 2001) and are striving to reduce and/or eliminate their operations' detrimental environmental effect and emphasizing sustainability initiatives that might help to improve the Earth's climate

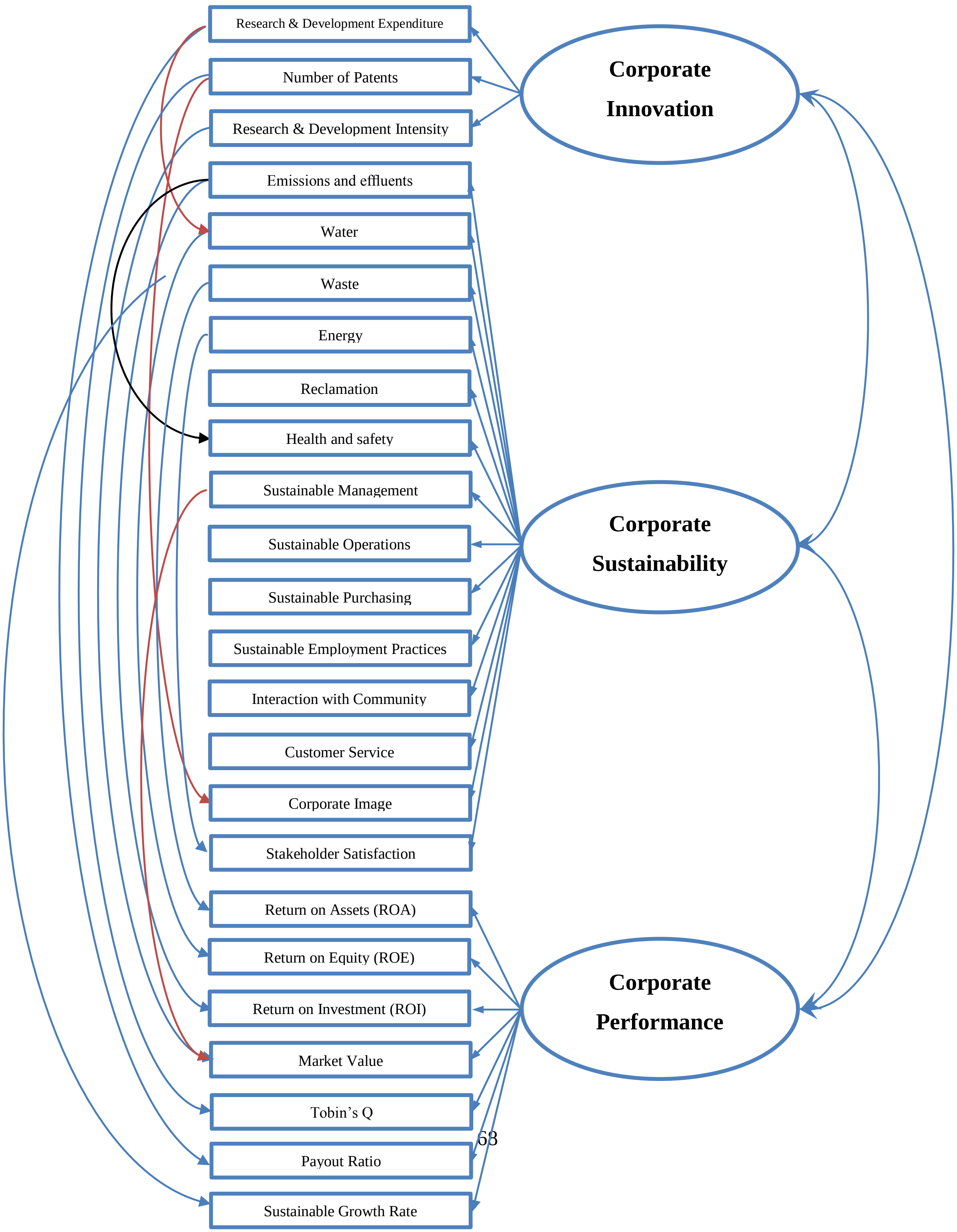
(Griffiths and Petrick, 2001). It is becoming more acceptable that innovation and sustainability can go hand in hand to reduce further impacts on climate change (Meinshausen et al., 2009, 2011).

Knowledgeable consumers are prepared to pay more for environmentally-friendly products and processes in order to contribute to the fight against climate change and limit mean global surface warming to 2°C (Piecyk, 2010). Firms are open to unconventional solutions that could reduce the severity of climate change issues (Lodhia, 2011; Neil, Arnell, and Tompkins, 2005). Some researchers (e.g., Fussier, 1996; Rennings, 2000) have examined new ideas, behaviors, products and processes that have been shown to reduce environmental impacts and/or meet ecologically sustainability targets. There has relatively little research on how innovation can help firms to achieve sustainability. There is no empirical research on identifying and analyzing how innovation can support and promote corporate sustainability.

Based on the literature review, innovation can be considered a valid argument for sustainability (Bönte and Dienes, 2013; Asongu, 2007a). It has been argued that a firm's sustainable development program can help develop innovative products or processes (Forsman, 2013). Corporations currently view sustainability as a legitimate source of innovation (Husted and Allen, 2006; Asongu, 2007b). According to Stigson (2002), sustainability strategies can help ensuring efficiency and promoting innovation. Morhardt (2009) argued that firms leveraging innovation are mainly because of sustainability pressure. Therefore, the model addresses the relationship between sustainability and innovation and explains the diverse aspects of innovation, including the very complex relationships between innovation and sustainability. The model provides a detailed discussion of innovation for sustainability and highlights how much innovation contributes to sustainability.

According to Nordheim and Barrasso (2007), the commonly reported corporate sustainability indicators and metrics are considered by the aforementioned model (Veleva and Ellenbecker, 2001). Tanzil and Beloff (2006) argued that these categories and its related measures are used by companies to track and manage their sustainability initiatives and their rate of success in deploying them (Searcy, McCartney, and Karapetrovic, 2007; Azapagic, 2004). Integrating social and environmental dimensions of sustainability was discussed by Elkington (Elkington, 1998), therefore, sustainability metrics used are fully aligned with his triple bottom line concept. Effective sustainability in the literature is discussed methodically and systematically (e.g., Bakshi and Fiksel, 2003; Sikdar, 2003; Schwarz, Beloff, and Beaver, 2002).

Figure 4.1 - The Research Proposed Model



It is conventional that sustainability metrics should fulfill the following criteria (Bakshi and Fiksel, 2003): straightforward, comprehensible, reproducible, dependable, robust, traceable, complementary to existing regulations, and useful for decision-making. Table 4.1 lists the three main constructs in the proposed model with the correspondent variables, which are adopted from previous studies or used for the first time in this research. The following sections give more details about these constructs, the main variables in each construct, the rationality behind selecting each construct, and the expected causal relationship based on the extent literature.

Table 4.1 - Proposed model constructs with the correspondent variables adopted from recent studies

Construct	Variable	Previous Study Adapted
Corporate Innovation	Research and Development Expenditure	Zhang, Baden-Fuller, and Mangematin, 2007
	Number of Patents	Benito, 2006
	Research and Development Intensity	Koc and Ceylan, 2007
Corporate Sustainability	Emissions and effluents	Hart and Ahuja, 1996
	Water	Russo and Fouts, 1997
	Waste	Dawson and Probert, 2007
	Energy	Rothenberg et al., 2001
	Reclamation	Barrett and Scott, 2001
	Health and safety	Pearce and Newcombe, 1998
	Management	Sweeney and Coughlan, 2008
	Operations	Gupta, 1995
	Purchasing	Min and Galle, 2001
	Employees	Wolf, 2013
	Interaction with Community	Orlitzky, Schmidt, and Rynes, 2003
	Customer Service	Kok et al., 2001
	Corporate Image	Welford, 2005
	Stakeholder Satisfaction	Labuschagne and Brent, 2006

Corporate Performance	Return on Assets	Epps and Cereola, 2008
	Return on Equity	Epps and Cereola, 2008
	Return on Investment	Brealey, 1996
	Market Value	Baysinger and Butler,1985
	Tobin’s Q	Adams and Mehran, 2005
	Sustainable Growth Rate	Brealey, Myers and Marcus, 2007

4.3 Model Hypotheses

The following sub-section will define the model constructs and introduce relevant hypotheses.

4.3.1 Corporate Innovation

Knight (1967) described four types of innovation that occur within an association: (1) product and/or service innovation; (2) product and/or service process innovation; (3) administrative structuring or restructuring innovation; and (4) human resources innovation. Daft (1978) added that innovation types can be categorized as either (a) administrative innovation, which includes an organization’s components and members, and (b) technical innovation, which applies to a merchandise or provision.

Likewise, Damanpour (1991) categorized innovation as a) technical innovation, which involves developing expertise and (b) professional innovation, which involves managerial processes in which organizational structures precede the innovations. Barney and Griffin (1992) categorized innovation as (a) technological innovation, which involves product and/or manufacturing process innovations, and (b) administrative innovation, which involve administrative innovation processes.

Schumpeter (1942) defines innovation as a creational demolition process meaning it involves making dynamic choices between alternatives, and hence, any change is a result of a continuous evolution, which stems from the result of infinite recreation within the technology's progress process. Technology is not static, as it is continuously driven by research and development (R&D) costs, which form the foundation of technological innovation. Christensen (1997) stated that technology evolves with the accumulation of technological innovations, so it involves the expansion, change, and dynamic processes in developing one or more technologies. Nelson and Winter (1982) stated that the individuals responsible for innovation increase their mutual knowledge through an accumulative process.

According to Anderson and Tushman (1990), technological evolution is regular and repetitive in nature. R&D is used as an indicator to shed some light on the technological innovation process. The long-term accumulation of technological innovation involves continuous investments in R&D. Patents are another indicator that looks at the technological evolution. Analyzing patents trends can be used to determine technological evolution patterns. Nonetheless, R&D intensity is another indicator that is used to capture the continuous technological evolution within an establishment. It is equal to the fraction of the R&D expenditures book value to the total number of sales.

Li and Atuahene-Gima (2001) and Koc and Ceylan (2007) determined the existence of a correlation between innovation, expressed in R&D and the firm's ROA. Several empirical studies (e.g., Dwyer and Mellor, 1993; Baldwin and Johnson, 1996; Salavou, 2002) have found that innovativeness is positively related organizational performance with respect to profitability, size, market share, return on investment and growth rate. However, innovation does not necessarily mean an assured positive impact on firm performance due to the case of shorter product life-cycles, as well as the increasing cost of developing innovations and of course increased competition within the industry (Chesbrough, 2007). Still, the study assumed the existence of a strong relationship between corporate innovation expressed in the number of patents and corporate performance measured by Tobin'Q.

Hypothesis 1: Corporate innovation is strongly and positively related to corporate performance.

4.3.1.1 Research and Development Expenditure

R&D applies to any investigative activities that a business employs for the express purpose of making a discovery that can either result in industrializing new products and processes or refine the existing products and processes. It is one avenue that enables a business to experience future growth. R&D is a critical stage from the conception of a novel or enhanced product or service through to the commercialization stage. The research component of R&D involves the investigation and experimentation stages of developing or improving a product/service while the development portion involves the process of designing and testing the effectiveness of new or improved products/services.

A firm's technological capability embodied is essential for its future performance, particularly when it involves expansion. One can evaluate a firm's technological and innovative capabilities by how much it invests in R&D. Aboody and Lev (2000) determined that investing in R&D leads to new products and process efficiencies, which creates a competitive advantage that improves performance. Zhang, Baden-Fuller, and Mangematin (2007) stated that organizations can capture rents from R&D investments when they are able to address appropriability hazards that are tied to innovation. Local firms might take advantage of those R&D activities, which means that the firms making the investment in R&D might not realize the full benefits. Nonetheless, it is expected that greater R&D spending will result in improved performance.

Hypothesis 2: Corporate performance is expected to improve based on a higher R&D expenditure.

4.3.1.2 Number of Patents

Patents are an ideal proxy measure for technological innovation. Mogee (1991) stated that patents have been widely written about and researched in evaluating the state of a firm's innovation efforts, determine its future course, and sustain its R&D decision-making (Beneito, 2006). Patent analysis is commonly used to evaluate technological evolution (Archibugi, 1992). Patents are considered to be a standardized source of information about technology. It reveals technological trends based on the current rates of technological modernization (Archibugi and Pianta, 1996).

However, there has been limited patent analysis of innovations in energy technology, and there has been relatively little patent data analysis of the characteristics of different energy technologies. Lee et al. (2012) described 21 energy technologies, which our research uses to define its focus. They used first-level criteria to divide these technologies into two groups: energy source technologies and energy storage development. Using second-level criteria, they subdivided the groups into old-fashioned energy, innovative and renewable energy, energy storage, and energy generation.

Table 4.2 lists the technologies that are being used in the energy sector today. Energy sources can be classified to Non- renewable versus renewable energy. Traditional energy includes coal, nuclear energy natural gas, and petroleum. Renewable energy includes biomass, enhanced geothermal, oceanic, hydropower, solar, wind, and hydrogen. Energy storage solutions include methods like flow cells and thermal energy while other includes heat pumps, combustion, and power systems (Lee and Lee, 2013).

Table 4.2 - The energy sector current and future technologies

level 1	level 2	level 3	Technologies
Energy Source Specific Technologies	Traditional energy	Fossil fuels	Coal
			Natural gas
			Petroleum
		Nuclear	Nuclear
	New and Renewable	Renewable	Solar
			Photovoltaic
			Biomass
			Wind
			Hydropower
			Tidal
			Geothermal
			Waste
		New	Fuel cell
			Hydrogen
			Gas-to-Liquid
			Coal-to-Liquid
Energy Generation and Storage Technologies	Storage	Electrical storage	Battery
			Flow cell
		Thermal storage	Thermal storage
	Generation	Others	Heat pump
			Power system
			Combustion

Patents are a significant method of protecting innovation, and there is a growing understanding of the importance of patent data. Conducting extensive analysis of information patents can help with understanding current and future technology trends through identification of emerging and declining technologies, as well as recognition of various energy technologies' evolutionary processes. Table 4.3 outlines the technologies noticed for this study. Margolis and Kammen (1999) argued that patent data can be used to understand the acceleration process of the energy technology innovation and can be analyzed to understand the different aspects of alternative technologies.

Table 4.3 - Current and future technologies description

Technology	Description
Coal	Technologies related to coal
Natural gas	Technologies related to methane
Petroleum	Technologies related to petrol
Nuclear	Technologies related to nuclear
Solar	Technologies related to the sun
Photovoltaic	Technologies related to solar radiation
Biomass	Technologies related to biomass
Wind	Technologies related to the wind
Hydropower	Technologies related to water
Tidal	Technologies related to tides
Geothermal	Technologies related to thermal
Waste	Technologies related to waste
Fuel cell	Technologies related to chemical reactions
Hydrogen	Technologies related to Hydrogen gas
Liquefied	Technologies related to turning coal or gas into the liquid
Battery	Technologies related to electrochemical cells
Flow cell	Technologies related to flow batteries
Thermal energy Storage	Technologies related to storage reservoirs
Heat pump	Technologies related to machine or device that diverts heat from one location
Power system	Technologies related to network of electrical components
Combustion	Technologies related to a sequence of chemical reactions

Analyzing patents can form a foundation for developing patent-based strategy and evaluating future performance. Several studies have grouped similar technologies for the purpose of analyzing and comparing different energy technologies' evolutionary patterns (Lee et al., 2012). Applying for a patent takes time and money, and while patents are applied to many new technologies with commercial potential, only a few of those technologies have developed significant commercial value that was transferred to innovation. Patent data is publicly available and offers valuable information, as it encompasses almost all technologies and covers long periods of time (Daim, Iskin, Li, Zielsdorff, Bayraktaroglu, Dereli, and Durmusoglu, 2012). Therefore, researchers have used this data to track technology development and technological evolution patterns.

A number of studies have examined technological evolution patterns using patent analysis (Narin and Noma, 1987; Arts, Appio and Van Looy, 2012). When someone files a patent in a specific technology field, then a new invention that is technically feasible and possesses commercial value will have contributed to existing technologies, which shows technical progress. Beneito (2006) stated that patent count is a popular method of determining innovation activity. Patents should achieve certain standards such as novelty, uniqueness, and industrial usage. Economists have sorting patents according to application date turns them into good indicators of technological evolution patterns. Popp (2005) stated that patent counts act as a measure of innovative output and indicators of the level of innovative activity. This study employs patents to analyze technological evolution patterns and how they affect firm performance.

Hypothesis 3: The higher the number of patents per year, the higher the firm's performance.

4.3.1.3 Research and Development Intensity

Numerous studies have tested the correlation between R&D intensity and firm financial performance, their findings are inconclusive (Li and Atuahene-Gima, 2001; Koc and Ceylan, 2007). Few studies were found that tried to find an association between R&D intensity and firm financial performance, for example, Prajogo (2006), Harhoff (1998), and Hall and Mairesse (1995). Other studies found a negative correlation (e.g., Graves and Langowitz, 1993). Zhang, Baden-Fuller, and Mangematin (2007) could not establish a clear association between R&D intensity and firm financial performance. Despite these mixed findings, this study hypothesizes that there is an affirmative and strong relationship between R&D intensity and the firm financial performance.

Hypothesis 4: Corporate performance is correlated with the research and development intensity.

4.3.2 Corporate Sustainability

Corporate sustainability creates long-term value for stakeholders when they embrace opportunities and manage risks that result from economic, environmental and social developments. However, as a business approach, it is in the early stages of development. The concept of corporate sustainability requires a radical transformational change in redefining the purpose of business. It stresses the fact that organizations need to create new ways of seeing, believing and doing. Elkington (1998) argued that companies must take a triple-bottom-line approach to business (i.e., in addition to reporting their financial performance, they must address, measure, and report on their environmental, social, and economic performance). Hoffman (2000) states that corporate legal and market rules have changed as there have increased in consumer and regulatory environmental concerns. Nattrass and Altomare (1999) outlined how companies can use standards-based environmental management systems (e.g., lSO 14001) to guide the company's strategic vision.

Wheeler and Sillanpaa (1997) stated that companies must be more stakeholder-inclusive. They argued that companies that seriously consider their stakeholders' concerns, and that strive to be good corporate citizens, will have a greater chance of succeeding in the long run. Hawken, Lovins, and Lovins (1999) listed companies that made their corporate approaches more sustainable, which led to the discovery of new niche markets and lower expenses. The author also states that businesses that react more quickly to the new rules will be more competitive than companies that do not. Willard (2002) showed that sound corporate sustainability can increase a company's ability to attract top-level talent, stabilize employee turnover rates, enhance employee morale, lower direct and indirect expenses, and boost business financial outcome. As a result, corporate sustainability can enhance the firm's financial performance.

Hypothesis 5: Corporate sustainability is strongly and positively related to corporate performance.

Corporate sustainability is an emerging business approach that offers an alternative to the traditional profit maximization business model. While corporate sustainability has not been universally adopted, there is growing evidence of its use and increasing popularity. Corporations are increasingly active in measuring and reporting on sustainability, as international business organizations have demonstrated greater academic interest and attention. Corporate adoption of the sustainability paradigm should result in new approaches to business, including the development of policies and programs relating to the company's economic, social, and environmental performance, and the measurement and reporting of that performance to stakeholders (Delmas and Blass, 2010).

Corporate sustainability activities include incorporating social characteristics into processes (e.g., fluorocarbon-free aerosol products), assuming advanced human resource management methods of practice (e.g., promoting work quality environments), improving environmental performance (e.g., recycling paper rather than cutting down trees), promoting objectives of community organizations (e.g., working with other social groups), providing humanitarian aid (e.g., relief aid during natural disasters), and offering philanthropic assistance (e.g., technology donations to inner city public schools). Daub (2007) stated that there is significant literature on corporate sustainability reporting. He added that corporate sustainability indicators can provide qualitative and/or quantitative information with respect to a company's economic, environmental and social effectiveness. Sustainability reporting has seen an increase in the scope of the reported information due to the broadening of potential target audiences. Moreover, verification practices are becoming more common.

According to Kolk (2003), there has been increased research into trends in sustainability reporting. The reason the scope of sustainability reports and verification practices has broadened because there are more potential target audiences. Therefore, indicators can be systematized in diverse ways (Azapagic, 2004). Roca and Searcy (2012) research on the indicators that are currently revealed in business sustainability reports grouped them in the following themes (refer table 4.4):

1) Emissions and Effluents;
2) Energy;
3) Water;
4) Waste;
5) Land Use and Reclamation;
6) Health and Safety Issues;

7) Environmental and Social Practices;

8) Operations;

9) Purchasing Behaviour;

10) Employment Practices;

11) Community Investments and Contributions;

12) Customers' Experience;

13) Corporate Image; and

14) Stakeholders' Satisfaction.

The reports are manually examined to identify the highlighted indicators for sustainability.

Table 4.4 - Sustainability indicators split by theme

Theme	Indicator
Emissions and effluents	Greenhouse gas and CO_2 equivalent emissions
	Greenhouse gas emissions intensity
	Emissions of Sulphur dioxide (SO_2)
	CO_2 emissions (direct/indirect/total)
	Emissions of nitrogen oxides (NOx)
	Carbon intensity in product (direct/total)
	Air compliance/GAP
	CO_2 emissions (direct/indirect/total) by sources
	CO_2 emissions intensity
	Emissions of total reduced Sulfur (TRS)
	Employee recordable injury frequency rate
	Estimated CO_2 eq. annual reduction (tons)
	Formaldehyde Emissions
	CO_2 emissions from vehicle fleet

	Flaring and venting Sources of Greenhouse Gas Emissions
Water	Water consumption Water consumption intensity Total surface water withdrawal (m^3/yr) Water consumption (Production) industrial or not mentioned Total groundwater withdrawal (m^3/yr) Liquid materials recycled (m^3) Total volume of water recycled/reused (m^3/yr) Reduction of freshwater demand Water compliance
Waste	Environmental spills and releases Solid waste material recycled (t)/reused Hazardous waste Total waste Volume of spills/weight Quantity of waste landfilled Total suspended solids (TSS) Waste diversion (from network operations) Water discharged/wastewater overflow Paper use intensity Quantity of paper shredding and recycling Solid waste disposal Global material consumption Non-hazardous waste Total items recycled (count) Waste intensity
Energy	Energy uses intensity Energy consumption (Production) Energy saved

	Fuel energy use Energy use (total electricity and fuel used (TJ)) Fossil fuel intensity Energy efficiency plan Energy uses by source Fossil fuel use Energy consumption (Building)
Reclamation	Number of branches/building Total acreage/surface Reclaimed to date (ha) Land status Land to be reclaimed (ha) New reclamation for the year (ha) Amount spent on land reclamation/reclamation costs
Health and safety	Lost time injury frequency Number of employee injury incidents per 200,000 hours worked Employees with disabilities Visible minorities employees Reportable environmental incidents Health and safety (H&S) incidents Accident rate/accident frequency Disabling injury frequency rate Contractor recordable injury frequency rate Work-related accident frequency (Lost time + Medical assistance/200,000 h)
Management	Visible minorities in management
Operations	Regulatory notifications and fines Promotion of online services/billing Number of factory audits/workplace inspections

	Pollutant Release Inventory (NPRI/INRP) legislation National Pollutant Release Inventory (NPRI), L'Inventaire national des rejects de pollutants (INRP)
Purchasing	Amount of purchase of goods and services locally
Employees	Total employees Percentage of aboriginal descent employees Employee turnover rate Investment in learning/training Employee satisfaction Full time/part time employees Employee compensation
Interaction with Community	Funding, donations, sponsorship and community investments Number of planted trees Community donations as % of domestic pre-tax profits
Customer Service	Number of business clients Client satisfaction Customer complaints and claims (number)
Corporate Image	Business volume by Industry sector Business volume by product / type of product
Stakeholder Satisfaction	Complaints from community Jobs maintained or created Total dividends paid to governments

Bell and Morse (2008) argued that sustainability indicators are very common components of corporate sustainability frameworks. Lawn (2006) stated that many studies published in the literature cover sustainability indicators. Bossel (1999) acknowledged that many scholars and institutions have been developing and evaluating sustainability indicators for the purpose of assessing corporate performance. Many studies highlighted the need to use indicators along with other assessment elements, such as conceptual models. There are many different names and descriptions of these combined elements. Daub's (2007) research on these indicators, which is described in business sustainability reports, includes a number of categories. We focus on indicators that provide insights on the following dimensions: 1) emissions and effluents; 2) energy; 3) water; 4) waste; 5) land use and reclamation; 6) health and safety issues; 7) environmental and social practices; 8) operations; 9) purchasing behaviour; 10) employment practices; 11) community investments and contributions; 12) customers' experience; 13) corporate image, and 14) stakeholders' satisfaction. Corporations should address these issues because a growing number of stakeholders (which includes investors and customers) include corporations' social and environmental performance in their decision-making process when considering investments and purchases. While corporations should concern themselves with their financial viability, they will not be able to participate in rectifying current ecological problems if they make this their sole concern. Corporations must also consider global ecological sustainability to help find solutions to environmental issues.

4.3.2.1 Emissions and effluents, Water, and waste

Labuschagne et al. (2005) stated that several publications have covered the ecological aspects of corporate activities. The related environmental issues are caused by the usage of resources and emissions they release into the air or waste discharged in water, and waste dumped in ground. Also, hazardous waste is another aspect that needs to be considered. It is also important to determine how they impact biodiversity and the product's environmental issues over the life cycle. Jose and Lee (2007) stated that there is increasing pressure for organizations to report their environmental footprint, whether they focus on sustainable development due to self-interest, social interest, or a combination of both. There has been greater publicity for initiatives that focus on reducing GHG emissions.

Hart and Ahuja (1996) argued that there is a solid rapport between a firm's performance and emission reduction. Russo and Fouts (1997) found that increasing a firm's environmental performance led to an increase in its financial performance. Wagner (2001) and (2005) stated that firms that focused on pollution prevention achieved a positive impact on their economic performance based on ROA and ROE. Probert and Dawson (2007) stated that sustainable products can reduce waste through a commitment to sustainable procurement. Cordeiro and Sarkis (1997) determined that increasing recycling had a negative impact on earnings-per-share growth, which means that there is a significant negative association between a company's environmental proactivity and its financial gains per-share performance.

Hypothesis 6: Decreasing emissions and effluents is directly related to corporate performance.

Hypothesis 7: Managing water effectively will have a progressive impact on corporate performance.

Hypothesis 8: A corporation's waste initiatives can have a undeviating influence on the corporate performance.

4.3.2.2 Energy

There has been increased demand for energy, which should continue to increase because society depends on abundant and uninterrupted energy supplies to continue living and working (Dunn, 2002; Jefferson, 2008). Organizations must focus on renewable and sustainable energy sources to manage this demand using environmentally friendly methods (Hennicke and Fischedick, 2006; Kajikawa, Yoshikawa, Takeda, and Matsushima, 2008). There is growing interest in the development of sustainable and renewable energy development fields (Kajikawa, Yoshikawa, Takeda, and Matsushima, 2008; Schilling and Esmundo, 2009; Daim, Kayakutlu, and Cowan, 2010). These initiatives can help with addressing environmental problems that are the result of fossil fuels (Dunn, 2002). Some renewable energy sources are expected to become more cost-effective than fossil fuel equivalents within a reasonable period of time (Schilling and Esmundo, 2009). A number of companies have developed internal strategies to improve their energy efficiency (Dimitropoulos, 2007). Rothenberg et al. (2001) stated that renewable energy use reduces or eliminates pollution and litigation, and also improves corporate productivity.

Hypothesis 9: Improving energy efficiency can impact corporate performance positively.

4.3.2.3 Reclamation

Land use measurement is an effective method of evaluating a company's ecological footprint. It is accessible and understandable to different audiences with an interest in a company's corporate sustainability practices. The firm's ecological footprint can be used to convert a given environmental impact into a land measurement (hectares). Barrett and Scott (2001) stated that, after evaluating and measuring all environmental impacts, the ecological footprint becomes the company's total land area required to support it based upon resources consumed and waste produced. Analyzing the company's ecological footprint can determine how close it is to being sustainable and identify the factors with the greatest ecological impact (Figge and Hahn, 2004).

Hypothesis 10: Better management of the firm's ecological footprint increases its performance.

4.3.2.4 Health and safety

An organization's polluting activities ultimately impact human health (i.e., morbidity, mortality). Maddison (1997) argued that a firm's pollutants have a significant impact on health. He added that the impacts associated with different pollutants are not simple. Pearce and Newcombe (1998) recent epidemiological study suggests that those impacts are serious. The environmental impacts of pollution are tied to a diverse range of effects, including human health and ecosystems. Corporate sustainability requires firms to guarantee that it will not allow for health and safety risks for those employed for the organization. Companies have the goal of ensuring that there will be no damaging impact on employees' physical health at any time during their employment. There is a growing number of special programs that prevent dangers to employees and ensure that they stay generally fit and healthy.

Hypothesis 11: Firm's health and safety initiatives contribute positively to its financial performance.

4.3.2.5 Sustainable Management

Adams, Thornton, and Sepehri (2012) stated that investors' demand has led to an increase in transparent management communication initiatives related to corporate responsibility, which includes published annual sustainability reports and corporate website data. Sweeney and Coughlan (2008) argued that, due to increase in corporate sustainability reporting, there is now an avenue for benchmarking. Ruf et al. (2001) claimed that greater transparency in a company's social and environmental impacts can significantly affect its overall performance. Management activities linked to environmental audits and environmental management systems can help to improve its bottom line results.

Hypothesis 12: Sustainable management programs have a direct and strong impact on the firm's financial performance.

4.3.2.6 Sustainable Operations and Purchasing practices

Integration of sustainability into daily business operation is becoming a must. For business activities to be conducted efficiently, one must define the roles and responsibilities of different operational processes to ensure that every employee knows from the organization's expectations with respect to sustainability. To systematically implement corporate sustainability, the firm must adopt process management on sustainability. According to Gupta (1995), organizations tend to create sustainable operations that satisfy environmental needs. Min and Galle (2001) argued that companies should establish procurement policies that favor vendors of sustainable products when conducting business transactions. Consideration of corporate sustainability issues in purchasing revolves around creating a sustainable supply chain, as well as awareness and consideration for the related issues (Marchi, Maria, and Micelli, 2013). One of the goals for sustainable procurement involves developing a relationship with suppliers where there is a focus on sustainability.

Hypothesis 13: Sustainable business operations are directly correlated to corporate performance.

Hypothesis 14: Sustainable purchasing practices have a positive impact on corporate performance.

4.3.2.7 Social Responsibility

An organization's social responsibility is defined as its state of consciousness of its own actions and its authentic and credible commitment to the community it operates within. The goal of social responsibility is to positively impact present and future relationships with stakeholders while remaining successful in the market over the long term. Baumgartner and Ebner (2010) argued that socially responsible organizations will focus on fulfilling their stakeholders' needs to assure their long-term loyalty. By making social issues relevant to their long-term bottom line, enlightened organizations will avoid the risk of not investing in social welfare. Orlitzky, Schmidt, and Rynes (2003) found a positive correlation between sustainability and organizational financial performance using meta-analysis. According to the study, a modest positive effect was found.

According to numerous studies, an association between corporate sustainability and financial performance was found but not clearly defined. Various research studies form the basis for social sustainability (e.g., Kok et al., 2001; Welford, 2005; Labuschagne and Brent, 2006). To be a good corporate citizen, a firm must increase its involvement in society's régime, the backing of its stakeholders and their issues, and contribute to and/or create sustainability-related activities for their local community (Donaldson and Preston, 1995). This is typically driven by the WCED concept of orientation for future generations without exploiting the present. Although a business' primary goal is to make money, Frederick (1960) argued that there is much consensus within the literature that support and involve the human element in achieving this goal. Specific programs, such as training, mentoring, and education, can help to promote the firm's goals for human capital development. A firm can address social sustainability issues that are related to its employment practices through cross-working education (i.e., job enrichment and enlargement) to overcome corporate sustainability challenges and issues (Wolf, 2013).

Management's involvement in sustainability issues from an employee's perspective typically focuses on awareness of their needs and claims. It looks also at the employees' motivational factors to encourage social sustainability implementation within the organization. Expansion of encouragements and reward systems (whether monetary, non-monetary or both) can support management in achieving their long-term sustainable goals (e.g., time, money, resources). Social sustainability aspects also consider the firm's ethical behavior toward external stakeholders (i.e., customers and clients). Basic social ethical behavior assumptions and principles include, but are not limited to, establishing a respectful culture, setting fair rules and regulations with external customers, and allocating wealth and profits fairly, giving serious consideration to stakeholders' needs and creating a culture of innovation (Herbig and Dunphy, 1998).

Hypothesis 15: A firm's employment practices can positively impact corporate performance.

Hypothesis 16: A firm's interaction with the community will have a direct impact on its financial performance.

Hypothesis 17: Attentiveness to customer service can have a direct impact on the firm's financial performance.

Hypothesis 18: Corporate image can have serious implications on corporate performance.

Hypothesis 19: Stakeholder satisfaction can have a direct impact on corporate performance.

4.3.3 Corporate Financial Performance

Kiel and Nicholson (2003) argued most empirical research on corporate performance uses accounting or market-based measures to evaluate a firm's financial capabilities. Barnhart, Marr, and Rosenstein (1994) discussed the criticism of accounting when it is compared to market-based measures. Management can manipulate accounting-based measures by changing accounting methods or accumulations, which are also challenging to equate across industries. Nicholson and Kiel (2003) stated that accounting-based measures use historical data, and reports rely on past success.

Rappaport (1987) stated that accounting-based measures eliminate threats and investment necessities, and the time value of money. Daily, Dalton, and Cannella (2003) demonstrated that market-based measures rely upon the worth of a company's common merchandise and findings are impacted by factors that are not in the leaders' control. On the other hand, market-based measures mirror risk-reduced performance and they have no negative effects caused by multi-industry settings. Kiel and Nicholson (2003) added that market-based measures look forward and reflect companies' current plans and strategies.

Most empirical studies used one measure to measure organizational performance and tend to focus on accounting-based performance, which reflects past years' results. However, market-based performance echoes the market's insight of future incomes, which are economic sources for sustainable development. These dealings of performance can validate a firm's accomplishments. However, mixed market and accounting measures of performance are more effective for balancing the risk that accounting measures largely ignore against operational performance issues that market measures exclude.

Therefore, this case utilizes the three categories of the firm's financial performance measures, in other words, the accounting based performance, the market-based performance, and the mixed market and accounting performance) and a sustainable advancement rate to achieve more precise results, and to minimize any weaknesses tied to a single performance measure. Oakland (1989) said that using different measurable and relevant performance indicators can have several advantages.

Kiel and Nicholson (2003) stated that the most frequently used accounting-based measures of corporate financial performance are ROA, ROE, and ROI. As for market-based measure, market value is selected as an indicator of performance. For the mixed market and accounting financial performance, the company's financial strength or strengths can be revealed using the Tobin's Q. Finally, sustainable growth rate, a widely used mixed market, and accounting performance measure, is used as an indicator of the financial viability of the firm.

4.3.3.1 Return on Assets

Return on assets (ROA) is a widely used accounting-based measure of corporate performance. It assesses the efficiency of assets employed (Weir and Laing, 2000). It also reflects the efficient use of a firm's assets (Kiel and Nicholson, 2003). Finkelstein and D'Aveni (1994) stated that ROA, which represents the profit over the total number of assets, is an indicator of short-term performance. Empirical research conducted by Bonn, Yoshikawa, and Phan (2004) demonstrated that ROA served to illustrate to stockholders the incomes that the firm generated from investment in principal resources. Epps and Cereola (2008) demonstrated that ROA can be used to assess the efficiency of the firm's management, as they are responsible for operating the business and using the firm's assets. Haniffa and Hudaib (2006) stated that ROA shows how a company's resources are employed in generating profit and that it demonstrates how the company's assets are used to effectively increase shareholders' economic interests. It also shows how efficiently management uses its assets to generate earnings. In formula form, ROA is calculated as follows:

ROA = Profit after tax / Total assets

4.3.3.2 Return on Equity

Return on equity (ROE) is an accounting-based measure of corporate performance. Butler and Baysinger (1985) argued that ROE is commonly used in corporate governance research. As an organization's main goal is to produce profits from its operations to benefit investors, Dehaene, De Vuyst and Ooghe (2001) showed that ROE illustrates to investors how their invested funds generate profits. Epps and Cereola (2008) defined ROE as net income divided by common equity; it measures the rate of yield on shareholders' equity and shows the company's ability to generate earnings by using shareholders' investments. ROE evaluates the efficiency of profits generated from shareholders' equity, where the higher the ratio, the higher the return. Business reporting practices, corporate governance, and firm performance should have a positive relationship. In formula form, ROE is calculated as follows:

ROE = Profit after tax / Shareholders' funds

4.3.3.3 Return on Investment

Return on investment (ROI) is a different accounting-based measure of corporate performance. Kelly et al. (2000) stated that corporations often use ROI to evaluate organizational performance and is integral to their survival. According to Brealey (1996), ROI is effective for evaluating a business' profitability. White et al. (1998) state that ROI measures the relationship between profits or investment income and the investments that produced the profits or income. Brealey (1996) defined ROI by dividing the after-tax operating profits over the book value of assets and is calculated by dividing revenue by a measure of investment. ROI determines a firm's efficiency in using assets to generate sales which lead income, and then it evaluates the profitability of assets being employed in the business. In formula form, ROI is calculated as follows:

ROI = (Profit after tax – Dividends) / Invested capital

4.3.3.4 Market Value

According to Crowther (1996) firm performance varies according to different stakeholders' perspectives. Rappaport (1986) stated that shareholder value is the firm's only concern, whereas Crowther (1996) states that there it is generally accepted that the wider stakeholder community has greater importance. Baysinger and Butler (1985) stated that the most commonly used market-based measure is the market value divided by the book value.

The market-based measure is frequently used to interpret the corporate financial performance is market value. It is determined according to the price a business owner could sell a firm as a currently functional business. It also demonstrates the firm's power for yielding cash flow. It is an indicator of the monetary value of the firm. Shareholders and managers are more interested in the firm's ongoing financial performance rather than its insolvency value. In other words, the amount that the firm would receive if all its assets are sold. In formula form, the market value is calculated as follows:

Market Value = Ln (stock price) * (outstanding Common shares)

4.3.3.5 Tobin's Q

Agrawal and Knoeber (1996) stated that Tobin's Q is an assortment of both market and an accounting-based measure of income. According to Gomper, Ishii and Metrick (2003), it is often used in organizational performance studies as an indicator of corporate financial performance. Bhagat and Jefferis (2002) argued that it illustrates a company's financial strength. Hermalin and Weisbach (1991) defined the firm's assets market value divided by the replacement cost of these assets as Tobin's Q. Min and Prather (2001) stated that a higher Q value relates to the greater effectiveness of governance mechanisms and higher market perception of company's performance. According to Weir and Laing (2001), a higher Q indicates the nearness in the interests of the shareholders and managers, whereas a lower Q means greater managerial freedom of choice. Leng (2004) illustrated that Tobin's Q can be simply measured by dividing the market value by the book value.

Tobin's Q is described by the assets' future profitability with respect to their replacement value and measures the assets' growth prospects. Jefferis and Bhagat (2002) describe Tobin's Q as the company's present market value divided by the resources' replacement cost, which is valued according to the firm's resources book value. Adams and Mehran (2005) calculated the market value of the firm as the current book value minus the assets' book value and this sum then being added to the equity's market value.

Tobin's Q associates the firm's assets market value the firm's assets book value. If the value of the Tobin's Q equals 1.0, then the company's assets reflect market value. A ratio greater than 1.0 means that market value surpasses the company's recorded assets. Therefore, an augmented Tobin's Q means that companies should invest more wealth because the business has a higher value than the price they funded, which therefore means shareholders will have a higher value for their share. However, a Tobin's Q less than the value of one means that the market value is lower than the company's assets, so the market might be underestimating the company. Tobin's Q measures the firm's growth prospect and returns from longstanding or concrete assets. In formula form, the Tobin's Q is shown as follows:

Tobin's Q = (Market value + outstanding preferred stock + Book value) / (Assets Book value)

4.3.3.6 Dividend Payout Ratio

According to da Silva, Goergen, and Renneboog (2004), the dividend Payout ratio is described as the percentage of earnings that is paid to investors. Also, referred to as the Shareholders dividends pay as a percentage of the firm's income. It is a key financial performance metric and a mixed market/accounting-based measure of the firm's performance. The ratio fluctuates centered on the industry and the firm's age. A ratio of 100% indicates that the firm is paying all its earnings as dividends. The lower the ratio, the better as the company retains some of its earnings for future use. If the ratio exceeds 100% this means that the firm is paying more that its net income in a specific year. Some companies would tend to do that in a specific fiscal year to attract more investments. As the ratio gets higher, the firm looks more attractive to investors.

This Payout Ratio is represented by:

Payout Ratio = DPS, Dividends per Share / EPS, Earnings per Share

where the DPS is equal to the total annual dividends paid over the number of outstanding shares and the EPS is equal to the sum of the annual income divided by the outstanding number of shares.

4.3.3.7 Sustainable Growth Rate

Brealey, Myers and Marcus (2007) stated that, for the firm to grow more quickly, it must invest more capital than it earns using equity financing or debt. SGR measures the firm propagation rate and the use of the firm's financial interior resources without the need for borrowing money from another source or issuing any new stock. It inaugurates a firm's maximum enhancement rate without the necessity of increasing its financial leverage. In formula form, the SGR is expressed as follows:

Sustainable Growth Rate = ROE * (1 – dividend payout ratio)

where, the dividend payout ratio is equal to the dividends per share divided by the earnings per share.

4.4 Corporate Innovation and Corporate Sustainability

The impact of sustainability on innovation is not yet clearly defined. It is becoming more important to integrate sustainability into the innovation process, but there has been no substantial effort to study this relationship. However, there is a strong belief that sustainability practices inspire innovation, and that it is a key driver of innovation. Pinkse and Kolk (2010) debated that the current literature on innovation has overlooked how sustainability can be used to describe and predict corporate innovation. Keeble et al. (2003) stated that more companies are interested in integrating corporate social responsibility into their core business activities. According to Garriga and Melé (2004), corporate social responsibility is based upon the concept of sustainable development. On the other hand, many scholars have argued that innovation can be the tool by which companies can achieve their sustainability goals (Hines and Marin, 2004). However, the relationship between corporate innovation and sustainability at a corporate level is uncertain. Organizational innovative behavior can enable corporations to take the right actions toward sustainable development. Hart and Dowell (2011) stated that there are many gaps in the research on corporate sustainability, which could be closed through empirical investigations. Research that focuses on explaining the correlation between diverse corporate sustainability practices and its innovativeness is still sparse. Supervising corporate sustainability entails the inspection of the influence of innovation on its social and environmental objectives (Wong, 2013). Innovation can be the strategic driver of sustainability.

Hypothesis 20: Corporate innovation is directly and strongly correlated with corporate sustainability.

Hypothesis 21: Corporate sustainability is directly and strongly correlated with corporate innovation.

4.5 Summary

As shown in the model depicted in Figure 4.1, the selected variables are selected due to their effect on a firm's performance and its evolution behavior. This model is built after conducting a thorough review of the literature on innovation and sustainability, where all possible variables were considered based on their relevance to the energy and energy-intensive materials production sectors.

Finally, a testable model is created and associated hypotheses are developed (refer table with corporate financial performance as the endogenous (dependent) latent construct and corporate innovation and corporate sustainability as the endogenous (dependent) latent create a testable model. However, this model can be modified after evaluating all directly related observed variables. A thorough explanation of the procedures for conducting this empirical evaluation of the proposed model along with all the selected measurable variables is presented in the next chapter "Methodology."

Table 4.5 - Proposed model hypotheses list

Hypotheses	
1	Hypothesis 1: Corporate innovation is strongly and positively related to corporate performance.
2	Hypothesis 2: Corporate performance is expected to improve based on a higher R&D expenditure.
3	Hypothesis 3: The higher the number of patents per year, the higher the firm's performance.
4	Hypothesis 4: Corporate performance is correlated with the research and development intensity.
5	Hypothesis 5: Corporate sustainability is strongly and positively related to corporate performance.
6	Hypothesis 6: Decreasing emissions and effluents is directly related to corporate performance.
7	Hypothesis 7: Managing water effectively will have a progressive impact on corporate performance.
8	Hypothesis 8: A corporation's waste initiatives can have a undeviating influence on the corporate performance.
9	Hypothesis 9: Improving energy efficiency can impact corporate performance positively.
10	Hypothesis 10: Better management of the firm's ecological footprint increases its performance.
11	Hypothesis 11: Firm's health and safety initiatives contribute positively to its financial performance.

12	Hypothesis 12: Sustainable management programs have a direct and strong impact on the firm's financial performance.
13	Hypothesis 13: Sustainable business operations are directly correlated to corporate performance.
14	Hypothesis 14: Sustainable purchasing practices have a positive impact on corporate performance.
15	Hypothesis 15: A firm's employment practices can positively impact corporate performance.
16	Hypothesis 16: A firm's interaction with the community will have a direct impact on its financial performance.
17	Hypothesis 17: Attentiveness to customer service can have a direct impact on the firm's financial performance.
18	Hypothesis 18: Corporate image can have serious implications on corporate performance.
19	Hypothesis 19: Stakeholder satisfaction can have a direct impact on corporate performance.
20	Hypothesis 20: Corporate innovation is directly and strongly correlated with corporate sustainability.
21	Hypothesis 21: Corporate sustainability is directly and strongly correlated with corporate innovation.

Chapter 5

Methodology

5.1 Introduction

In Chapter Four, a new model was proposed to test the role of innovation and sustainability in the evolution of the North American energy sector and energy-intensive materials production firms by answering four important questions: (1) How are firms leveraging innovation to increase their future financial performance? (2) How are companies striving to reduce their environmental and social impact for improved financial performance? (3) How is innovation driving corporate sustainability practices and altering the way companies think to become more environmentally friendly? (4) How are organizations turning sustainability into innovation’s new frontier to achieve a competitive advantage and influence the current energy dilemma? This chapter focuses on the research process involved in verifying the proposed structural model. It discusses the sampling process, study method and data collection procedure, as well as arithmetical investigation of the gathered data. It describes the measures taken to analyze the statistics, as well as hypotheses testing results and measures assessment. We proposed a comprehensive figures analysis tool that utilizes dissimilar elements of first generation multivariate methods, as it was found to be most suitable for performing these types of analysis.

SEM stands for, structural equation modeling is appropriate for such types of expletory researches. To ensure systematic routine of the analysis process, Babin et al. (2010) and Hair et al. (2006) six stages SEM systematic process was followed. SEM is an abiding analysis that supports testing and possibly confirms the theory. Hancock and Mueller (2009) argued that SEM is most appropriate for quantitatively testing a hypothetical relationship between latent and observed variables. Schumacker and Lomax (2010) stated that SEM allows researchers to answer multiple interconnected research questions. Rigdon, Gefen, and Straub (2011) highlighted that SEM is a single, methodical, and comprehensive analysis. In the following section, a brief introduction to SEM is presented.

Structural equation modeling (SEM) uses empirical data (both cross-sectional and longitudinal data) to assess the legitimacy of a substantive theory (Koufteros, 1999). This method uses a philosophy testing approach referred to as a confirmatory to assess the structural theory’s multivariate analysis, which depends on upon causal relations between several changes. This causal pattern of inter-variable relationships within the theory is specified as a priority. It has a purpose of determining the consistency of the hypothesized theoretical model (refer to Figure 4.1) with the collected data that evaluates the premeditated theory. According to Kline (2005), SEM uses a large sample of the value N greater than 200 to evaluate both path and measurement models. Hair et al. (1998) argued that SEM is effective for causal modeling of multi-dimensional and varying data sets that collect numerous measures of the planned constructs. The confirmatory technique is often used to validate a developed research model, and analysis includes an exploratory element.

SEM focuses on latent constructs (e.g., corporate innovation, corporate sustainability and corporate performance) over observed variables that are used to measure these constructs. Measurement is usually difficult and error prone; SEM can produce unbiased estimates for relationships between latent constructs by explicitly modeling measurement error, and can associate multiple measures with one latent construct. According to Bullock et al. (1994), SEM can express complicated variable relationships through either hierarchical or non-stratified equations to present a depicted model in its entirety. The structural equation theoretical model includes three constructs, which were assessed using multiple indicators.

This research is about studying a theoretical phenomenon (i.e., the role of innovation and sustainability in the evolution of energy firms) that is not measured unswervingly. Using the SEM technique, the theoretical concepts of corporate innovation, corporate sustainability, and corporate performance are also known as constructs, hidden variables, factors or unobserved variables. Latent variables are a type of hypothetical variables that are identified based on a group of measured and observed variables. In this situation, the organizational ability to innovate is a latent variable, which represents the capability of the organizational construct (e.g., corporate sustainability). Observed variables are measurable variables that are commonly denoted to as indicators, or calculated or manifest variables. The SEM model distinguishes between exogenous and endogenous latent variables. In this study, independent variables are represented by exogenous variables (i.e., corporate innovation and corporate sustainability), while endogenous variables represent the dependent variables (i.e., corporate performance). Exogenous latent variables predict other latent variables while other latent variables predict endogenous variables.

Kline (2005) defined measurement error as the direct result of other unique sources of variance on the observed variable. These variance sources reflect unreliability or random error, as well as causes of systematic variance that are not consequences of measurement error factors. According to Schumacker and Lomax (2010), observed variable measurement error is a percentage that compliments the observed variable score which measures something that is hypothetically measured by the latent variable. Byrne (2001) stated that residual errors are errors in predicting endogenous latent variables that are based on exogenous latent variables, which means that it indicates the differences between the dependent variable's observed and predicted values.

The SEM path diagram graphically illustrates the research hypothetical model. Ellipses represent latent variables (corporate innovation, corporate sustainability, and corporate performance), and rectangles represent observed variables. One-headed straight arrows represent how one variable affects another by giving an indication of the subsequent effect from its cause. Curved double-headed arrows represent correlations between two variables. Small circles represent measured and residual error terms, which are the unobserved variables. A two-step SEM process is used to assess the hypotheses in Chapter Three against empirical data. This process includes assessments of the both models (i.e., measurement and confirmatory).

5.2 Structural Equations with Latent Variables

Byrne (1998) explained how SEM can use a hypothesis-testing or confirmatory approach by performing a multivariate analysis to the proposed structural model. Researchers are well aware of the power of such a statistical methodology. This covariance structure analysis, referred to as confirmatory factor analysis (CFA), which is a powerful way to investigate hypothesized relationships between latent variables that are measured by observed indicators. Researchers use SEM to put emphasis on latent constructs over the observed variables that they would use to divide these constructs. Latent constructs are also applicable to the theoretical or unobserved constructs while observed variables apply to empirical or manifest variables; this is due to the fact that factors define latent variables (commonly referred to as explaining indicators), in a certain setting, are likely difficult to collect due to numerous errors. SEM explicitly models measurement error to help with driving unprejudiced approximations for the association among different unobserved constructs. Therefore, it permits the association of numerous measures with one single latent construct.

SEM is capable of invoking a structured measurements covariance matrix. When the parameters of the model are estimated, a comparison of the model's covariance matrix to a data-based or numerical covariance matrix can be achieved. CFA confirmation can be achieved by relating the calculated covariance matrix with the authentic covariance matrix that resulted from the empirical data. SEM plausibly explains the connections between these measurements. SEM typical analysis consists of measurement- and structural model. A measurement model illustrates the operationalization of each unobserved construct using corresponding measurable factors. On the other hand, a structural model shows the associations between unobserved constructs.

Hair et al. (1998) explained that SEM is the most appropriate technique for testing the structural models. SEM enables simultaneous estimation of a series of regression equations for all the paths that are presented in the proposed model. SEM is effective for dependent variables that resemble independent in their nature (Hair et al., 1998). SEM allows testing complex path models that use sophisticated relationships. It is a robust method than similar techniques that involve multiple regression analysis (Kelloway, 1998). SEM considers both measurement and prediction questions to produce a unique analysis. With typical latent variable models, SEM enables simultaneous assessment of measurement quality and examines extrapolative connections among constructs. SEM enables simultaneous path analysis and CFA, which permits researchers to ask accurate questions about the researched phenomena. These analyzers are ideal for approximating predictive relationships between the latent constructs.

SEM is useful in portraying a connection between numerous independent and dependent variables. It is a mix of regression. factor analysis, and analysis of variance. SEM has the capability of performing a multilevel regression and analysis of variance (ANOVA) on factors.

The following paragraphs discuss the different types of variables that occur in SEM in depth to allow for a clearer explanation of the procedure. Exogenous variables are not influenced by another variable in this model while endogenous variables are in fact influenced by other variables within the model. Observed variables (or indicator variables) are directly measured and observed. In contrast, unobserved constructs have to be measured indirectly and represent the “factors” in a factor analysis. Latent variables increase the SEM’s complexity because one must account for all possible observed variables, or observed indicators, to quantify the latent variable.

Covariance and correlation function as the building blocks when representing data when using a software program that uses SEM to do model specification. Covariances and correlations between variables represent the relationship between two variables that might not be causal. In practice, most models involve causal and non-causal relationships. Determining covariance estimates between variables improves estimation of direct and indirect effects of other variables, especially when working with complex models where many parameters must be estimated.

A structural equation model diagram must include a structural model for the proposed model to be completed. This model is used to relate all variables required for the proposed model. A measurement model is also part of the structural equation model diagram, which must be completed for the proposed model. It is an essential requirement and part of the diagram, which is analogous to factor analysis. It shows all observed variables that were “loaded” onto the latent variable, and their relationships, variances, and errors. The structural and measurement models must follow some rules when creating a structural model; this will be discussed later in the chapter. The structural and measurement models combine to form the structural equation model, which includes all measured, observed, or manipulated factors in the examined set of variables.

SEM is used to answer any research question about observed variables of one or more independent or dependent variables. However, its key purpose is to dictate the legitimacy of a proposed causal model, which means that SEM is a confirmatory technique. As with other tests and models, one collects a sample to make inferences about a population that makes up the sample. The covariance matrix, which is based on the sample of collected measurements, serves as the dataset. Therefore, SEM’s empirical question is whether the proposed model results in a population covariance matrix that is consistent with the sample covariance matrix. A model must be specified a priori to undergo validation testing, so SEM can answer many questions. It can determine whether the model is adequate. One can estimate and compare parameters with the sample covariance matrix. The goodness of fit statistics is calculated to determine if the proposed model is appropriate or requires revision. SEM can compare multiple theories specified a priori. It can calculate whether the independent variables account for the amount of variance in the dependent variables (observed or latent). SEM can indicate the reliability of measured variables. It can also describe group differences, such as the two sectors being investigated.

5.3 Limitations and Assumptions

A full model is a priori because SEM is a confirmatory technique. One must define the number of parameters being estimated before analysis, including covariances, path coefficients, and variances. Before starting the analysis, one must first specify all relationships in the model to test based on the measurements' sample and variables. SEM is effective for modeling complex relationships between multivariate data, one must consider the importance of sample size although it is often underemphasized). Consider the following assumptions: the sample should include at least 200 observations. Another cut off would be the number of observed variables multiplied by 8 in the proposed model, plus the number 50. SEM works better with a larger sample size. As with other multivariate statistical methodologies, most estimation techniques require multivariate normality. Data for univariate and multivariate outliers should be examined. Variable transformations are an option and it requires normality.

SEM technique examines first-order (linear) relationships between all observed and latent variables. SEM by generating bivariate scatterplots for all the variables. A power transformations are possible if there is a quadratic relationship between two variables. A point of caution, multicollinearity is among the main issues. Multicollinearity can be observed between variables and can create a problem. All available software checks for multicollinearity when constructing the covariance matrix. Extreme multicollinearity can be determined.

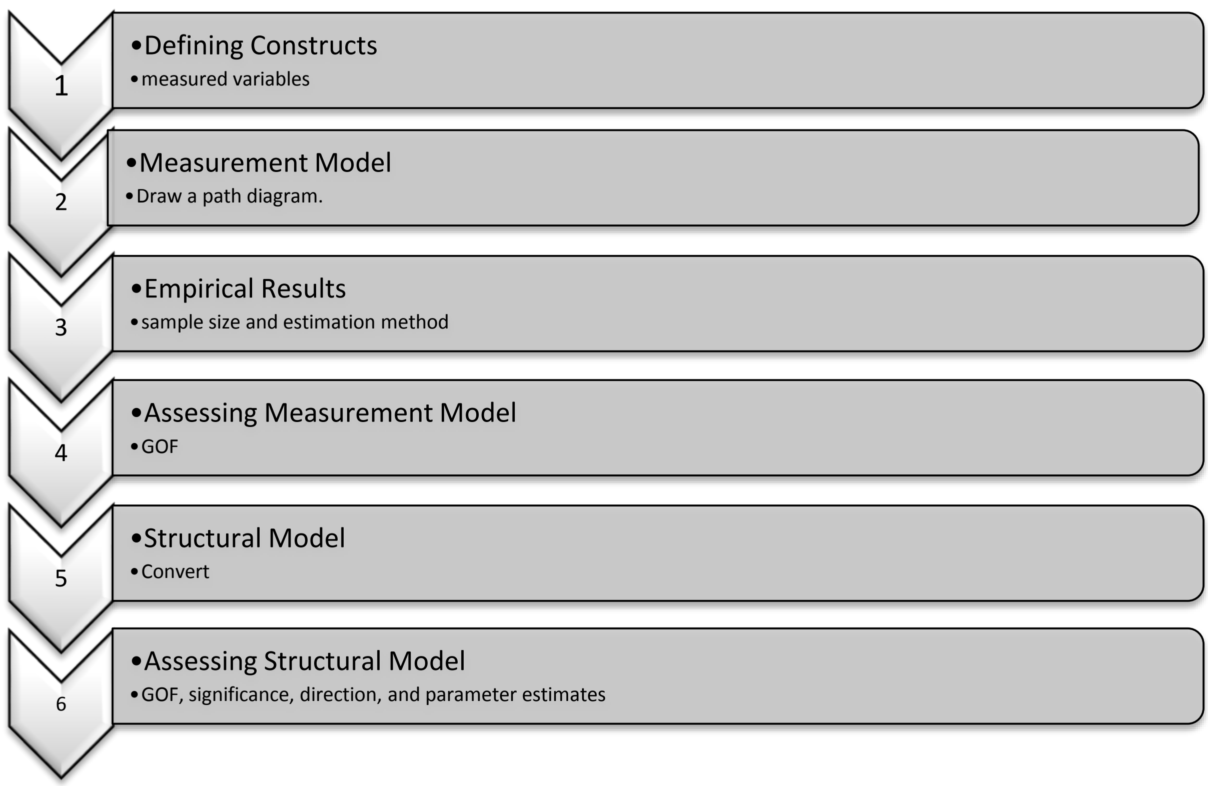
5.4 Data Preparation

LISREL software handles complete data sets. The dataset has no missing values as firms with missing data points were removed from the sample. The raw data sources are (a) Compustat, available at www.wrds-web.wharton.upenn.edu for all financial performance indicators, as well as research and development expenditures for 2014 and prior, (b) CSR reports (available at the firms' URLs, see Appendix F) for all environmental stewardship, social responsibility, and community involvement, and (c) The Lens database, available at www.lens.org, the CIPO, stands for, Canadian intellectual property office available at www.ic.gc.ca, and the USPTO, stands for, United States patent and trademark office, both available at www.uspto.gov for granted and patent applications. Units of measurement for all observed variables were checked for consistency and transformations were made as needed, for example, Tera to Giga Joules (TJ to GJ) and KWh to MWh for energy variables.

5.5 The Six-Steps Process

Figure 5.1 shows the six-step process for building a structural equation model. The process and the systematic procedure is presents in this section. The six step procedure is a well-known and common practice among researchers.

Figure 5.1 – Structural equation modeling six-step process



5.5.1 Defining the Constructs

Constructs are defined and operationalized during this stage. Research questions, relevant literature, and findings from different studies conducted earlier to this research are referenced. The research focuses on corporate innovation, corporate sustainability, and corporate financial performance, which make up the measurement model. The constructs, which are defined below, are operationalized by choosing suitable measurable factors. All indicators were selected based on their previous use in other studies, which results in a high degree of validity and specificity. This section describes the methodology involved in developing the three constructs. Measurement items originate from the previous literature on corporate innovation and corporate sustainability, although there is some modification to reflect the research context. This modification is observed across different studies that investigate these constructs. Currently, there is no measurement scale for the corporate innovation construct, thus, the measurement items were taken from literature about technological innovation, which is based on R&D expenditure, patents registered, and R&D intensity which is a clear indicator for a firm's commercialization efforts, as these items were used in explaining corporate innovation capabilities.

Moreover, according to Bell and Morse (2008), sustainability reports are considered a reliable source to obtain sustainability indicators. These indicators are used in measuring corporate sustainability (Atkinson, 2000; Benijts, 2008). Lawn (2006) argued the use of sustainability indicators in conceptual models. He stated that every latent construct (i.e., environmental stewardship, social responsibility, and community involvement) can be explained by other observed variables. All manifest variables used were embraced from numerous highly respected research studies related to corporate innovation, corporate sustainability, and corporate financial performance. These indicators have been extensively used in research studies related to the field of study.

5.5.1.1 Corporate Financial Performance

Barney (2002) argued that a wide variety of definitions of firm performance have been proposed in the literature. In the case of this study, the dependent variable "corporate performance" is a firm's total wealth generated before distribution to stakeholders as opposed to accounting profit allocated to shareholders (Riahi-Belkaoui, 2003). The literature includes two common approaches to organizational performance measurement. Spanos et al. (2004) argued that one approach involves adopting a single measure that depends on upon how the measure relates to performance. Miller (2004) debated the use of several measures to compare analyzes with identical independent and different dependent variables. The validity of using both approaches depends on upon whether those measures satisfy the assumptions. The study examines corporate performance using accounting-based, market-based, and mixed market/accounting measures.

Kiel and Nicholson (2003) argued that accounting-based measures are based on historical data, and reports focus on past success. Rappaport (1987) mentioned that accounting-based measures do not include risks and investment requirements, or the time value of money. Daily, Dalton, and

Cannella (2003) illustrated that market-based measures depend on the value of companies' common stock and factors beyond the control of the firms' leaders affect the findings. Conversely, market-based measures reflect risk-adjusted performance and are not adversely influenced by multi-industry contexts. Kiel and Nicholson (2003) stated that market-based measures look forward and illustrate a company's current plans and strategies. As a result, both measures of performance can highlight a firm's accomplishments.

However, mixed market and accounting measures of performance are more effective in balancing the risk that accounting measures largely ignore with respect to operational performance issues that do not exist in market measures. Therefore, this study utilizes the three cornerstones of performance measurement (i.e. market-based performance, accounting-based performance, mixed market and accounting performance). It includes the sustainable growth rate for greater accuracy, and to reduce any weaknesses that apply to a single performance. Oakland (1989) stated that one must employ important, measurable and relevant performance indicators.

Kiel and Nicholson (2003) stated that the most frequently used accounting-based variables of corporate performance are ROE, ROA, and ROI. As for market-based measure, market value is selected as an indicator of performance. For the mixed market and accounting performance, and in order to reveal the company's financial strength Tobin's Q was selected and PR, the dividend ratio of payout, which provides an indicator of the firm's ability to pay its shareholders and the reserved funds kept with the company for future investments. Finally, sustainable growth rate, a widely used mixed market, and accounting performance measure, is used as an indicator of the firm's financial viability.

5.5.1.2 Corporate Innovation

Research and development is a key strategic variable (observed variable) used to measure corporate innovation. R&D is considered to be a good indicator of a firm's technological capacity. It has been widely used in similar researches. A firm's tangible technological resources and intangible innovative resources is mainly based on the amount of funds spent on R&D. Therefore, a firm's technical ability and state-of-the-art aptitude is determined by the dollar amount invested in R&D. New products and process improvements are a direct outcome of R&D investments (Aboody and Lev, 2000). Organizations can realize rents from R&D investments by addressing appropriability issues tied to innovation (Zhang, Baden-Fuller, and Mangematin, 2007).

Patents were used as a key strategic variable (observed variable) to measure corporate innovation. Economists have determined that patents, arranged according to the date of application, are good indicators of R&D activity. According to Popp (2005), patent counts can measure innovative output, and also function as an indicator of innovative activity levels. Analyzing firms' patents can help with forming the foundation for a patent-based strategy. According to Mogee (1991), the patent analysis is effective for analyzing technological innovation. Patents serve as an indirect measure of innovation activities as they are useful for evaluating firms' current innovation efforts, determining future direction and supporting R&D decision-making. The application of patent data can support the identification of technological methodologies (Oltra and Saint Jean, 2009). Patent counts are also a useful measure (Oltra, Kemp and De Vries, 2010).

Patents are an effective method of protecting innovation. Therefore, it is useful to analyze the comprehensive information provided by patents about technological trends and R&D activities, which is useful for identifying both emerging and declining technologies and understanding the evolutionary processes of different energy technologies. Since patents provide useful technological information, as well as information on new technology, the databases of the USPTO, United States Patent and Trademarks Office and CIPO, the Canadian Intellectual Patent Office can be effective sources of analysis. According to Lee et al. (2012), recent studies have evaluated similar technologies with similar characteristics and evaluated the resulting technological evolution patterns across different energy technologies. The keywords used to retrieve patents are shown in Table 5.1.

Table 5.1 - Patents retrieval keywords

Technology	Search phrase
Coal	coal
Natural gas	natural gas
Petroleum (Crude oil)	crude oil
Nuclear	nuclear
Solar	solar
Photovoltaic	photovoltaic
Biomass	biomass

Wind	wind
Hydropower	hydropower
Tidal (Ocean)	tidal
Geothermal	geothermal
Waste	waste
Fuel cell	fuel cell
Hydrogen	Hydrogen
Liquefied	coal to liquid or coal to liquids or gas to liquid or gas to liquids
Battery	battery
Flow cell	flow cell
Thermal energy Storage	thermal storage
Heat pump	heat pump
Power system	power system
Combustion	combustion

The patent application takes time and cost, and new technologies with commercial potential are applied for patents, although very few patents have resulted in sufficient commercial value for transfer to innovation (Daim, Iskin, Li, Zielsdorff, Bayraktaroglu, Dereli, and Durmusoglu, 2012). Therefore, R&D intensity is a key strategic variable (observed variable) in the measurement of corporate innovation. It is calculated as the ratio of the R&D expenditures spent by a certain firm to the total sales volume expressed in dollars. McWilliams and Siegel (2000) stated that they chose R&D intensity because it is commonly used in technology and sustainability-related literature.

5.5.1.3 Corporate sustainability

Sustainability as a corporate strategy has a number of goals, including long-term corporate efficiency, performance, growth, and company competitiveness, which can be achieved by including social and environmental aspects into corporate management. According to the literature, there are different approaches to managing environmental and social impacts that can result in corporate sustainability (Banerjee, 2002). The sustainable development concept drives sustainability as a strategic approach. Sustainability reflects corporate strategy through quantitative and/or qualitative forms of feedback. Corporate sustainability can be measured using different indicators. Those indicators can be also monitored and evaluated over time (Veleva and Ellenbecker, 2001). Assessing the relative success of corporate sustainability can be done by looking at the overall firm environmental and social performance using these indicators. Companies can use indicators to determine their progress toward sustainability goals, and to demonstrate that they are including their environmental and social impacts (Azapagic, 2004).

According to Bell and Morse (2008), corporate sustainability frameworks consist of these common sustainability indicators. Lawn (2006) argued that many researchers employ sustainability indicators to assess corporate sustainability. Meadows (1998) acknowledged that they can also be used with conceptual models and other assessment elements. There are many different combinations of these sustainability indicators. Daub (2007) stated that corporate sustainability indicators can produce qualitative and quantitative data that determine the changes in a company's environmental and social effectiveness. The increases in potential target audiences have increased the scope of reported information from sustainability reporting, and verification practices have become more commonplace.

According to Kolk (2003), there has been increased research into trends in sustainability reporting. The scope of sustainability reports and verification practices has broadened because there are more potential target audiences. Therefore, indicators can be systematized in different ways (Azapagic, 2004). Roca and Searcy (2012) did research on the indicators that are unveiled in corporate sustainability reports and categorized them in the following themes (refer to Table 5.2): 1) emissions and effluents; 2) energy; 3) water; 4) waste; 5) land use and reclamation; 6) environmental expenditure; 7) health and safety issues; 8) sustainable operations; 9) purchasing behaviour; 10) employment practices; 11) community involvement; 12) community investments and contributions; and 13) community volunteer services. Items from the prior research were adapted and used to operationalize latent constructs.

Table 5.2 - Sustainability indicators split by theme

Theme	Indicator
Emissions and effluents	Total Greenhouse gas (GHG) measured in tons of carbon dioxide equivalent (CO_2e), Total Flared and Vented Gases measured in metric tons of CO_2 equivalent, Sulphur dioxide and Nitrogen oxides measured in tons, Volatile organic compounds (VOCs) measured in tons
Water	Total volume of water recycled as a percentage of the Total Water Used expressed in percent (%),
Waste	Total Number of Spills in Thousands of barrels, Waste Recycled as a percentage of the total waste in percent (%),
Energy	Total energy consumption measured in Gigajoules, Total Non-carbon energy generated in MWh,
Reclamation	Total reclaimed land as a percentage of the total land use expressed in percent (%), Protected wildlife habitat in acres,
Environmental Expenditure	Environmental expenditures in dollars
Health and safety	Employees and Contractors lost-time injuries expressed in number of injuries, Employees and contractors Lost time injury rate measured in number of Cases/200,000 hours worked, Employees and Contractors recordable injuries expressed in number of injuries, Employees and contractors' Recordable injury rate measured in number of Cases/200,000 hours worked, Employees and contractors Fatalities per year

Operations	Compressed natural gas (CNG) vehicles in fleet measured in number of vehicles
Purchasing	Purchase of goods and services locally as percentage of total sales (%),
Employees	New Hires expressed as a percentage of the total number of employees (%), Voluntary Turnover Rate expressed in percentage (%), Employees in Employee Unions or Associations expressed in percentage (%), Diversity expressed in percentage of Women in the workforce (%), Minority employees expressed in percentage (%),
Community Involvement	Planted trees expressed in number, Grass seed planted presented in acres, Forest Land Established in acres
Community Investment	Funding, donations, sponsorship and community investments expressed in Millions of Dollars
Community Volunteer Services	Employee volunteer hours showed in number of hours

5.5.2 Measurement Model

During this stage, a general measurement model was developed using the three latent constructs, including each latent construct respective observed indicators. The process involves defining a model is to depict the relationship between different proposed latent and observed constructs and variables. Figure 5.1 shows a detailed diagram of the hypothesized measurement model, where the ellipses are representative of the hypothetical latent constructs that formulate the new desired proposed model. Each latent construct has its observed indicators, which are sure to be affected by the latent construct.

Most existing studies focus either on greater financial payoffs from innovation (e.g., Cohen and Levinthal, 1990; Kurapatskie and Darnall, 2013) or implications for integrating corporate sustainability into the firm's financial performance (e.g., McWilliams, Siegel, and Wright, 2006; McWilliams and Siegel, 2000; Salzmann, Ionescu-somers and Steger, 2005; Willard, 2005; Sariannidis et al., 2013). The link between corporate innovation and corporate sustainability and their combined impact on corporate performance has not been previously addressed. The role of innovation and sustainability in a firm's evolution has not been studied, although researchers believe that there could be noticeable consequences for academic advancement and managerial practice. This quest was fully demonstrated in Chapter 2, "Literature Review", and Chapter 3, "Conceptual Foundation," which resulted in different sporadic models to explain each relationship separately.

It is believed that revolutionary sustainable energy solutions can create a low carbon economy. There are many proposed carbon-free alternatives to conventional energy sources, but there have been relatively limited actions on these options. The ability to test these options using empirical data collected from different sources is granted through the proposed model. This promotes an understanding of how energy sector firms can evolve due to the relationship between innovation, sustainability, and performance as most of the existing literature suggests that firms must follow an innovative path for energy transition. The role of innovation and sustainability in the evolution of energy sector firms and whether there is a definitive link between these concepts (i.e., sustainability driving innovation or innovation driving sustainability) is explored using the defined measurement model shown in Figure 5.1. The CFA model provides a theoretical framework and empirical model that describes how firms evolve in light of the interrelationship between a firm's financial performance and its innovation capabilities and sustainability goals.

CFA is used to confirm the theorized measurement-model. It is also used to display the correlation between all the observed variables allocated to the three latent constructs in the proposed theoretical model. CFA is theory driven. The proposed measurement theory shown in Figure 5.1 specifies the constructs and the related set of measured variables. The CFA technique tests the ability of measured variables to accurately measure constructs that are not directly measured.

In order to perform an SEM, it is required to identify the number of measurable variables in the model. The first and foremost step in building the model for measurement is to determine the number of observed indicators and latent constructs that are used to compose the model. The following section details the scheme that was followed to build the measurement model. A detailed set of guidelines for building the SEM using LISREL software is presented below. The following rules are generally compatible with the existing software programs that were used to perform the analysis.

SEM analysis starts by building a proposed causal model to be drawn before attempting the analysis. The following six basic rules are presented for drawing the proposed model:

1- The rectangles represent the observed variables and the ellipses represent Latent variables and

2- A hypothesized direct relationship is represented by a line with an arrow in one direction between two variables;

3- Arrows originate at the causal variable and moves towards the variable that is caused;

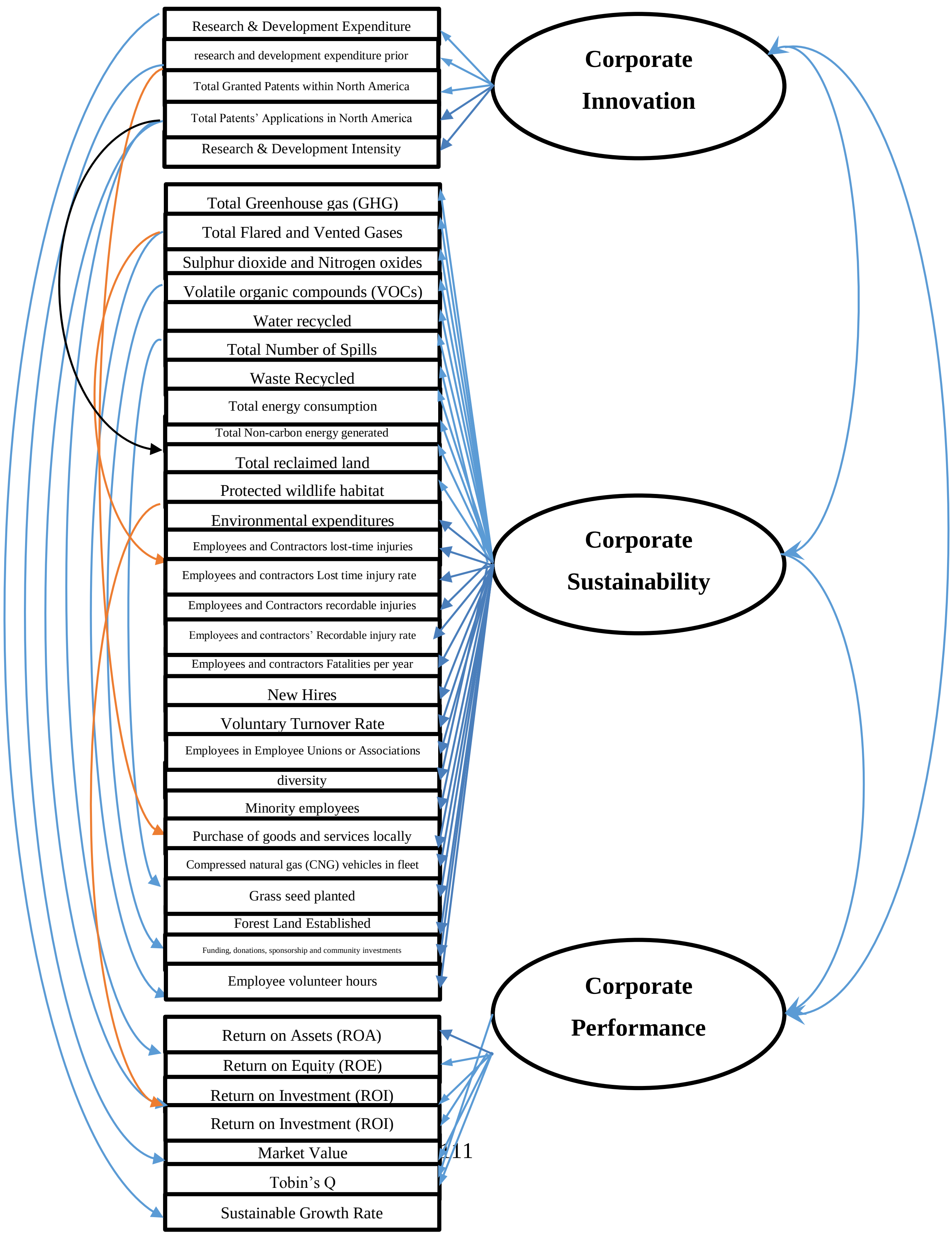
4- Curved lines with arrows in both directions demonstrates a bi-directional relationship (i.e., a covariance);

5- Covariance arrows should only be allowed for exogenous variables;

6- Endogenous variable residual term should be added to the model; and

7- A circle with Ɛ stands for error, inside represent the residual term which.

Figure 5.2 - Path Diagram Showing Hypothesized Measurement Model Specification (CFA Model)



The original model included 3 unobserved variables, combined with 42 observed factors for operationalization. The number of indicators used to explain each of the three latent constructs meets the cutoff criteria determined by Hair et al. (2010). Also, degrees of freedom is another criteria. The measurement model df should be more than the established number of paths. Given the number of observed and unobserved constructs and indicators and the large enough sample size, problems were not expected. In this case, the maximum likelihood (ML) method was used to approximate parameters, with PRELIS 2.30 producing the covariance matrix.

5.5.3 Empirical Results

Research design and data collection takes place during this stage. The nature of the research quantitative in nature and requires an appropriate number of observations. Hair et al. (2010) discussed five different aspects that affect SEM's required sample size. Their aspects are shown below

1. Normality of data collected,
2. Technique used for estimation,
3. Complexity of the model,
4. Data points with Zero of missing values, and
5. Observed variable average error of variance.

Velicer, Ding, and Harlow (1995) state that multiple cases set a minimum acceptable sample size of 100 to 150 subjects when engaging in structural equation modeling. Kelloway (1998) proposed that the appropriate size of the sample used should more than 200 observations while Boomsma (1983) recommends about 400 for moderately complex models. According to Chou and Bentler (1987), the sample to the parameters ratio should be from values of five to one, and if ten to one, that would yield better results. Structural Equation Modelling requires large samples for performing data analysis. There is a general principle that the larger the sample, the higher the stability in the result. Following these researchers' views, and considering budget and time constraints, the current research will use a target sample size of 400, which follows Boomsma's (1983) recommendation and Bentler and Chou's (1987) suggested sample to parameter ratio of 10:1. The sample size used is in line with most researchers' recommendations for structural equation models.

5.5.3.1 Sampling Frame

Using the NAICS code, which is a scheme utilized by statistical agencies in Canada, the Mexico and the United States to classify businesses and to facilitate contrast of manufacturing data across these dominions, firm-level data were composed from several sources including corporate sustainability reports and secondary data sources (i.e., Compustat financial database, United States patent and trademark, Canadian patents database). The North American industry classification system (NAICS) was used to isolate all energy-related and sustainable materials codes. GHG emissions and carbon dioxide emitted from producing steel, cement, plastic, paper, and aluminum account for over 20 percent of overall global emissions (Allwood and Cullen, 2012). In addition, greenhouse gas (GHG) emissions from both the North American energy and energy-intensive materials production sectors account for approximately 50 percent of total GHG emissions. Since the emerging challenge is to reduce greenhouse gas emissions consistent with corporate sustainability goals and government policy objectives, it was legitimate to include both in our sampling frame.

Statistics Canada defines NAICS categories based on an establishment's primary activity. Tables 5.3 and 5.4 lists the NAICS codes for energy-related and energy-intensive materials production -related firms included in our research. NAICS codes enable grouping of similar companies and industries, which simplifies the collection of statistical data. Code searching simplifies industry research or comparison of companies to its competitors. NAICS codes are two to six digits long. Two-digit codes only indicate an economy's sector, while six-digit codes refer to a specific industry. The three aforementioned countries mutually agree upon the five-digit NAICS codes; each country uses the sixth digit to be more specific in its categorization. Most databases are North American, which makes it more appropriate to use the North American six-digit code when searching. Appendix D and E present the full list of companies used to perform the analysis.

All financial information was obtained from Compustat, an accounting, and financial database for more than 25,000 publicly held companies, as well as research and development expenditures for 2014 and prior. All environmental stewardship, social responsibility, and community involvement information was retrieved from public corporate responsibility reports and corporate citizenship reports. All patent information was acquired from the Lens database, an open public resource for innovation cartography, USPTO, the United States patent and trademark office and CIPO, the Canadian intellectual property office.

Table 5.3 – Energy-Related North American industry classification system (NAICS) Codes

NAICS Code	Title	L1	Title	L2	Title	L3	Title	L4	Title	NFCC/FCC	Certainty
211111	Crude Petroleum and Natural Gas Extraction	21	Mining, Quarrying, and Oil and Gas Extraction	211	Oil and Gas Extraction	2111	Oil and Gas Extraction	21111	Oil and Gas Extraction	NFC	1
211112	Natural Gas Liquid Extraction	21	Mining, Quarrying, and Oil and Gas Extraction	211	Oil and Gas Extraction	2111	Oil and Gas Extraction	21111	Oil and Gas Extraction	NFC	1
212111	Bituminous Coal and Lignite Surface Mining	21	Mining, Quarrying, and Oil and Gas Extraction	212	Mining (except Oil and Gas)	2121	Coal Mining	21211	Coal Mining	NFC	1
212112	Bituminous Coal Underground Mining	21	Mining, Quarrying, and Oil and Gas Extraction	212	Mining (except Oil and Gas)	2121	Coal Mining	21211	Coal Mining	NFC	1
212113	Anthracite Mining	21	Mining, Quarrying, and Oil and Gas Extraction	212	Mining (except Oil and Gas)	2121	Coal Mining	21211	Coal Mining	NFC	1
212291	Uranium-Radium-Vanadium Ore Mining	21	Mining, Quarrying, and Oil and Gas Extraction	212	Mining (except Oil and Gas)	2122	Metal Ore Mining	21229	Other Metal Ore Mining	NFC	1
213111	Drilling Oil and Gas Wells	21	Mining, Quarrying, and Oil and	213	Support Activities for Mining	2131	Support Activities for Mining	21311	Support Activities for Mining	NFC	1

			Gas Extraction								
213112	Support Activities for Oil and Gas Operations	21	Mining, Quarrying, and Oil and Gas Extraction	213	Support Activities for Mining	2131	Support Activities for Mining	21311	Support Activities for Mining	NFC	1
213113	Support Activities for Coal Mining	21	Mining, Quarrying, and Oil and Gas Extraction	213	Support Activities for Mining	2131	Support Activities for Mining	21311	Support Activities for Mining	NFC	1
221111	Hydroelectric Power Generation	22	Utilities	221	Utilities	2211	Electric Power Generation, Transmission and Distribution	22111	Electric Power Generation	NFC	1
221112	Fossil Fuel Electric Power Generation	22	Utilities	221	Utilities	2211	Electric Power Generation, Transmission and Distribution	22111	Electric Power Generation	NFC	1
221113	Nuclear Electric Power Generation	22	Utilities	221	Utilities	2211	Electric Power Generation, Transmission and Distribution	22111	Electric Power Generation	NFC	1
221114	Solar Electric Power Generation	22	Utilities	221	Utilities	2211	Electric Power Generation, Transmission and Distribution	22111	Electric Power Generation	NFC	1
221115	Wind Electric Power Generation	22	Utilities	221	Utilities	2211	Electric Power Generation, Transmission and Distribution	22111	Electric Power Generation	NFC	1
221116	Geothermal Electric Power Generation	22	Utilities	221	Utilities	2211	Electric Power Generation, Transmission and Distribution	22111	Electric Power Generation	NFC	1
221117	Biomass Electric Power Generation	22	Utilities	221	Utilities	2211	Electric Power Generation,	22111	Electric Power Generation	NFC	1

							Transmission and Distribution				
221118	Other Electric Power Generation	22	Utilities	221	Utilities	2211	Electric Power Generation, Transmission and Distribution	22111	Electric Power Generation	NFC	1
221121	Electric Bulk Power Transmission and Control	22	Utilities	221	Utilities	2211	Electric Power Generation, Transmission and Distribution	22112	Electric Power Transmission, Control, and Distribution	NFC	1
221122	Electric Power Distribution	22	Utilities	221	Utilities	2211	Electric Power Generation, Transmission and Distribution	22112	Electric Power Transmission, Control, and Distribution	NFC	1
221210	Natural Gas Distribution	22	Utilities	221	Utilities	2212	Natural Gas Distribution	22121	Natural Gas Distribution	NFC	1
237120	Oil and Gas Pipeline and Related Structures Construction	23	Construction	237	Heavy and Civil Engineering Construction	2371	Utility System Construction	23712	Oil and Gas Pipeline and Related Structures Construction	NFC	1
237130	Power and Communication Line and Related Structures Construction	23	Construction	237	Heavy and Civil Engineering Construction	2371	Utility System Construction	23713	Power and Communication Line and Related Structures Construction	NFC	1
324110	Petroleum Refineries	32	Manufacturing	324	Petroleum and Coal Products Manufacturing	3241	Petroleum and Coal Products Manufacturing	32411	Petroleum Refineries	NFC	1
331318	Other Aluminum Rolling, Drawing, and Extruding	33	Manufacturing	331	Primary Metal Manufacturing	3313	Alumina and Aluminum Production and Processing	33131	Alumina and Aluminum Production and Processing	NFC	1
331420	Copper Rolling, Drawing, Extruding, and Alloying	33	Manufacturing	331	Primary Metal Manufacturing	3314	Nonferrous Metal (except Aluminum) Production and Processing	33142	Copper Rolling, Drawing, Extruding, and Alloying	NFC	1
331491	Nonferrous Metal (except Copper and Aluminum) Rolling, Drawing, and Extruding	33	Manufacturing	331	Primary Metal Manufacturing	3314	Nonferrous Metal (except Aluminum) Production and Processing	33149	Nonferrous Metal (except Copper and Aluminum) Rolling,	NFC	1

									Drawing, Extruding, and Alloying		
333131	Mining Machinery and Equipment Manufacturing	33	Manufacturing	333	Machinery Manufacturing	3331	Agriculture, Construction, and Mining Machinery Manufacturing	33313	Mining and Oil and Gas Field Machinery Manufacturing	NFC	1
333132	Oil and Gas Field Machinery and Equipment Manufacturing	33	Manufacturing	333	Machinery Manufacturing	3331	Agriculture, Construction, and Mining Machinery Manufacturing	33313	Mining and Oil and Gas Field Machinery Manufacturing	NFC	1
333414	Heating Equipment (except Warm Air Furnaces) Manufacturing	33	Manufacturing	333	Machinery Manufacturing	3334	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	33341	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	NFC	1
334512	Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use	33	Manufacturing	334	Computer and Electronic Product Manufacturing	3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	33451	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	NFC	1
334515	Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals	33	Manufacturing	334	Computer and Electronic Product Manufacturing	3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	33451	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	NFC	1
486110	Pipeline Transportation of Crude Oil	48	#N/A	486	Pipeline Transportation	4861	Pipeline Transportation of Crude Oil	48611	Pipeline Transportation of Crude Oil	NFC	1
486210	Pipeline Transportation of Natural Gas	48	#N/A	486	Pipeline Transportation	4862	Pipeline Transportation of Natural Gas	48621	Pipeline Transportation of Natural Gas	NFC	1
486910	Pipeline Transportation of Refined Petroleum Products	48	#N/A	486	Pipeline Transportation	4869	Other Pipeline Transportation	48691	Pipeline Transportation of Refined Petroleum Products	NFC	1
486990	All Other Pipeline Transportation	48	#N/A	486	Pipeline Transportation	4869	Other Pipeline Transportation	48699	All Other Pipeline Transportation	NFC	1
541350	Building Inspection Services	54	Professional, Scientific, and Technical Services	541	Professional, Scientific, and Technical Services	5413	Architectural, Engineering, and Related Services	54135	Building Inspection Services	NFC	1

541620	Environmental Consulting Services	54	Professional, Scientific, and Technical Services	541	Professional, Scientific, and Technical Services	5416	Management, Scientific, and Technical Consulting Services	54162	Environmental Consulting Services	NFC	1
541690	Other Scientific and Technical Consulting Services	54	Professional, Scientific, and Technical Services	541	Professional, Scientific, and Technical Services	5416	Management, Scientific, and Technical Consulting Services	54169	Other Scientific and Technical Consulting Services	NFC	1
624229	Other Community Housing Services	62	Health Care and Social Assistance	624	Social Assistance	6242	Community Food and Housing, and Emergency and Other Relief Services	62422	Community Housing Services	NFC	1
926110	Administration of General Economic Programs	92	Public Administration	926	Administration of Economic Programs	9261	Administration of Economic Program	92611	Administration of General Economic Programs	NFC	1
926130	Regulation and Administration of Communications, Electric, Gas, and Other Utilities	92	Public Administration	926	Administration of Economic Programs	9261	Administration of Economic Program	92613	Regulation and Administration of Communications, Electric, Gas, and Other Utilities	NFC	1

Table 5.4 - Five Key energy-intensive materials production -Related North American industry classification system (NAICS) Codes

NAICS Code	Title	L1	Title	L2	Title	L3	Title	L4	Title	NFCC/FCC	Certainty
212210	Iron Ore Mining	21	Mining, Quarrying, and Oil and Gas Extraction	212	Mining (except Oil and Gas)	2122	Metal Ore Mining	21221	Iron Ore Mining	NFC	1
322110	Pulp Mills	32	Manufacturing	322	Paper Manufacturing	3221	Pulp, Paper, and Paperboard Mills	32211	Pulp Mills	NFC	1

322121	Paper (except Newsprint) Mills	32	Manufacturing	322	Paper Manufacturing	3221	Pulp, Paper, and Paperboard Mills	32212	Paper Mills	NFC	1
322122	Newsprint Mills	32	Manufacturing	322	Paper Manufacturing	3221	Pulp, Paper, and Paperboard Mills	32212	Paper Mills	NFC	1
322130	Paperboard Mills	32	Manufacturing	322	Paper Manufacturing	3221	Pulp, Paper, and Paperboard Mills	32213	Paperboard Mills	NFC	1
322211	Corrugated and Solid Fiber Box Manufacturing	32	Manufacturing	322	Paper Manufacturing	3222	Converted Paper Product Manufacturing	32221	Paperboard Container Manufacturing	NFC	1
322212	Folding Paperboard Box Manufacturing	32	Manufacturing	322	Paper Manufacturing	3222	Converted Paper Product Manufacturing	32221	Paperboard Container Manufacturing	NFC	1
322219	Other Paperboard Container Manufacturing	32	Manufacturing	322	Paper Manufacturing	3222	Converted Paper Product Manufacturing	32221	Paperboard Container Manufacturing	NFC	1
322220	Paper Bag and Coated and Treated Paper Manufacturing	32	Manufacturing	322	Paper Manufacturing	3222	Converted Paper Product Manufacturing	32222	Paper Bag and Coated and Treated Paper Manufacturing	NFC	1
322230	Stationery Product Manufacturing	32	Manufacturing	322	Paper Manufacturing	3222	Converted Paper Product Manufacturing	32223	Stationery Product Manufacturing	NFC	1
322291	Sanitary Paper Product Manufacturing	32	Manufacturing	322	Paper Manufacturing	3222	Converted Paper Product Manufacturing	32229	Other Converted Paper Product Manufacturing	NFC	1
322299	All Other Converted Paper Product Manufacturing	32	Manufacturing	322	Paper Manufacturing	3222	Converted Paper Product Manufacturing	32229	Other Converted Paper Product Manufacturing	NFC	1
325211	Plastics Material and Resin Manufacturing	32	Manufacturing	325	Chemical Manufacturing	3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	32521	Resin and Synthetic Rubber Manufacturing	NFC	1
325212	Synthetic Rubber Manufacturing	32	Manufacturing	325	Chemical Manufacturing	3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	32521	Resin and Synthetic Rubber Manufacturing	NFC	1
325992	Photographic Film, Paper, Plate, and Chemical Manufacturing	32	Manufacturing	325	Chemical Manufacturing	3259	Other Chemical Product and Preparation Manufacturing	32599	All Other Chemical Product and Preparation Manufacturing	NFC	1
326111	Plastics Bag and Pouch Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32611	Plastics Packaging Materials and Unlaminated Film and Sheet Manufacturing	NFC	1

326112	Plastics Packaging Film and Sheet (including Laminated) Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32611	Plastics Packaging Materials and Unlaminated Film and Sheet Manufacturing	NFC	1
326113	Unlaminated Plastics Film and Sheet (except Packaging) Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32611	Plastics Packaging Materials and Unlaminated Film and Sheet Manufacturing	NFC	1
326121	Unlaminated Plastics Profile Shape Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32612	Plastics Pipe, Pipe Fitting, and Unlaminated Profile Shape Manufacturing	NFC	1
326122	Plastics Pipe and Pipe Fitting Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32612	Plastics Pipe, Pipe Fitting, and Unlaminated Profile Shape Manufacturing	NFC	1
326130	Laminated Plastics Plate, Sheet (except Packaging), and Shape Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32613	Laminated Plastics Plate, Sheet (except Packaging), and Shape Manufacturing	NFC	1
326140	Polystyrene Foam Product Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32614	Polystyrene Foam Product Manufacturing	NFC	1
326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32615	Urethane and Other Foam Product (except Polystyrene) Manufacturing	NFC	1
326160	Plastics Bottle Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32616	Plastics Bottle Manufacturing	NFC	1
326191	Plastics Plumbing Fixture Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32619	Other Plastics Product Manufacturing	NFC	1
326199	All Other Plastics Product Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32619	Other Plastics Product Manufacturing	NFC	1
326211	Tire Manufacturing (except Retreading)	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3262	Rubber Product Manufacturing	32621	Tire Manufacturing	NFC	1

326212	Tire Retreading	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3262	Rubber Product Manufacturing	32621	Tire Manufacturing	NFC	1
326220	Rubber and Plastics Hoses and Belting Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3262	Rubber Product Manufacturing	32622	Rubber and Plastics Hoses and Belting Manufacturing	NFC	1
326291	Rubber Product Manufacturing for Mechanical Use	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3262	Rubber Product Manufacturing	32629	Other Rubber Product Manufacturing	NFC	1
326299	All Other Rubber Product Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3262	Rubber Product Manufacturing	32629	Other Rubber Product Manufacturing	NFC	1
327310	Cement Manufacturing	32	Manufacturing	327	Nonmetallic Mineral Product Manufacturing	3273	Cement and Concrete Product Manufacturing	32731	Cement Manufacturing	NFC	1
331110	Iron and Steel Mills and Ferroalloy Manufacturing	33	Manufacturing	331	Primary Metal Manufacturing	3311	Iron and Steel Mills and Ferroalloy Manufacturing	33111	Iron and Steel Mills and Ferroalloy Manufacturing	NFC	1
331210	Iron and Steel Pipe and Tube Manufacturing from Purchased Steel	33	Manufacturing	331	Primary Metal Manufacturing	3312	Steel Product Manufacturing from Purchased Steel	33121	Iron and Steel Pipe and Tube Manufacturing from Purchased Steel	NFC	1
331221	Rolled Steel Shape Manufacturing	33	Manufacturing	331	Primary Metal Manufacturing	3312	Steel Product Manufacturing from Purchased Steel	33122	Rolling and Drawing of Purchased Steel	NFC	1
331222	Steel Wire Drawing	33	Manufacturing	331	Primary Metal Manufacturing	3312	Steel Product Manufacturing from Purchased Steel	33122	Rolling and Drawing of Purchased Steel	NFC	1
331313	Alumina Refining and Primary Aluminum Production	33	Manufacturing	331	Primary Metal Manufacturing	3313	Alumina and Aluminum Production and Processing	33131	Alumina and Aluminum Production and Processing	NFC	1
331314	Secondary Smelting and Alloying of Aluminum	33	Manufacturing	331	Primary Metal Manufacturing	3313	Alumina and Aluminum Production and Processing	33131	Alumina and Aluminum Production and Processing	NFC	1
331315	Aluminum Sheet, Plate, and Foil Manufacturing	33	Manufacturing	331	Primary Metal Manufacturing	3313	Alumina and Aluminum Production and Processing	33131	Alumina and Aluminum Production and Processing	NFC	1
331318	Other Aluminum Rolling, Drawing, and Extruding	33	Manufacturing	331	Primary Metal Manufacturing	3313	Alumina and Aluminum Production and Processing	33131	Alumina and Aluminum Production and Processing	NFC	1

331511	Iron Foundries	33	Manufacturing	331	Primary Metal Manufacturing	3315	Foundries	33151	Ferrous Metal Foundries	NFC	1
331512	Steel Investment Foundries	33	Manufacturing	331	Primary Metal Manufacturing	3315	Foundries	33151	Ferrous Metal Foundries	NFC	1
331513	Steel Foundries (except Investment)	33	Manufacturing	331	Primary Metal Manufacturing	3315	Foundries	33151	Ferrous Metal Foundries	NFC	1
331524	Aluminum Foundries (except Die-Casting)	33	Manufacturing	331	Primary Metal Manufacturing	3315	Foundries	33152	Nonferrous Metal Foundries	NFC	1
332111	Iron and Steel Forging	33	Manufacturing	332	Fabricated Metal Product Manufacturing	3321	Forging and Stamping	33211	Forging and Stamping	NFC	1

5.5.3.2 Sampling Method

As this study focuses on the North American energy sector, it leverages the North American industry classification system (NAICS); a detailed NAICS can be found in Appendix A, to isolate all energy-related codes (refer to Appendix B). Furthermore, to enhance the requisite breadth and depth of the study, energy-intensive materials production firms that require intensive use and consumption of energy in their production processes, and cause a substantial increase in CO2 and other GHG emissions, are included in the research sample. In their study of sustainable materials, Allwood and Cullen (2012) concluded that CO2 and other GHG emissions that result from production of steel, cement, plastic, paper, and aluminum account for over 20% of overall global emissions; therefore, the study's scope was expanded by including energy-intensive materials production sector firms within North America. The NAICS code was used to identify related codes for both sectors (refer to Appendix C). Reducing energy demand and consumption along with related GHG emissions in the production processes of these five key materials can have a considerable impact on the environment. Based on the argument that CO2 emissions need to be reduced by 50% or more by 2050, energy-intensive industrial processes that cause environmental harm are considered a key contributor that cannot be neglected. Using the NAICS code and the equivalent Standard Industry Code (SIC), multiple sources including corporate sustainability reports and publicly financial data available from Compustat financial database, more than four hundred business establishments were identified along with their corresponding data points.

To ensure sample representativeness, we adopted a random sampling methodology. To ensure random sample selection from the Compustat accounting and financial database, we extracted and checked all firms related to the NAICS codes shown in Tables 5.3 and 5.4. Firms that had incomplete data were omitted. We added non-North American companies with North American subsidiaries to the sample. Appendix F shows the complete sample under investigation. Table 5.5 illustrates the combination of observed variables and latent constructs.

Table 5.5 - Latent Constructs and Observed Indicators

Exogenous (independent) latent construct **Corporate Innovation**	Research and development expenditure, research and development expenditure prior

	(i.e., previous year), Total Granted Patents within North America, Total Patents' Applications in North America, and research and development intensity
Exogenous (independent) latent construct **Corporate Sustainability including the three themes (i.e., Environmental Stewardship, Social responsibility, and community involvement)**	Total Greenhouse gas (GHG) measured in tonnes of carbon dioxide equivalent (CO_2e), Total Flared and Vented Gases measured in metric tons of CO2 equivalent, Sulphur dioxide and Nitrogen oxides measured in tonnes, Volatile organic compounds (VOCs) measured in tonnes, Total volume of water recycled as a percentage of the Total Water Used expressed in percent (%), Total Number of Spills in Thousands barrels, Waste Recycled as a percentage of the total waste in percent (%), Total energy consumption measured in Gigajoules, Total Non-carbon energy generated in MWh, Total reclaimed land as a percentage of the total land use expressed in percent (%), Protected wildlife habitat in acres, and Environmental expenditures in dollars, Employees and

	Contractors lost-time injuries expressed in number of injuries, employees and contractors Lost time injury rate measured in number of Cases/200,000 hours worked, Employees and Contractors recordable injuries expressed in number of injuries, employees and contractors Recordable injury rate measured in number of Cases/200,000 hours worked, employees and contractors Fatalities per year, New Hires expressed as a percentage of the total number of employees (%), Voluntary Turnover Rate expressed in percentage (%), Employees in Employee Unions or Associations expressed in percentage (%), diversity expressed in percentage of Women in the workforce (%), Minority employees expressed in percentage (%), Purchase of goods and services locally as percentage of total sales (%), and finally Compressed natural gas (CNG) vehicles in fleet measured in number of vehicles, Planted trees expressed in number, Grass seed planted presented in acres, Forest Land

	Established in acres, Funding, donations, sponsorship and community investments expressed in Millions of Dollars, and Employee volunteer hours showed in number of hours
Endogenous (dependent) latent construct **Corporate Financial Performance**	ROA equal to Profit after tax / Total assets, ROE equal to Profit after tax / Shareholders' funds, ROI equal to (Profit after tax – Dividends) / Invested capital, Market Value equal to Ln (Year-end closing stock price) * (Common shares outstanding), Tobin's Q equal to (Market value of shareholder's equity + Liquidating value of the firm's outstanding preferred stock + Book value of total debts) / (Book value of total assets), the dividend payout ratio is equal to the dividends per share divided by the earnings per share, and Sustainable Growth Rate equal to ROE * (1 – dividend payout ratio).

This section uses the data collected from the aforementioned databases to empirically test the theorized model. Next section covers stage four to six of the SEM procedure, which looks at the both models assessment (i.e., measurement and structural) plus their specification.

5.5.4 Measurement Model Assessment

Because of the projected research model intricacy, SEM is the most suitable tool that can validate the proposed model. The following process discussed will enable the test of the proposed structure model as an entire entity to deduce the correlations between exogenous and endogenous variables. The three unobserved variables are explained by a number of various observed indicators. These manifest variables used are collected from different highly respected researchers that agreed on appropriability of such variables when it comes to interpreting research constructs, which are corporate innovation, corporate environmentalism, corporate financial performance, and corporate social responsibility. These indicators have been extensively tested by many researchers for their use. Thus, the proposed model tested using SEM has a proven theoretical foundation and hypothetical base for its functionality. Therefore, it is highly suitable for the SEM confirmatory approach using data in order to validate. This hypothesized SEM is verified using LISREL 8.80 for Windows.

SEM require determination of the model structure and estimation technique as an initial step. In order to specify the model and its parameters estimates, a path diagram is drawn graphically (Hair et al., 1998). LISREL 8.80 is used to test the dependability of the subject 42 indicators used to measure corporate innovation, corporate sustainability, and corporate financial performance to confirmatory factor analysis. Also, proposed model is validated using CFA (Hair et al., 2010). The MLE stands for, maximum likelihood estimation is selected because of its adaptability and wide-use for estimating parameters (Gerbing, and Anderson 1988). MLE is used to find the most probable estimated values to present the best fit (Kelloway, 1998). It is used with large samples due to its accuracy.

Anderson and Gerbing's (1988) used the CFA to assess and improve the measurement model. The same approach was used in this research. CFA determines the accuracy of measured items and their predictable power. Nunnally (1988) addressed unidimensionality as a prerequisite for testing reliability and validity. The three constructs are unidimensional and their rudimentary elements signify a single primary characteristic. Each group of items is linked with one another and only one construct in the model can explain that item. Unidimensionality and average variance extracted (AVE) are effective for assessing the strengths of observed variables and their associated constructs.

Anderson and Gerbing (1988) defined unidimensionality as the ability to measure only one construct using a set of measured variables. Gefen, Rigdon, and Straub (2011) stated that the factor loading matrix demonstrates how different loading coefficients are associated with measured variables. Gefen, Rigdon and Straub (2011) argued that a high coefficient is required on only one theorized factor. Any loading coefficient higher than 0.60 is considered to be relatively high while one less than 0.40 is considered to be low. Hair et al. (2006) stated that cross-loadings indicate unidimensionality and observed variables with low cross-loadings should be deleted. Larcker and Fornell (1981) stated that ayn AVE assessed value greater than or equal to 0.50 means that the latent variable is capable of explaining over half the variance of its observed variables. Urbach and Ahlemann (2010) added that you can validate a construct's distinctiveness from other constructs to ensure that each AVE is larger than the highest squared correlation of one construct with another construct.

Unidimensionality alone is insufficient, therefore, we must assess reliability after establishing unidimensionality. Linn, Werts and Jöreskog (1974) and Sörbom and Jöreskog (1988) proposed composite reliability, which assesses construct reliability and therefore represents the portion of measure variance that can be accredited to the principal characteristic. Linn, Werts, and Jöreskog (1974) signified the characteristic variance proportion to the error variance and the characteristic summation.

Validity is assessed after unidimensionality and reliability tests are done. Construct validity is another measure to express the predictability power of all the manifest indicators in explaining the unobserved variable. It is also used to express the appropriability of such factors and their inter-linkage with the latent construct. This section's goal is to gauge the construct validity of the model. Table 5.6 presents the correlation matrix which offers a good starting point, as the constructs should relate to each other. The constructs were assumed to be positively related which was apparent in the correlation matrix showing the relationships between different construct.

Numerous verifications were used to evaluate the dependability and legitimacy of the factors selected and variables identified. The different test showed that indicators were adequate and reliable. Therefore, indicators and constructs fit the measurement model and met all the standards. The theoretical model shown in Figure 5.2 can now be assessed for structural model fit.

Table 5.6 - Covariance matrix of the observed variables.

	ROA	ROE	ROI	MV	TobinQ	PR	SGR	R_D	R_D_Prio	GrantedP	PatentAp	RandDint	GHG	FandV	SOandNO	VOCs	waterrec	Spills	WasteRec	Energy	Energyge
ROA	0.01	0.01	0.00	-0.01	0.01	-0.01	0.01	-0.90	0.13	0.01	0.00	0.00	-0.01	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.01
ROE	0.01	0.03	0.00	0.00	0.01	-0.01	0.02	0.33	1.34	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02
ROI	0.00	0.00	0.05	0.01	0.00	0.00	0.00	-1.78	-1.25	0.00	0.00	0.00	0.00	-0.01	0.01	0.00	0.00	0.00	0.00	-0.01	-0.01
MV	-0.01	0.00	0.01	0.59	0.05	0.08	-0.03	58.11	49.14	0.05	0.06	-0.01	0.17	0.12	0.19	0.08	0.00	0.00	0.00	0.11	-0.14
TobinQ	0.01	0.01	0.00	0.05	0.24	0.00	0.00	5.50	10.72	0.01	0.01	0.01	-0.01	0.01	-0.04	-0.02	0.01	0.00	0.00	-0.01	0.08
PR	-0.01	-0.01	0.00	0.08	0.00	0.22	-0.01	-6.35	-6.23	-0.01	-0.01	0.00	0.02	0.00	0.06	0.03	0.00	0.00	0.00	0.01	0.01
SGR	0.01	0.02	0.00	-0.03	0.00	-0.01	0.03	-2.80	-0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.05
R_D	-0.90	0.33	-1.78	58.11	5.50	-6.35	-2.80	71106.25	39214.13	42.86	44.76	-0.06	48.95	46.75	40.93	70.49	-6.03	4.37	0.07	31.82	40.15
R_D_Prio	0.13	1.34	-1.25	49.14	10.72	-6.23	-0.48	39214.13	39578.63	30.15	28.31	-0.34	35.81	31.93	23.45	35.28	-5.37	1.93	-0.01	16.89	48.07
GrantedP	0.01	0.00	0.00	0.05	0.01	-0.01	0.00	42.86	30.15	0.27	0.20	0.01	0.08	0.07	0.04	0.10	0.00	0.00	0.00	0.03	0.12
PatentAp	0.00	0.00	0.00	0.06	0.01	-0.01	0.00	44.76	28.31	0.20	0.26	0.02	0.06	0.05	0.05	0.07	-0.01	0.00	0.00	0.03	0.10
RandDint	0.00	0.00	0.00	-0.01	0.01	0.00	0.00	-0.06	-0.34	0.01	0.02	0.07	0.00	-0.01	0.00	-0.01	0.00	0.00	0.00	0.00	0.01
GHG	-0.01	0.00	0.00	0.17	-0.01	0.02	0.00	48.95	35.81	0.08	0.06	0.00	0.96	0.99	0.53	0.87	-0.01	0.01	0.00	0.43	1.03
FandV	0.00	0.00	-0.01	0.12	0.01	0.00	0.00	46.75	31.93	0.07	0.05	-0.01	0.99	1.35	0.45	1.00	0.00	0.01	0.00	0.47	1.43
SOandNO	-0.01	0.00	0.01	0.19	-0.04	0.06	0.00	40.93	23.45	0.04	0.05	0.00	0.53	0.45	0.81	0.46	-0.02	0.01	0.00	0.05	-0.18
VOCs	0.00	0.01	0.00	0.08	-0.02	0.03	0.01	70.49	35.28	0.10	0.07	-0.01	0.87	1.00	0.46	1.31	-0.01	0.00	0.00	0.50	1.50
waterrec	0.00	0.00	0.00	0.00	0.01	0.00	0.00	-6.03	-5.37	0.00	-0.01	0.00	-0.01	0.00	-0.02	-0.01	0.07	0.00	0.00	0.00	-0.01
Spills	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.37	1.93	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00
WasteRec	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.00	0.00	-0.01	0.11	-0.01	0.01	0.00	31.82	16.89	0.03	0.03	0.00	0.43	0.47	0.05	0.50	0.00	0.00	0.00	0.66	1.19
Energyge	0.01	0.02	-0.01	-0.14	0.08	0.01	0.05	40.15	48.07	0.12	0.10	0.01	1.03	1.43	-0.18	1.50	-0.01	0.00	0.00	1.19	6.52
Reclaime	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
wildlife	0.00	0.00	0.00	-0.02	-0.01	0.05	0.00	12.65	-0.54	-0.02	-0.02	-0.01	0.13	0.17	0.05	0.22	0.00	0.01	0.00	0.14	0.34
EnvExp	-0.01	-0.01	0.03	0.45	-0.06	0.11	-0.01	117.01	57.50	0.09	0.07	0.00	0.37	0.31	0.36	0.57	-0.01	0.00	0.00	0.27	0.78
losttime	0.00	0.00	0.01	0.09	-0.01	0.01	-0.01	-5.19	-7.19	-0.02	-0.01	0.00	-0.15	-0.24	0.08	-0.19	0.01	0.00	0.00	0.17	0.73
recordab	0.00	-0.01	0.00	0.07	-0.01	-0.01	-0.01	8.82	6.69	0.01	0.01	0.00	-0.19	-0.27	-0.05	-0.21	0.00	0.00	0.00	-0.14	-0.64
LTIR	0.00	0.00	0.00	0.02	0.00	0.01	0.00	5.53	2.02	0.00	0.00	-0.01	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.02	0.00
RIR	0.00	0.00	0.00	-0.01	-0.01	0.01	0.00	-0.39	-1.95	-0.01	-0.01	0.00	0.01	0.01	0.02	0.03	0.00	0.00	0.00	-0.01	0.01
Fatalitiy	0.01	0.01	0.01	-0.07	0.03	0.00	0.02	75.30	47.54	0.06	0.09	-0.03	0.48	0.60	-0.01	0.71	-0.01	-0.01	0.00	0.32	1.57
NewHires	-0.02	-0.02	-0.01	0.39	-0.05	0.03	-0.01	21.38	13.90	-0.07	-0.14	0.03	-0.14	-0.31	0.17	-0.17	0.02	0.01	0.00	-0.07	-0.96
VTurnover	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.41	-0.72	0.00	0.00	0.00	0.00	-0.01	0.00	-0.01	0.00	0.00	0.00	0.00	-0.01
Unionize	-0.01	-0.01	-0.02	0.33	-0.01	0.05	-0.01	57.50	35.99	0.02	0.01	0.02	0.40	0.43	0.19	0.50	0.01	0.00	0.00	0.33	1.04
Diversity	-0.01	0.00	-0.01	0.29	0.00	0.04	0.01	43.59	34.09	0.00	-0.02	0.04	0.22	0.20	0.18	0.25	0.03	0.00	0.00	0.15	0.47
Minority	-0.02	0.00	0.00	0.22	0.02	0.00	0.01	10.52	14.25	0.02	0.00	0.00	0.11	0.04	0.06	0.14	0.02	0.02	0.00	0.13	0.46
localpur	-0.01	-0.01	0.01	0.50	-0.08	0.10	0.00	193.84	97.62	0.03	0.06	0.01	0.36	0.26	0.31	0.48	-0.02	0.00	0.00	0.30	0.45
CNGvehic	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	22.19	3.91	0.01	0.01	0.02	0.01	-0.01	0.01	0.03	0.00	0.01	0.00	0.00	-0.01
Plantedt	0.00	0.00	0.00	-0.05	0.01	-0.03	0.01	20.16	6.90	0.01	0.01	0.06	0.03	0.11	-0.05	0.12	0.01	0.00	0.00	0.06	0.22
Grasssee	0.00	0.00	-0.01	-0.01	0.02	0.01	0.00	0.42	-4.02	-0.01	0.00	0.00	-0.02	-0.03	0.00	-0.01	0.00	0.00	0.00	0.00	0.02
ForestLa	0.00	0.00	-0.01	-0.03	0.01	0.02	0.00	-0.90	-3.68	0.00	0.00	0.00	0.07	0.09	0.00	0.10	0.00	0.00	0.00	0.10	0.34
communit	0.00	0.00	0.00	0.14	0.01	0.01	-0.01	61.39	33.39	0.03	0.04	-0.01	0.20	0.23	0.13	0.34	-0.01	0.00	0.00	0.19	0.40
voluntee	0.00	0.00	0.00	0.07	0.01	0.02	0.00	43.00	20.32	0.02	0.02	0.00	0.19	0.21	0.07	0.27	0.00	0.00	0.00	0.18	0.48

	Reclaime	wildlife	EnvExp	losttime	recordab	LTIR	RIR	Fatalitiy	NewHires	VTurnover	Unionize	Diversity	Minority	localpur	CNGvehic	Plantedt	Grasssee	ForestLa	communit	voluntee
ROA	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.01	-0.02	0.00	-0.01	-0.01	-0.02	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
ROE	0.00	0.00	-0.01	0.00	-0.01	0.00	0.00	0.01	-0.02	0.00	-0.01	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00
ROI	0.00	0.00	0.03	0.01	0.00	0.00	0.00	0.01	-0.01	0.00	-0.02	-0.01	0.00	0.01	0.00	0.00	-0.01	-0.01	0.00	0.00
MV	0.00	-0.02	0.45	0.09	0.07	0.02	-0.01	-0.07	0.39	0.00	0.33	0.29	0.22	0.50	-0.01	-0.05	-0.01	-0.03	0.14	0.07
TobinQ	0.00	-0.01	-0.06	-0.01	-0.01	0.00	-0.01	0.03	-0.05	0.00	-0.01	0.00	0.02	-0.08	0.00	0.01	0.02	0.01	0.01	0.01
PR	0.00	0.05	0.11	0.01	-0.01	0.01	0.01	0.00	0.03	0.00	0.05	0.04	0.00	0.10	0.00	-0.03	0.01	0.02	0.01	0.02
SGR	0.00	0.00	-0.01	-0.01	-0.01	0.00	0.00	0.02	-0.01	0.00	-0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.00	-0.01	0.00
R_D	0.03	12.65	117.01	-5.19	8.82	5.53	-0.39	75.30	21.38	-1.41	57.50	43.59	10.52	193.84	22.19	20.16	0.42	-0.90	61.39	43.00
R_D_Prio	0.15	-0.54	57.50	-7.19	6.69	2.02	-1.95	47.54	13.90	-0.72	35.99	34.09	14.25	97.62	3.91	6.90	-4.02	-3.68	33.39	20.32
GrantedP	0.00	-0.02	0.09	-0.02	0.01	0.00	-0.01	0.06	-0.07	0.00	0.02	0.00	0.02	0.03	0.01	0.01	-0.01	0.00	0.03	0.02
PatentAp	0.00	-0.02	0.07	-0.01	0.01	0.00	-0.01	0.09	-0.14	0.00	0.01	-0.02	0.00	0.06	0.01	0.01	0.00	0.00	0.04	0.02
RandDint	0.00	-0.01	0.00	0.00	0.00	-0.01	0.00	-0.03	0.03	0.00	0.02	0.04	0.00	0.01	0.02	0.06	0.00	0.00	-0.01	0.00
GHG	0.00	0.13	0.37	-0.15	-0.19	0.00	0.01	0.48	-0.14	0.00	0.40	0.22	0.11	0.36	0.01	0.03	-0.02	0.07	0.20	0.19
FandV	0.00	0.17	0.31	-0.24	-0.27	0.01	0.01	0.60	-0.31	-0.01	0.43	0.20	0.04	0.26	-0.01	0.11	-0.03	0.09	0.23	0.21
SOandNO	0.00	0.05	0.36	0.08	-0.05	0.00	0.02	-0.01	0.17	0.00	0.19	0.18	0.06	0.31	0.01	-0.05	0.00	0.00	0.13	0.07
VOCs	0.00	0.22	0.57	-0.19	-0.21	0.02	0.03	0.71	-0.17	-0.01	0.50	0.25	0.14	0.48	0.03	0.12	-0.01	0.10	0.34	0.27
waterrec	0.00	0.00	-0.01	0.01	0.00	0.00	0.00	-0.01	0.02	0.00	0.01	0.03	0.02	-0.02	0.00	0.01	0.00	0.00	-0.01	0.00
Spills	0.00	0.01	0.00	0.00	0.00	0.00	0.00	-0.01	0.01	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00
WasteRec	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.00	0.14	0.27	0.17	-0.14	0.02	-0.01	0.32	-0.07	0.00	0.33	0.15	0.13	0.30	0.00	0.06	0.00	0.10	0.19	0.18
Energyge	0.00	0.34	0.78	0.73	-0.64	0.00	0.01	1.57	-0.96	-0.01	1.04	0.47	0.46	0.45	-0.01	0.22	0.02	0.34	0.40	0.48
Reclaime	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
wildlife	0.00	0.50	0.13	-0.06	-0.10	0.01	0.02	0.24	-0.14	0.00	0.12	0.05	0.03	0.14	-0.03	0.03	0.01	0.05	0.05	0.09
EnvExp	0.00	0.13	2.01	0.01	-0.02	0.02	0.04	0.26	0.33	0.00	0.64	0.41	0.41	0.39	0.02	0.10	0.02	0.01	0.28	0.26
losttime	0.00	-0.06	0.01	0.71	0.38	0.01	0.02	-0.17	0.13	0.00	-0.13	-0.03	-0.03	0.00	0.05	-0.06	0.00	-0.06	-0.06	-0.08
recordab	0.00	-0.10	-0.02	0.38	0.71	-0.02	0.02	-0.21	0.20	0.00	-0.16	-0.07	-0.13	-0.02	0.05	-0.09	-0.01	-0.04	-0.02	-0.07
LTIR	0.00	0.01	0.02	0.01	-0.02	0.08	0.01	0.02	0.02	0.00	0.01	0.00	0.02	0.06	-0.01	0.00	0.01	0.00	0.02	0.02
RIR	0.00	0.02	0.04	0.02	0.02	0.01	0.09	-0.05	0.02	0.00	-0.02	0.02	-0.01	0.01	0.01	0.03	0.01	0.02	0.01	0.00
Fatalitiy	0.00	0.24	0.26	-0.17	-0.21	0.02	-0.05	2.63	-0.54	-0.01	0.57	0.11	0.14	0.31	0.02	0.10	0.00	0.08	0.27	0.29
NewHires	0.00	-0.14	0.33	0.13	0.20	0.02	0.02	-0.54	2.61	0.01	0.97	1.09	1.09	0.49	-0.01	-0.07	0.01	-0.11	0.08	-0.02
VTurnover	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.01	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unionize	0.00	0.12	0.64	-0.13	-0.16	0.01	-0.02	0.57	0.97	0.00	2.05	1.18	1.18	0.75	-0.02	0.13	-0.04	0.07	0.27	0.21
Diversity	0.00	0.05	0.41	-0.03	-0.07	0.00	0.02	0.11	1.09	0.00	1.18	1.42	1.00	0.52	-0.02	0.13	-0.03	0.02	0.14	0.10
Minority	0.01	0.03	0.41	-0.03	-0.13	0.02	-0.01	0.14	1.09	-0.01	1.18	1.00	2.86	0.20	0.01	0.01	-0.01	0.01	0.11	0.09
localpur	0.00	0.14	0.39	0.00	-0.02	0.06	0.01	0.31	0.49	0.00	0.75	0.52	0.20	2.46	0.03	0.10	0.01	0.00	0.30	0.24
CNGvehic	0.00	-0.03	0.02	0.05	0.05	-0.01	0.01	0.02	-0.01	0.00	-0.02	-0.02	0.01	0.03	0.26	0.03	0.00	-0.01	0.02	0.00
Plantedt	0.00	0.03	0.10	-0.06	-0.09	0.00	0.03	0.10	-0.07	0.00	0.13	0.13	0.01	0.10	0.03	0.95	0.05	0.02	0.08	0.09
Grasssee	0.00	0.01	0.02	0.00	-0.01	0.01	0.01	0.00	0.01	0.00	-0.04	-0.03	-0.01	0.01	0.00	0.05	0.15	0.02	0.03	0.02
ForestLa	0.00	0.05	0.01	-0.06	-0.04	0.00	0.02	0.08	-0.11	0.00	0.07	0.02	0.01	0.00	-0.01	0.02	0.02	0.21	0.00	0.04
communit	0.00	0.05	0.28	-0.06	-0.02	0.02	0.01	0.27	0.08	0.00	0.27	0.14	0.11	0.30	0.02	0.08	0.03	0.00	0.36	0.21
voluntee	0.00	0.09	0.26	-0.08	-0.07	0.02	0.00	0.29	-0.02	0.00	0.21	0.10	0.09	0.24	0.00	0.09	0.02	0.04	0.21	0.31

5.5.5 Structural Model

The CFA technique is applied to successfully authenticate the measurement model. The structural model specification is achieved by using research hypotheses to assign causality between unobserved constructs. The structural model is depicted by the path diagram. Structural paths are represented by the arrows between different unobserved constructs.

A path diagram depicts the relationships between the unobserved variables by proposing the structural paths. It is considered the first step in establishing both measurement and structural models. The structural model then helps in estimating the relationships between the model different latent constructs. The statistical estimation of the predefined relationships is generated in the form of the structural paths coefficients magnitude that determines the fortitude of the connections between unobserved variables. The measurement model is critical step in the SEM building process. It is used to validate the established relationship among different constructs. The theoretical model proposed will initially specify the structural paths between constructs. This initial step mainly searches for dependencies in the proposed relationships to establish the hypotheses discussed in chapter four. The hypotheses presented in chapter four indicates an explicit relationship between the different pairwise of the unobserved constructs.

Based on relevant literary works and researches, the theory presented was constructed. Most existing studies focus either on greater financial payoffs from innovation (e.g., Cohen and Levinthal, 1990; Kurapatskie and Darnall, 2013) or implications for integrating corporate sustainability into the firm's financial performance (e.g., McWilliams, Siegel, and Wright, 2006; McWilliams and Siegel, 2000; Salzmann, Ionescu-somers and Steger, 2005; Willard, 2005; Sariannidis et al., 2013). The new model was tested using an all-inclusive data set and a sophisticated analytical method that associates different attributes of multivariate techniques for the first generation.

The structural relationships of the model hypotheses are shown in the path diagram shown in Figure 5.2. Table 5.7 presents all the research hypotheses along with their results

Table 5.7 - Proposed Model Hypotheses

Hypotheses	
Hypothesis 1	Corporate innovation is strongly and positively related to corporate performance.
Hypothesis 2	Corporate performance is expected to improve based on a higher R&D expenditure.
Hypothesis 3	The higher the number of patents per year, the higher the firm's performance.
Hypothesis 4	Corporate performance is correlated with the research and development intensity.
Hypothesis 5	Corporate sustainability is strongly and positively related to corporate performance.
Hypothesis 6	Decreasing emissions and effluents is directly related to corporate performance.
Hypothesis 7	Managing water effectively will have a positive impact on corporate performance.
Hypothesis 8	A corporation's waste initiatives can have a direct impact on corporate performance.
Hypothesis 9	Improving energy efficiency can impact corporate performance positively.
Hypothesis 10	Better management of the firm's ecological footprint increases its performance.
Hypothesis 11	Firm's health and safety initiatives contribute positively to its financial performance.
Hypothesis 12	Sustainable management programs have a positive impact on the firm's performance.
Hypothesis 13	Sustainable business operations are directly correlated to corporate performance.
Hypothesis 14	Sustainable purchasing practices have a positive impact on corporate performance.
Hypothesis 15	A firm's employment practices can positively impact corporate performance
Hypothesis 16	A firm's community investments will have a positive impact on its performance.
Hypothesis 17	Planted trees and seeds can have a strong impact on corporate performance.
Hypothesis 18	Employees volunteer hours can have serious implications on corporate performance.
Hypothesis 19	Corporate innovation is directly and strongly correlated with corporate sustainability.
Hypothesis 20	Corporate sustainability is directly and strongly correlated with corporate innovation.

The model shown in Figure 5.2 is used to estimate, test the whole theory, and also includes measurement of the hypothesized structural relationships among constructs as well as the relations of indicators to their respective constructs.

5.5.6 Structural Model Assessment

The concluding stage tests the legitimacy of the estimated structural paths and its conforming hypothetical relationships (i.e., H1 to H20). Validation involves investigating the model and the diagnostics structural model fit. Moreover, SEM fitted model focuses on the structural relationships and compare it to the predefined hypothetical relationships using statistical tests. These tests are performed to test the hypothesis to determine the fit between the data that is collected using different model fit statistics and the theoretical structural model. Based on previous research procedures, Schreiber (2008) suggested reporting the $\chi 2$, $\chi 2/df$ ratio, SRMR stands for, standardized root mean square residual and RMSEA stands for, root mean square errors of approximation along with associated confidence intervals.

Hu and Bentler (1999) stated that the assessment known as the goodness-of-fit test is often used to measure the degree of incongruity between the observed data and the covariance matrix (as indicated by the proposed model). Hooper et al. (2008) stated that the proposed model can be used if its chi-square value meets a threshold of 0.05 which is significant. Moreover, the ratio of chi-square to degrees of freedom can be used as a supplement (Kline, 2005). Schumacker and Lomax (2010) argued that one can use the $\chi 2/df$ ratio for adjusting the effect of model size on the chi-square statistic. Bollen (1990) added that a value below 5 indicates an acceptable model fit.

Ho and McDonald (2002) stated that the root means square errors of approximation (RMSEA) is a frequently used fit statistic tool. Kline (2005) determined that since RMSEA accounts for model complexity, it is a parsimony-adjusted index formula. MacCallum et al. (1996) stated that RMSEA allows evaluation of confidence intervals to complement point estimates. According to Browne and Cudeck (1993), RMSEA measures the approximation error; which is a proof of the hypothetical model's capability to yield the population covariance matrix. Schreiber (2008) stated that a confidence interval that ranges from 0.00 and 0.08 and an RMSEA value located in between 0.06 and 0.08 indicate a suitable model.

SRMR which stands for, standardized root means square residual, measures the average absolute covariance residuals and it reflects the mean standardized differences between predicted and observed covariances (Kline, 2005). A perfect model fit should have no residuals; however, Hu and

Bentler (1999) stated that a number below 0.08 is a respectable fit and Byrne (2001) determined that an SMRR below 0.05 represents a well-fitting model.

The prediction power of the model has no lone statistical test that is able to best describe it (Jöreskog and Sörbom, 1993). Consequently, the goodness-of-fit measures are classified by type and should be used together to assess the fitness of the proposed model. These types of measures are as follows (a) Absolute, (b) Incremental, and (c) Parsimonious fit-measures.

Kelloway (1998) stated that measures of absolute fit are used to assess the overall model fit whereas, measures of parsimonious fit are for comparing models with unlike values of estimated coefficients and measures of incremental fit are used to associate different models. These three types are discussed in details in the chapter (6).

5.6 Conclusion

Structural equation modeling (SEM) have become synonymous with LISREL models and software. It is achievable to empirically assess complex theories, like the one under investigation, using LISREL. The proposed theory is expressed as a hypothetical model for experiential or manifest variables and the unobservable latent variables, as discussed earlier in the chapter. In other words, corporate innovation and corporate sustainability as the exogenous (independent) latent constructs and corporate financial performance as the endogenous (dependent) latent construct. Observed variables identified in the theoretical model data points were collected from different sources and composed in a database. LISREL program was used to suit the model to the data, relatively. The next chapter demonstrates the usability of the LISREL program in this empirical research.

The SEM was performed using the LISREL (Linear Structural Equations) approach. According to Jöreskog and Sörbom (2006), LISREL 8.80 for Windows is a suitable Windows software product for running SEM which is utilized to perform the research analytical portion.

Chapter 6

Results and Discussions

6.1 Context

There are three key reasons for the use of the SEM (which stands for Structural Equation Modeling technique) in this study. First, it allows the summarization of the data for observed variables. Second, it enables the minimization of the impact of bias due to measurement errors in estimating treatment effects, which increases accuracy compared to traditional analysis. Third, it enables the investigation of the effects between primary conceptual variables, as opposed to a specific set of variables. Since the SEM technique is theory driven, it can be used to test the proposed theory to determine the relationship between corporate sustainability and corporate innovation. There has long been substantial demand for justifying the relationship of both constructs.

Using the SEM technique to test the proposed theory justifies the specification of the interdependent relationships between independent constructs and their relationship with the dependent construct. Chapter (5) discussed the proposed SEM model and outlined the operational and quantitative models within the research observed variables using a system of concurrent linear equations to perform the analysis. This chapter presents the proposed theory assumptions and illustrates the research priori theoretical model exhibiting the causality between all the variables (i.e., observed and unobserved). When conducting the SEM technique, an approach of two steps is advocated by Gerbing and Anderson (1988) was used. This two-stage approach consists of (1) testing the models structure and (2) verify the models measurement.

The proposed model analyzes the researched theoretical causal relationships between the principally projected latent variables. On the basis, the measurement model is simply a type of confirmatory to ensure proper measurement of intended relationships between all variables (i.e., latent and observed).

6.2 LISREL (Linear Structural RELations)

According to Hoyle (1995), SEM implements a complete statistical approach to validate hypotheses and more specifically the relationships between observed and latent variables. It may be used to test four categories of theoretical models: confirmatory factor, path, structural equation models and regression. LISREL (linear structural relations) can be used to assess all four models by following five stages: specification, identification, parameter estimation, testing, and modification. It employs eight matrices that organize any model's causal paths, loadings, correlations, and error terms.

According to McDonald (1978) and (1980) many attempts have been made to identify the general form of structural equation models; however, the LISRAEL model, as described by Jöreskog and his acquaintances (Notably: Jöreskog, 1970; Jöreskog, 1973; Jöreskog, 1977; Jöreskog and Sorbom, 1979; Jöreskog and Wold, 1982), provides the most useful formulation. This model and its component methods and software are identical with structural equation modeling (SEM), which allowed this study to empirically assess the proposed theory.

This theory serves as a theoretical model for both observed (manifest) and unobservable (latent) variables. The LISREL program's most important feature is its ability to analyze latent variables in a wide variety of models. When data was gathered for the observed variables of the projected theoretical model, the LISREL program was used to best adjust the mode; to fit the data. The LISREL model for corporations in the energy and energy-intensive materials production sectors under investigation output considered both components discussed in the previous paragraph, namely (a) the equational structuring model and (b) the model's measurements.

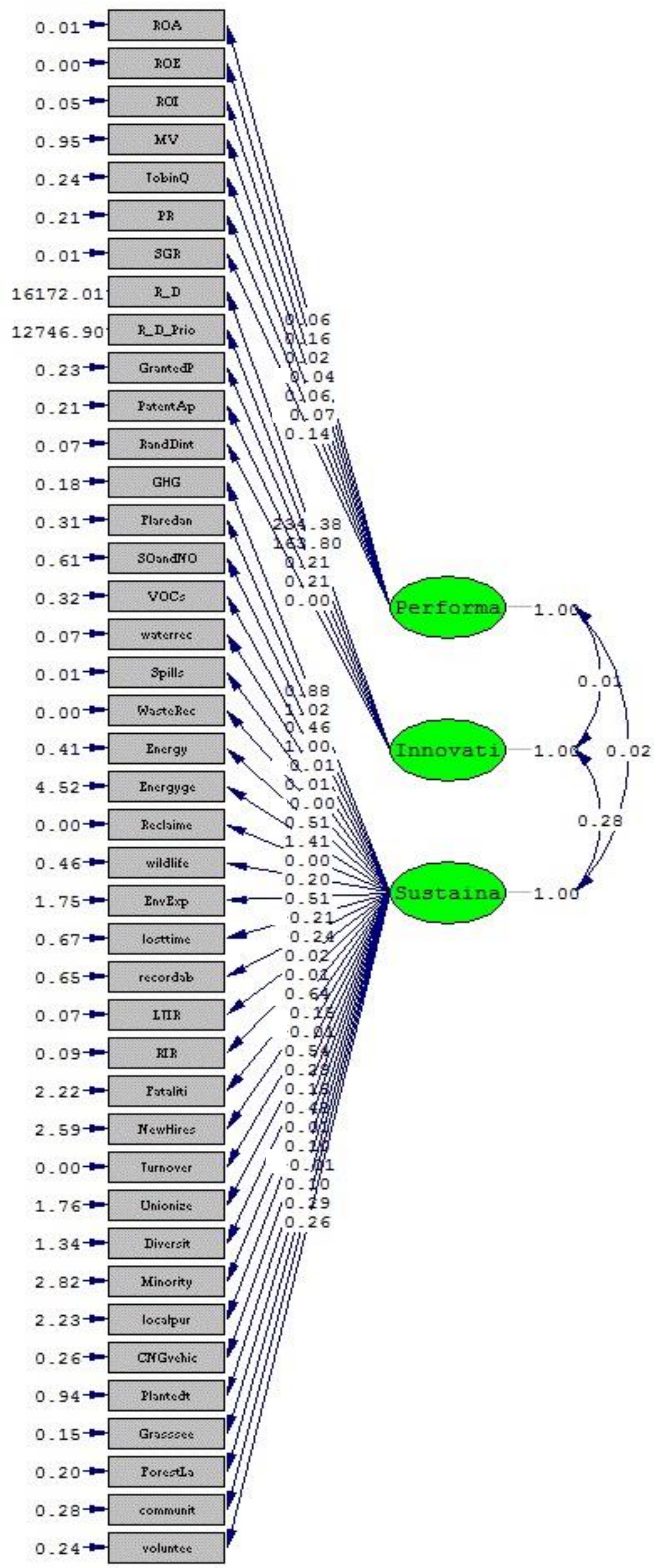
The matrix formulated by LISREL shows observed and latent variables along with the errors associated. It distinguishes between the criterion and predictor sets of variables. The LISREL model initially involved a universal sequence of matrix algebra statements, which involved a complex arrangement of Greek notations. However, in the newest version of the LISREL program, which is LISREL 8.8, which was used in this research, there are fewer complexities remaining from the original model statement and the program makes it easier to create structural equation models based on path diagrams. The LISREL model construction described in this chapter refers to the path diagram rather than the more general matrix algebra formulation of the model.

The general method of conveying an LISREL model is explained in details by Mels LISREL 8.51 for windows. According to Hayduk (1996), the LISREL model has two types of observed variables: a) the x variables, which signify the latent independent and exogenous variables and b) the (y) variables, which characterize dependent or independent variables. This specific model uses a simultaneous system of linear equations to represent the correlation between the (x) and (y) variables. The next step classifies these equations into SEM equations that describe the connection between measurement model equations and latent constructs that define the relationship between the experimental (x) and (y) variables and their conforming variables.

The model characterized as an SEM and is produced using LISREL is an adaptable, inclusive form that identifies the association between the dependent variable (i.e., corporate financial performance) and the independent variables (i.e., corporate innovation and corporate sustainability). Figure 6.1 shows the three-variable models that exemplify many of the ideologies used to construct this model. Such path diagram involves a system of simultaneous linear equations. The SEM technique produces an output structure equation model based upon the assets of multiple regression, factor, and multivariate types of analyzes (MANOVA). It also enables directional predictions among the independent and dependent variable, as well as modeling of indirect effects.

The theoretical path diagram in Figure 6.1 displays 34 *(x)* variables as indicators of the two exogenous (independent) latent constructs, ξ variables. Note that corporate innovation and corporate sustainability are denoted as ξ_1 and ξ_2, respectively. There is one endogenous (dependent) latent construct, η variable, with seven *(Y)* variables. The (ε) and (δ) variable errors, as well as the (ς) equation errors, are included in the model.

Figure 6.1 - The structural equation model



6.3 The structural equation model

The SEM equations that describe the connections between the latent constructs are as following:

$$Y_i = \mathcal{N} + \Lambda\, H_i + K\, X_i + E_i$$

$$H_i = \alpha + \beta\, H_i + \Gamma\, X_i + \xi_i$$

Where,

Λ, Lambda (uppercase)

N, Eta (uppercase)

K, Kappa (uppercase)

E, Epsilon (uppercase)

B, Beta (uppercase)

Γ, Gamma (uppercase)

Also,

$$\mu_\eta = \Lambda\,(\alpha + \Gamma\kappa)$$

$$Cov\,(\eta) = \Lambda\,(\Gamma\Phi\Gamma' + \Psi)\,\Lambda'$$

Phi (uppercase Φ) covariance matrix Φ, and Psi (uppercase Ψ) covariance matrix Ψ, where each dependent latent construct (η) has on (Ψ) which represent the residual error in the variable. In other words, (Ψ) represents all of the influences on the latent dependent variable not explicitly accounted in the model.

6.4 The measurement model

The measurement model is shown in figure 6.1 specified how corporate innovation, corporate sustainability and corporate performance (i.e., exogenous and endogenous latent constructs) are noted in terms of their observed variables. Table 6.1 defines the measurement assets of the observed variables in relation to their associated latent constructs. The measurement models shown in Table 6.1 are relative to the connections that exist between the respective latent constructs of the observed variables. This model specifies the relationship between the unobserved constructs which are related to the observed variables, which have the function of measuring. The endogenous manifest indicators measurement models labeled the (p) variables, are contained in the (y) vector, and the exogenous manifest indicators measurement models, labeled (q) variables, are represented by the (x) vector. These vectors are utilized to connect the manifest indicators and the unobserved constructs and are represented by the equations:

$$\Upsilon = \Gamma_y + \Lambda_y \eta + \varepsilon, E(\varepsilon) = 0, Cov(\varepsilon) = \Theta_\varepsilon$$

$$X = \Gamma_x + \Lambda_x \xi + \delta, E(\delta) = 0, Cov(\varepsilon) = \Theta_\delta$$

Respectively, the average vectors of the observed variables are

$$\mu_y = \Gamma_y + \Lambda_y \Lambda (\alpha + \Gamma\kappa), \text{ and } \mu_x = \Gamma_x + \Lambda_x \kappa$$

The flexible specification of the LISREL model is shown in terms of parameters and simple equality constraints. Due to its flexibility, it is capable of handling a variety of problems. Table 6.1 shows the measurement of the, p, endogenous and the, q, exogenous manifest indicators.

Table 6.1 - The measurement properties of the observed variables.

Observed Variable	Measurement Equation	Error Variance	R-squared
ROA	0.06*Corporate Performance	0.01	0.39
ROE	0.16*Corporate Performance	0.001	0.95
ROI	0.02*Corporate Performance	0.05	0.75
Market Value	0.04*Corporate Performance	0.95	0.20

Tobin's Q	0.06*Corporate Performance	0.24	0.14
Payout Ratio	0.07*Corporate Performance	0.21	0.26
Sustainable Growth Rate	0.14*Corporate Performance	0.01	0.64
R&D	234.38*Corporate Innovation	16172.01	0.77
R&D Prior	163.80*Corporate Innovation	12746.90	0.68
Total Granted Patents in North America	0.21*Corporate Innovation	0.23	0.17
Total Application Patents in North America	0.21*Corporate Innovation	0.21	0.17
R&D Intensity	0.01*Corporate Innovation	0.07	0.01
Total Greenhouse gas (GHG) (tonnes carbon dioxide equivalent (CO_2e))	0.88*Corporate Sustainability	0.18	0.81
Total Flared and Vented Gases (metric tons CO2 equivalent)	1.02*Corporate Sustainability	0.31	0.77
Sulphur dioxide and Nitrogen oxides (tonnes)	0.46*Corporate Sustainability	0.61	0.26
Volatile organic compounds, VOCs (tonnes)	1.00*Corporate Sustainability	0.32	0.76
Total volume of water recycled as a percentage of the Total Water Used (%)	0.01*Corporate Sustainability	0.07	0.80
Total Number of Spills (Thousand barrels)	0.01*Corporate Sustainability	0.01	0.32
Waste Recycled as a percentage of the total waste (%)	0.01*Corporate Sustainability	0.05	0.10
Total energy consumption (Gigajoules)	0.51*Corporate Sustainability	0.41	0.39

Total Non-carbon energy generated (MWh)	1.41*Corporate Sustainability	4.52	0.31
Total reclaimed land as a percentage of the total land use (%)	0.01*Corporate Sustainability	0.01	0.10
Protected wildlife habitat (acres)	0.20*Corporate Sustainability	0.46	0.78
Environmental expenditures (dollars)	0.51*Corporate Sustainability	1.75	0.13
Employees and Contractors lost-time injuries (number of injuries)	0.21*Corporate Sustainability	0.67	0.64
Employees and Contractors recordable injuries (number of injuries)	0.24*Corporate Sustainability	0.65	0.82
Lost time injury rate (employees and contractor) (Cases/200,000 hours worked)	0.02*Corporate Sustainability	0.08	0.31
Recordable injury rate (employees and Contractors) (Cases/200,000 hours worked)	0.01*Corporate Sustainability	0.09	0.15
Fatalities (employees and contractors)	0.64*Corporate Sustainability	2.22	0.16
New Hires (%)	0.15*Corporate Sustainability	2.59	0.81
Voluntary Turnover Rate (%)	0.01*Corporate Sustainability	0.01	0.12
Employees in Employee Unions or Associations (%)	0.54*Corporate Sustainability	1.76	0.14
Diversity (%)	0.29*Corporate Sustainability	1.34	0.59
Minority employees (%)	0.18*Corporate Sustainability	2.82	0.11
Purchase of goods and services locally (%)	0.48*Corporate Sustainability	2.23	0.93

Compressed natural gas (CNG) vehicles in fleet (number)	0.01*Corporate Sustainability	0.26	0.37
Planted trees (number)	0.10*Corporate Sustainability	0.94	0.11
Grass seed planted (acres)	0.01*Corporate Sustainability	0.15	0.76
Forest Land Established (acres)	0.10*Corporate Sustainability	0.20	0.44
Funding, donations, sponsorship and community investments (Million Dollars)	0.29*Corporate Sustainability	0.28	0.24
Employee volunteer hours (hours)	0.26*Corporate Sustainability	0.24	0.23

The path coefficients from the proposed model are subsequently derived from the following model definition equations that can be written in that general format.

$$\boldsymbol{X_i = \lambda_{ii}\, \xi_i + \lambda_{ij}\xi_j + \delta_i}$$

6.5 The Correlation Matrix

The departure point for the LISREL model is the matrix of associations between the latent constructs. Table 6.2 shows the relationship matrix between the dependent variables (i.e., corporate financial performance) and the dependent variable (i.e., corporate innovation and corporate sustainability).

Table 6.2 - correlation matrix between the independent variables and the dependent variable.

	Corporate Financial Performance	**Corporate Innovation**	**Corporate Sustainability**
Corporate Financial Performance	1.00	0.00	0.00

Corporate Innovation	0.01 (0.06)	1.00	0.24
Corporate Sustainability	0.02 (0.05)	0.28	1.00

Table 6.2 shows that the exogenous (independent) latent constructs have strong, significant positive associations with the endogenous (dependent) latent construct. From this study, it was concluded that there is a constructive relationship between corporate innovation and the corporations' financial situation with a correlation coefficient of 6 percent (adjusted value). The model exhibited that corporate sustainability has a significantly greater association with corporate financial performance with a correlation coefficient of 5 percent (adjusted value). The two independent variables showed a productive relationship relative to the dependent variable with an added correlation coefficient of more than 10 percent. In addition, analysis of the results displayed a strong correlation between sustainability and innovation. It showed that the relationship is valid in both directions. Sustainability can drive innovation, and vice versa. Innovation can impact sustainability by 24 percent while sustainability can affect innovation by 28 per cent.

6.6 Covariance Matrix

The covariance of the observed variables results in a symmetric matrix (see Table 6.3); only the elements in and below the diagonal are required. If there are k labels for the observed variables, then the covariance is of order k x k and contains k (k + 1)/2 distinct elements. Enter each element row-wise, where each row begins with the element in the first column and ends with the diagonal element.

Table 6.3 - Covariance matrix of the observed variables

	ROA	ROE	ROI	MV	TobinQ	PR	SGR	R_D	R_D_Prio	GrantedP	PatentAp	RandDint	GHG	FandV	SOandNO	VOCs	waterrec	Spills	WasteRec	Energy	Energyge	Reclaime
ROA	0.01																					
ROE	0.01	0.03																				
ROI	0.00	0.00	0.05																			
MV	-0.01	0.00	0.01	0.59																		
TobinQ	0.01	0.01	0.00	0.05	0.24																	
PR	-0.01	-0.01	0.00	0.08	0.00	0.22																
SGR	0.01	0.02	0.00	-0.03	0.00	-0.01	0.03															
R_D	-0.90	0.33	-1.78	58.11	5.50	-6.35	-2.80	71106.25														
R_D_Prio	0.13	1.34	-1.25	49.14	10.72	-6.23	-0.48	39214.13	39578.63													
GrantedP	0.01	0.00	0.00	0.05	0.01	-0.01	0.00	42.86	30.15	0.27												
PatentAp	0.00	0.00	0.00	0.06	0.01	-0.01	0.00	44.76	28.31	0.20	0.26											
RandDint	0.00	0.00	0.00	-0.01	0.01	0.00	0.00	-0.06	-0.34	0.01	0.02	0.07										
GHG	-0.01	0.00	0.00	0.17	-0.01	0.02	0.00	48.95	35.81	0.08	0.06	0.00	0.96									
FandV	0.00	0.00	-0.01	0.12	0.01	0.00	0.00	46.75	31.93	0.07	0.05	[illegible]	0.99	1.35								
SOandNO	-0.01	0.00	0.01	0.19	-0.04	0.06	0.00	40.93	23.45	0.04	0.05	[illegible]	0.53	0.45	0.81							
VOCs	0.00	0.01	0.00	0.08	-0.02	0.03	0.01	70.49	35.28	0.10	0.07	[illegible]	0.87	1.00	0.46	1.31						
waterrec	0.00	0.00	0.00	0.00	0.01	0.00	0.00	-6.03	-5.37	0.00	-0.01	[illegible]	-0.01	0.00	-0.02	-0.01	0.07					
Spills	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.37	1.93	0.00	0.00	[illegible]	0.01	0.01	0.01	0.00	0.00	0.01				
WasteRec	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	-0.01	0.00	0.00	[illegible]	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
Energy	0.00	0.00	-0.01	0.11	-0.01	0.01	0.00	31.82	16.89	0.03	0.03	[illegible]	0.43	0.47	0.05	0.50	0.00	[illegible]	0.00	0.66		
Energyge	0.01	0.02	-0.01	-0.14	0.08	0.01	0.05	40.15	48.07	0.12	0.10	[illegible]	1.03	1.43	-0.18	1.50	-0.01	[illegible]	0.00	1.19	6.52	
Reclaime	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.15	0.00	0.00	[illegible]	0.00	0.00	0.00	0.00	0.00	[illegible]	0.00	0.00	0.00	0.00
wildlife	0.00	0.00	0.00	-0.02	-0.01	0.05	0.00	12.65	-0.54	-0.02	-0.02	-0.01	0.13	0.17	0.05	0.22	0.00	0.01	0.00	0.14	0.34	0.00
EnvExp	-0.01	-0.01	0.03	0.45	-0.06	0.11	-0.01	117.01	57.50	0.09	0.07	0.00	[illegible]	0.31	0.36	0.57	[illegible]	0.00	0.00	0.27	0.78	0.00
losttime	0.00	0.00	0.01	0.09	-0.01	0.01	-0.01	-5.19	-7.19	-0.02	-0.01	0.00	[illegible]	-0.24	0.08	-0.19	[illegible]	0.00	0.00	0.17	0.73	0.00
recordab	0.00	-0.01	0.00	0.07	-0.01	-0.01	-0.01	8.82	6.69	0.01	0.01	0.00	-0.19	[illegible]	[illegible]	[illegible]	0.00	0.00	0.00	-0.14	-0.64	0.00
LTIR	0.00	0.00	0.00	0.02	0.00	0.01	0.00	5.53	2.02	0.00	0.00	-0.01	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.02	0.00	0.00
RIR	0.00	0.00	0.00	-0.01	-0.01	0.01	0.00	-0.39	-1.95	-0.01	-0.01	0.00	0.01	0.01	0.02	0.03	0.00	0.00	0.00	-0.01	0.01	0.00
Fatalitiy	0.01	0.01	0.01	-0.07	0.03	0.00	0.02	75.30	47.54	0.06	0.09	-0.03	0.48	0.60	-0.01	0.71	-0.01	-0.01	0.00	0.32	1.57	0.00
NewHires	-0.02	-0.02	-0.01	0.39	-0.05	0.03	-0.01	21.38	13.90	-0.07	-0.14	0.03	-0.14	-0.31	0.17	-0.17	0.02	0.01	0.00	-0.07	-0.96	0.00
VTurnover	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.41	-0.72	0.00	0.00	0.00	0.00	-0.01	0.00	-0.01	0.00	0.00	0.00	0.00	-0.01	0.00
Unionize	-0.01	-0.01	-0.02	0.33	-0.01	0.05	-0.01	57.50	35.99	0.02	0.01	0.02	0.40	0.43	0.19	0.50	0.01	0.00	0.00	0.33	1.04	0.00
Diversity	-0.01	0.00	-0.01	0.29	0.00	0.04	0.01	43.59	34.09	0.00	-0.02	0.04	0.22	0.20	0.18	0.25	0.03	0.00	0.00	0.15	0.47	0.00
Minority	-0.02	0.00	0.00	0.22	0.02	0.00	0.01	10.52	14.25	0.02	0.00	0.00	0.11	0.04	0.06	0.14	0.02	0.02	0.00	0.13	0.46	0.01
localpur	-0.01	-0.01	0.01	0.50	-0.08	0.10	0.00	193.84	97.62	0.03	0.06	0.01	0.36	0.26	0.31	0.48	-0.02	0.00	0.00	0.30	0.45	0.00
CNGvehic	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	22.19	3.91	0.01	0.01	0.02	0.01	-0.01	0.01	0.03	0.00	0.01	0.00	0.00	-0.01	0.00
Plantedt	0.00	0.00	0.00	-0.05	0.01	-0.03	0.01	20.16	6.90	0.01	0.01	0.06	0.03	0.11	-0.05	0.12	0.01	0.00	0.00	0.06	0.22	0.00
Grasssee	0.00	0.00	-0.01	-0.01	0.02	0.01	0.00	0.42	-4.02	-0.01	0.00	0.00	-0.02	-0.03	0.00	-0.01	0.00	0.00	0.00	0.00	0.02	0.00
ForestLa	0.00	0.00	-0.01	-0.03	0.01	0.02	0.00	-0.90	-3.68	0.00	0.00	0.00	0.07	0.09	0.00	0.10	0.00	0.00	0.00	0.10	0.34	0.00
communit	0.00	0.00	0.00	0.14	0.01	0.01	-0.01	61.39	33.39	0.03	0.04	-0.01	0.20	0.23	0.13	0.34	-0.01	0.00	0.00	0.19	0.40	0.00
voluntee	0.00	0.00	0.00	0.07	0.01	0.02	0.00	43.00	20.32	0.02	0.02	0.00	0.19	0.21	0.07	0.27	0.00	0.00	0.00	0.18	0.48	0.00

	wildlife	EnvExp	losttime	recordab	LTIR	RIR	Fatalitiy	NewHires	VTurnover	Unionize	Diversity	Minority	localpur	CNGvehic	Plantedt	Grasssee	ForestLa	communit	voluntee
wildlife	0.50																		
EnvExp	0.13	2.01																	
losttime	-0.06	0.01	0.71																
recordab	-0.10	-0.02	0.38	0.71															
LTIR	0.01	0.02	0.01	-0.02	0.08														
RIR	0.02	0.04	0.02	0.02	0.01	0.09													
Fatalitiy	0.24	0.26	-0.17	-0.21	0.02	-0.05	2.63												
NewHires	-0.14	0.33	0.13	0.20	0.02	0.02	-0.54	2.61											
VTurnover	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.01	0.00										
Unionize	0.12	0.64	-0.13	-0.16	0.01	-0.02	0.57	0.97	0.00	2.05									
Diversity	0.05	0.41	-0.03	-0.07	0.00	0.02	0.11	1.09	0.00	1.18	1.42								
Minority	0.03	0.41	-0.03	-0.13	0.02	-0.01	0.14	1.09	-0.01	1.18	1.00	2.86							
localpur	0.14	0.39	0.00	-0.02	0.06	0.01	0.31	0.49	0.00	0.75	0.52	0.20	2.46						
CNGvehic	-0.03	0.02	0.05	0.05	-0.01	0.01	0.02	-0.01	0.00	-0.02	-0.02	0.01	0.03	0.26					
Plantedt	0.03	0.10	-0.06	-0.09	0.00	0.03	0.10	-0.07	0.00	0.13	0.13	0.01	0.10	0.03	0.95				
Grasssee	0.01	0.02	0.00	-0.01	0.01	0.01	0.00	0.01	0.00	-0.04	-0.03	-0.01	0.01	0.00	0.05	0.15			
ForestLa	0.05	0.01	-0.06	-0.04	0.00	0.02	0.08	-0.11	0.00	0.07	0.02	0.01	0.00	-0.01	0.02	0.02	0.21		
communit	0.05	0.28	-0.06	-0.02	0.02	0.01	0.27	0.08	0.00	0.27	0.14	0.11	0.30	0.02	0.08	0.03	0.00	0.36	
voluntee	0.09	0.26	-0.08	-0.07	0.02	0.00	0.29	-0.02	0.00	0.21	0.10	0.09	0.24	0.00	0.09	0.02	0.04	0.21	0.31

	GHG	FandV	SOandNO	VOCs
Energy	0.43	0.47	0.05	0.50

6.7 Measures for Goodness of Fit

Sections 6.3 and 6.4 discussed both models (i.e., measurement and structural). The structural model is more impactful and relevant to the study because it delivers an unswerving guideline of the proposed theory. Also, valuable is the model of measurement as it proposes an assessment of the reliability of the observed variables which evaluate the latent constructs. The measurement model proposes that observed indicator variables are dependable and offers a respectable and adequate data collected fit, and furthermore uses all these observed variables in order to perform the structural model.

There are several measures for the goodness/badness of fit that are used to assess the overall adequacy of the theorized model in Chapter 4 (see Figure 4.1). The model is capable of measuring the degree to which the covariance input matrix relates to the initially proposed model's matrix forecast. From this fact is it possible to devise 3 kinds of measures for the goodness of fit: (1) parsimonious (2) absolute and (3) incremental.

6.7.1 Absolute Fit Indices

In order to determine whether the planned model coincides with the covariance matrix, several absolute fit indices can be used for that purpose. Among these are (a) goodness of fit, (b) chi-square, and (c) RMSEA, more commonly referred to as root mean square error of approximation statistic.

6.7.1.1 Chi-Square Statistic

Sörbom and Jöreskog (1993) argued that the likely chi-square ratio (χ^2) statistic is an essential assessment of the overall fit. They claimed that it is the only numerically proven based quantity of goodness-of-fit that can be used in SEM. Bentler and Hu (1999) claimed that chi-square value is traditionally used to determine overall model fit as well as assess the sample and the fitted covariance differences. The chi-square test uses a specific hypothesis to compare observed and expected data. The chi-square value equals to the product of (N-1) times f_{ML}, or [$\chi 2 = (N-1) * f_{ML}$], where the sample degrees of freedom is represented by N-1 and the assessment of the minimized statistical fitting equation is represented by f_{ML} and is given through maximum likelihood (ML) estimation.

In general, the null hypothesis of the chi-squared test is there is a minimal significant discrepancy when comparing the expected and observed result while the alternative hypothesis is that there is a significant difference between these results. In this situation, larger chi-square values are "better." The desired outcome is to reject the null hypothesis and look towards its alternative. However, in SEM, the null hypothesis of the chi-squared test would state that there is a non-important variation between the predicted matrix and the actual matrix while the alternative hypothesis would state that there is a significant difference. In this situation, the fit becomes more suitable as the chi-square value decreases.

According to the LISREL output file, (refer to Appendix G), the minimum fit function chi-square is equal to 3066.98 with a P-value of 0.231. Normal weighted least squares chi-square is equal to a value of 3469.56 with a P-value of 0.283, which indicates a respectable 'fit'. Failure of variance from the null hypothesis means there is no substantial difference between the actual matrix and the predicted matrix. According to Barrett (2007), there would be an insignificant result at a value of 0.05 when there is a good model fit. Since 0.283 is greater than the P-value of 0.05, it achieves a good model fit that will provide significant results.

Kline (2005) argued that the chi-squared test stands as the most utilized fit statistic, but is limited in its use. McIntosh (2006) stated that this test assumes normality, so nonconformities from normalcy cause rejections of the model even when it is properly quantified. Bentler and Bonnet (1980) declared that sample size will affect the chi-square statistic as large samples will result in the rejection of the model. However, Jöreskog and Sörbom (1993) stated that when there is a small sample size, the chi-square statistic is deficient. Kenny and McCoach (2003) determined that the chi-square statistic cannot distinguish between well-fitting models and poorly-fitting models.

The restriction of the model chi-square means that it can use alternative indices to evaluate model fit. Wheaton et al. (1977) described relative or normed chi-square ($\chi2/df$) as an alternative that will provide better results. As per Tabachnick and Fidell (2007) and Wheaton et al. (1977), the acceptable would as high as 5.0 and as low as 2.0. Also, Bollen (1989) stated that values of 2.0, 3.0 or 5.0 in the relative/normed chi-square of 2.0, 3.0 having been suggested as indicating a reasonable fit. The LISREL output Degrees of Freedom, or df, is equal to 776 and the normal weighted least squares chi-square, or $\chi2$, is equal to 3469.56. Therefore, the $\chi2/df$ is equal to 4.5, which is within the acceptable range. Again, the overall fit is deemed acceptable.

6.7.1.2 Goodness of Fit Index

Sorbom and Jöreskog (1993) created the GFI statistic which is an alternative to the chi-square statistic. Fidell and Tabachnick (2007) stated that it computes the amount of discrepancy considered by the projected population covariance. Siguaw and Diamantopoulos (2000) claimed that reproducing the covariance matrix is based on the variances and covariances that the model takes into account. This statistic ranges from 0 to 1 with a smaller value indicating a decrease in the size of the sample. Sharma (2005) stated that the GFI has a downward bias when the degrees of freedom is larger than the sample size. According to Hong and MacCallum (1997), it was found that there is an upward bias, which shows that as a number of parameters elevate, the GFI also increases (Shevlin, and Miles 1998). A maximum value of 0.90 has conventionally been recommended for the GFI; nonetheless, when sample sizes and factor loadings are low, it is recommended to have a higher cut-off of 0.95 (Shevlin and Miles, 1998; Bollen, 1990).

According to Sörbom and Jöreskog (1989), the GFI measures the difference of when a model is or isn't fit. This non-statistical measure ranges from 0, which signifies a meager fit, to 1 which means ,a flawless fit, whereas evident, the higher the value is, the better fit (although there is no standard level of acceptability). The LISREL output file indicated that the GFI is equal to 0.972, which indicated an almost perfect fit.

6.7.1.3 Adjusted Goodness of Fit Index

The scale's sensitivity has reduced its popularity, and some have suggested ceasing using this index (Sharma et al, 2005). The AGFI regulates the goodness-of-fit index based upon degrees of freedom, as reduced fits are caused by more concentrated models (Fidell and Tabachnick, 2007). Therefore, there lies a greater preference for more parsimonious models and more penalties for complicated models. AGFI is proportional to sample size.

As with GFI, AGFI values range from 0 to 1; it is generally accepted that well-fitting models have values of 0.90 or greater. The LISREL output file indicated that the Adjusted Goodness of Fit Index, more commonly known as the AGFI, has a value of 0.937, which again indicates an almost perfect fit.

Sample size has a detrimental impact on these two fit guides, and so they are not banked on upon as stand-alone indices. However, they are often used in covariance structure analyses due to their historical significance.

6.7.1.4 Hoelter's CN ("critical N") Index

According to Hu and Bentler (1999), the Hoelter's Critical N (CN) mean is positively associated with sample size. A cut-off/critical CN value should exceed 200 to properly evaluate model fit. At $N \geq 250$ under independence conditions, and $N \geq 500$ under dependence conditions, all models received almost complete acceptance. The LISREL output file indicated that the Critical N (CN) is equal to 289.965, which again is within the acceptable range.

6.7.1.5 Akaike's Information Criterion Index

According to Burnham, Anderson, and Huyvaert (2011), the AIC compares different models and measures actual theory for the goodness of fit measure, and applies to maximum likelihood approximation. The Akaike's Information Criterion Index is a proportional measure between models that have a different quantity of constructs, with those that produce the lowest values being the target. The Akaike's Information Criterion equals the chi-square divided by n: 2k / (n-1). In this formula, k = 0.5v/v + 1 – df, n equals sample size and v equals number of variables. The absolute AIC Index value is independent; despite values closer to 0 also being more ideal in this assessment and indicative of a more suitable fit. The AIC value is needed to compare one model to another.

A minute AIC value usually arises when, with less projected coefficients, and there are lesser chi-square values. This designates a suitable fit of forecast against the experimental covariances, as well as a model that does not have a danger of being "overfitted". The LISREL output file indicated that the Model AIC is equal to 3639.56, which is closer to zero. However, the AIC penalizes overly complex models which are not common to the chi-square index. The LISREL output file indicated that the Saturated AIC is equal to 1722, which is lower than the Independence AIC and the Model AIC.

6.7.1.6 Expected Cross-validation Index

Based on the study done by Cudeck & Browne (1993), there is a linear relationship between ECVI and AIC, so it yields the same rank order of competing models as the AIC. The LISREL output file indicated that the Expected Cross-Validation Index (ECVI) is equal to 0.960, which is less than zero. The ECVI is useful for comparing structural equation models that differ in restrictiveness. The 90 Percent Confidence Interval for ECVI is between 0.913 and 1.009. Also, the ECVI for Saturated Model is equal to 0.454.

6.7.1.7 Root mean square residual Index

According to Hu and Beltler (1999), the ideal model fit indicated by the RMR statistic is equal to 0, with increasing values signifying a worse fit. The LISREL output file indicated that the RMR is equal to 29.22 and the Standardized RMR is equal to 0.0542, which is close to zero. Because RMR is calculated with non-standard variables, the scales of the observed variable is what the range is dependent upon.

6.7.2 Incremental Fit Indices

According to Shevlin and Miles (2007), incremental fit indices could be referred to as comparative indices of fit. Ho and McDonald (2002) defined a collection of indices that associate the chi-square statistic to the initial model (M0), rather than using chi-square statistic (χ^2test) in its raw format, as the relative fit indices. According to Ho and McDonald (2002), all variables are uncorrelated in the null hypothesis for these models. These measures compare the baseline and proposed models and are denoted as the independence model. In this case, experiential variables are expected to be unrelated. This model is so constrained that it would not fit well with any relative set of data.

Incremental fit measures that appear in LISREL output are as follows:

i. NFI, stands for, Normed Fit Index

ii. TLI, stands for, Tucker-Lewis Index

iii. NNFI, stands for, Non-Normed Fit Index

iv. CFI, stands for, Comparative Fit Index

v. IFI, stands for, Incremental Fit Index

vi. RFI, stands for, Relative Fit Index

It is commonly know that a cut-off value greater than 0.9 would normally be used across the board for incremental fit indices. Theorized models fulfilling this criteria are deemed adequate from a incremental perspective. In other words, the model has a predictability power of more than 90 percent with is adequate in such analysis. These indices can be leveraged in estimating the proposed model fit. Their capability to deliver cut-off can be used to assess covariance values. Therefore, scholars using these measures can elect whether a model does or does not sufficiently fit the data that has a broad overview of different sample sizes and research circumstances.

Alternatively, there is a 10 percent room for improvement. Therefore, every incremental fit index will look at a way of improving the proposed model. These absolute cut-off values are commonly used by researchers and proved to be achieving the desired results. It is the desire of the research to achieve a generalizable model that can support the proposed theory.

Marsh et al. (2004) have stated that when assessing model fit for different sample sizes and research circumstances, traditional cut-off values should not be used. Hu and Bentler (1999) shared a similar opinion in their findings regarding establishing cut-off values because it is not universally applicable to different indices of fit, sizes of sample, distributions, or estimations. McDonald and Marsh (1990) argued that based on the philosophy underlying the postulated model high incremental fit indices of values greater than 0.90 cannot be used to validate interpretations.

Bentler and Hu (1998) stated that other factors, such as model intricacy and interpretation of parameter estimates, must be considered when determining model validity. Setting cut-off values for the above-mentioned fit indices to interpret model fit must be evaluated on theoretical issues that could be distinctive for a specific study. Marsh et al. (2004)

While there are diverse ways to calculate the fit indices and their causal assumptions, they all associate an independence model to the projected model. They indicate improvements from the planned model compared to the null model with independence among variables and ranging from a 0 or similar fit to the null model to a 1 value fit or a perfect fit.

6.7.2.1 Normed Fit Index

Bentler and Bonnet (1980) showed that NFI is the preliminary index to show up in LISREL output having the functioning of comparing the $\chi 2$ value of the null model relative to the actual model. The worst-case situation is the independence model, as it is a model that shows the point where there is no correlation between measured variables. The statistic ranges between 0 and 1; Bonnet and Bentler (1980) recommend that to have a good fit, values should exceed 0.90. Bentler and Hu (1999) recently suggested that that cut-off value should be NFI $\geq$ 0.95. The LISREL output file indicated that the Normed Fit Index (NFI) is equal to 0.951, which is a value larger than 0.95 by Bentler and Hu (1999) and therefore indicates an almost perfect fit.

6.7.2.2 Non-Normed Fit Index

Bentler (1990) and Mulaik et al. (1989) argued that NNFI index, also known as Tucker-Lewis Index underestimates fit for samples less than 200 due to its sensitivity for sample size. According to Kline (2005), the NFI should not be relied upon entirely. This problem was addressed through the introduction of the NNFI (also referred to as the Tucker-Lewis index). According to Byrne (1998), the recommended cut-off could be as low as 0.80; however, recent research suggested that a value greater than 0.95 of the NNFI be the threshold (Bentler and Hu, 1999). The LISREL output file indicated that the Non-Normed Fit Index (NNFI) is equal to 0.980, which is higher than 0.95 suggested by Bentler and Hu (1999). This is also indicative of an almost perfect fit.

However, when there is a small sample size, even though some statistics may determine that there is a good fit the NNFI can a indicate poor fit (Kline, 2005; Bentler, 1990; Fidell and Tabachnick, 2007). Values can exceed 1.0, due to the abnormal nature of NNFI, which in turn, can make the results problematic to deduce (Byrne, 1998).

6.7.2.3 Comparative Fit Index

According to Bentler (1990), CFI, also known as the Comparative Fit Index accounts for sample size, and provides good results even when there is small sample size. Fidell and Tabachnick (2007) stated that Bentler (1990) first introduced this index and subsequently included it in his EQS program under the tab for the fit indices (Kline, 2005). CFI adopts a lack of correlation between latent variables and associates its relative null model with the example covariance matrix, similar to the NFI.

According to Fan et al. (1999), this index is a part of all SEM programs and due to the lack of affect that size of the sample has, it is extremely efficient.

CFI values vary between zero and one, with lower values indicating a worse fit. There was an initial cut-off criterion of CFI values greater than or equal to 0.90. However, recent studies have revealed that to ensure rejection of incorrectly specified models, the value should surpass 0.90 (Bentler and Hu, 1999). Therefore, a value of CFI that is greater than or equal to 0.95 designates a suitable fit (Hu and Bentler, 1999). The LISREL output file indicated that the Comparative Fit Index (CFI) is equal to 0.989, which is greater than the 0.95 cut-off value suggested by Bentler and Hu (1999). This indicates an almost perfect fit.

6.7.2.4 Incremental Fit Index

Bollen (1990) determined that the Bollen's IFI more commonly referred to as the incremental fit index is relatively indifferent to sample size. Any value greater than 0.9 is acceptable, although values can be greater than 1. IFI can be computed by subtracting the independence model chi-square (i.e., variables are uncorrelated) and the target model chi-square value divided by the degree of freedom (df) can be used to find the target model. The LISREL output file indicated that the Incremental Fit Index (IFI) is equal to 0.990, which is greater than the most recent suggest a cut-off of 0.90 by Hu and Bollen (1990). This indicates an almost perfect fit.

6.7.2.5 Relative Fit Index

Bollen (1989) argued that the Relative Fit Index (RFI), also known as RHO1, is not certain to fluctuate from 0 up to 1. Yet, the lower the RFI value, the worse the fit. The LISREL output file indicated that the Relative Fit Index (RFI) is equal to 0.890, which is close to 1 as indicated by Bollen (1989). This indicates an almost perfect fit.

6.7.3 Parsimonious Fit Measures

According to Bentler (1989), theories should be as basic as possible. They also stated that models with fewer unknown parameters are more likely to be scientifically applicable and explainable. The theorized model goodness of fit can be analyzed using parsimonious fit measures. It is useful in comparing the amount of projected estimates that are desirable for model fit level attention. The objective is to conclude whether it is possible to attain a level model fitting the data with too many coefficients (commonly known as overfitting). Their measures compare models based on some criteria that employ the quantity of estimated parameters and the fit.

6.7.3.1 Parsimony Goodness of Fit Index

According to Mulaik & al. (1989), you can use GFI to find PGFI by regulating for degrees of freedom losses. The PGFI index seriously penalizes model difficulty, resulting with cheaply fitting values of the index that are significantly inferior to suitably fitting indices. In spite of no threshold levels being suggested for this index, Mulaik et al. (1989) stated that you can achieve parsimony fit indices within the range of the 0.5 value whereas different goodness of fit indices surpasses the 0.90 value. Combining different measures of fit with parsimony fit indices (Mulaik et al., 1989). Nevertheless, they are more difficult to interpret as there is no suggested threshold level for these statistics. The LISREL output file indicated that the PGFI, known as the Parsimony Goodness of Fit Index has a value of 0.962, which is greater than the most recent suggest a cut-off of 0.90 by Mulaik et al. (1989). This indicates an almost perfect fit.

6.7.3.2 Parsimonious Normed Fit Index

According to Mulaik et al. (1989), PNFI, which is based on NFI, and on top of attempting to attain a certain level of fit it accounts for the number of degrees of freedom. Reaching closer fit for different degrees of freedom that is calculated for the theorized model is called parsimony. PNFI values are more respectable when they are higher, and the value itself is often used to compare models varying freedom levels. According to Williams and Holahan (1994), differences between models of 0.06 to 0.09 indicate substantial model differences. The LISREL output file indicated that the Parsimony Normed Fit Index (PNFI) is equal to 0.852, which is within the most recent suggest a cut-off of 0.90 by Williams and Holahan (1994). This indicates an almost perfect fit.

6.7.4 Noncentrality-based Indices

The centrality parameter is a challenging concept. The centrality parameter employs the logic where the null hypothesis is true (= 0) and the chi-square fit is based on an assessment. This results in a circulation of the chi-square that is central. We should be testing to discard the alternative hypothesis (H_a), due to the fact that in structural modeling we do not want to reject the independent hypothesis. When an assessment discards the substitute or alternative hypothesis, (H_a), it would lead to making statistical judgements, when (H_a) is assumed to be true in the population, using the "noncentral" chi-square distribution created. This kind of approach to model fit uses equivalent values of chi-square and df for the model as a standard of having a perfect fit rather than that f 0. Accordingly, the "centrality" parameter estimate is valued as the subtraction of the degree of freedom from the chi-square value (-df).

6.7.4.1 Root Mean Square Error of Approximation

According to Steiger (1990), the RMSEA is the third fit statistic. Byrne (1998) claimed that the RMSEA determines the suitability of the fit towards the population's covariance matrix, using unidentified but optimally chosen parameter estimations. Siguaw and Diamantopoulos (2000) declared that it is viewed as one of the most enlightening fit indices because of the lack of impact that the number of estimated parameters has on the model that is relative to it. RMSEA uses the fewest quantity of parameters out of all of the models. MacCallum et al. (1996) recommended that RMSEA values fluctuating from 0.10 down to 0.05 are a symptom of a reasonable fit. Furthermore, any numbers greater than 0.10 are of negative fit, a value from 0.10 down to 0.08 provides an average fit, then lastly, a value below 0.08 demonstrates a respectable fit. Nevertheless, Steiger (2007) set an upper limit of 0.07, while Bentler and Hu (1999) suggested a maximum value close to 0.06. Authorities in this area tend to follow these suggestions.

The RMSEA calculation formula is as follows

$$\sqrt{\frac{\delta_{u}}{df_{M}(N-1)}}$$

RMSEA approximates the general estimation error for each model degree of freedom and also account for sample size. If RMSEA = 0, this does not say that χ 2M = 0 (i.e., fit is perfect) but rather only says that χ 2M = df M. A rule of thumb provided by Cudeck and Browne (1993) is that an RMSEA value that is 0.05 represents a near perfect fit; whereas, any values within the 0.08 and the 0.05 mark propose sensible error of approximation. An RMSEA advocates poor fit when the value is equal to or exceeds 0.1.

Browne and Cudeck (1993) indicated that regarding the population, the error of approximation is explained by the RMSEA. According to MacCallum et al. (1996), the value represents the badness-of-fit and as the value increases the goodness-of-fit decreases. Poor fit is designated by the 0.10 mark or higher, mediocre fit lies between the 0.08 to 0.10 mark, values from 0.05 to 0.08 are acceptable. The LISREL output file indicated that the RMSEA is at a value of 0.0274, which is lower than the cut-off of 0.05. Hence, this indicates an almost perfect fit.

It is viable to report the confidence interval at 90%, which is estimated by RMSEA, for the population parameter. This range reflects the uncertainty degree and displays an estimate to the level of confidence within the 90 percent. In this case, the LISREL output file indicated that the Confidence Interval at 90 Percent of the RMSEA is within the 0.0000 to 0.0668 interval, which is less than the cut-off of 0.05. This indicates an almost perfect fit. The LISREL output showed lower level value for this interval to be 0.0000 which is lower than 0.05, the independent hypothesis fit is still regarded. Nevertheless, the upper range of the same confidence interval (0.0668) exceeds 0.10. Because of this, the premise of poor approximate fit can be disregarded. Hence, the RMSEA value of 0.0274 coincides with the proposition of good fit.

MacCallum et al. (1996) stated that RMSEA can be used to calculate a confidence interval around its value. McQuitty (2004) added that the statistic's known distribution values enable this calculation, and it also allows more precise testing of the null hypothesis. RMSEA is conveyed in conjunction with a confidence interval of 90%. The lower boundary is close to 0 and the upper limit is lower than 0.08 when an ideal fit is regarded.

6.8 Model Assessment

The goal is to develop a model that satisfies three key conditions. A statistically fitted model using data collected. A model that takes into account all possible types of errors. A functionally meaningful model that has a predictability power. Refer to Figure 4.1 that illustrates the proposed model versus Figure 6.1 that shows the fitted structural equation model. In order to achieve the desired results, the proposed model goodness-of-fit is evaluated using three recommended measure of fit (Jöreskog and Sörbom, 1993).

6.8.1 Parameter Estimates

The measurement model parameter estimates are examined to identify unreasonable values or anomalies. Table 6.1 displays the properties of measurement for the observed variables. According to a priori specification, the variables estimates are quantified by a certain figure and a sign. The SMC, squared multiple correlations, for each relationship in the model is presented in table 6.1. SMC express the change in the causal relationship among latent constructs. It measures the strength of the linear relationship between different variables. A quick review of Table 6.1 shows that the SMC values align with our previous expected results and confirm the practicality of the model.

6.8.2 Overall Fit

The second step in the model assessment is to examine the model overall fit. The LISREL output file indicated that the minimum fit function chi-square, which is equal to 3066.98 with a P-value of 0.231 and the normal weighted least squares chi-square, where the non-normality is corrected through the event of a Fit function using weight. This N-value is equal to 3469.56 with a P-value of 0.283, which indicates a respectable ‘fit’. Fail to reject the null hypothesis indicated a no significant difference between the predicted and actual model. According to Barrett (2007), a good model fit is provided when an insignificant difference is found at a 0.05 level. A 0.283 is found which is greater than the P-value of 0.05, indicating a good model fit is achieved. Moreover, none of the goodness-of-fit indices discussed in section 6.7 indicated a week data fit; therefore, a detailed evaluation of the model fit is discussed in the following sections as the preliminary results were satisfactory.

6.8.3 Fit in Detail

All the consistent and comparative residuals as well as the modification indices are shown in appendix G, LISREL output file and were used to enhance the predictability of the model. Nonetheless, the output file recommends a modified fit for the data collected; refer to Appendix G.

6.9 Improving Model Fit

According to Chou and Bentler (1993) and Jöreskog and Sörbom (1989), since the fit of the initial models may be considered unacceptable, the model adjustment is an unavoidable, especially when using SEM. Under these circumstances, model modification involves freeing fixed parameters which cause an improvement in model fit. According to Pedhazur (1997), you can free the parameters sequentially, one at a time, until you achieve satisfactory results for the fit of the reviewed model.

6.9.1 Modification Indices

Jöreskog and Sörbom (1993) argued that modification indices can evaluate the fit of an indicated model, which can, in turn, calculate each unestimated factor. The amount of expected decrease in a chi-square value can be analyzed using different modification index. This takes place by specifically constraining one factor and re-estimating the model. The highest value always indicates the factor needs to be considered to have the highest impact for fit improvement. Each change will add incrementally to the model fit. There is a difference between a factor and a modification index. A factor can help change the overall model fit, represented by chi-square (χ^2). In fact, this change portrays the authenticity of the parameter value. MacCullum (1986) stated that modification indices are used to evaluate the impact of hypothetically based models. Yet, they can be utilized to change a factor that is fundamentally construed. In order to consider the use of model modification it is required to perform theoretical justification, and even in this case the researcher should be doubtful about variations. Hair et al. (1998) discussed the model re-specification constructed exclusively based on such modification indices. He also explained the statistically important putative model.

6.9.2 Correlated Errors

The model modification different categories involve adding correlated errors to enhance fit. This enables identification of two kinds of correlated errors. The first type of errors is concerned with those of the latent constructs (i.e., residuals) (Pedhazur, 1997) and the second type of errors is related to those of the observed variables (i.e., measurement errors). One important assumption of latent variable analysis in cross-sectional studies is that there is no correlation of fault relationships between indicator variables. In case there is an association between observed indicators error terms, then the indicators measure something addition to the construct that is being measured.

Using associated errors of latent constructs have several advantages and disadvantages regarding model fit improvement. For example, adding correlated errors of measurement can (1) dramatically improve the model's overall fit and can also reveal unanticipated and possible variances among measurable variables. (2) However, according to Hoyle (1995), measurement errors are always posthoc and rarely provides an acceptable explanation for the correlation. Consequently, there is a high probability of sample correlation idiosyncratic and impossible to duplicate. (3) Anderson and Gerbing (1988) argued model fit improvement using correlated errors when such covariation is taken into consideration. Jöreskog and Sörbom (1993) argued that including any type of correlated error terms is a mismanagement of structural equation modeling, particularly when its only purpose is to obtain a better fit to the data.

6.10 Results Summary

Table 6.4 summarizes the Goodness of Fit Statistics produced by the LISREL 8.8 software file output for the model described previously in Chapter Four that were fitted to the data collected using MLE, or maximum likelihood estimation method. The model fitting results are demonstrated in the same order discussed in this chapter. The first set of measures assesses the overall goodness of fit between those understood by the fitted model parameters using various fit indices and the observed correlations. According to Jöreskog and Sörbom (1996), the second set of measures looks at the relative fit of the model to other models using fit indices that vary between 0 and 1, with 0 implying the worst possible fitting model. The third set of measures evaluates the parsimony of the model using parsimony-corrected fit indices. The last set of measures is related to the centrality of the fitted model

Since the late 1990s, there has been concern that 0.90 which is the recommended cut-off values for fit indices should be increased to 0.95, and should be applied due to their increase in success. Bentler and Hu (1999) thoroughly examined various cut-offs for many of these measures and came to the conclusion that a combination of the above fit indices should be used to minimize both error types (i.e., Type I and II).

Table 6.4 – Fit Indices Summary

Fit Measure	Value	Criteria
Minimum Fit Function Chi-Square	3066.98	The larger the chi-square value the "better."
Normal Theory Weighted Least Squares Chi-Square	3469.56	No significant differences between the actual and predicted matrices
Goodness-of-Fit Index (GFI)	0.972	From 0 (poor fit) to 1 (perfect fit), higher values indicate better fit, no threshold

		levels of acceptability have been established
Adjusted Goodness of Fit Index (AGFI)	0.937	From 0 (poor fit) to 1 (perfect fit), higher values indicate better fit, no threshold levels of acceptability have been established
Root Mean Square Error of Approximation (RMSEA)	0.0274	A value of "0" indicates the best fit and higher values indicate worse fit. Values ranging from 0.05 to 0.08 are deemed acceptable; values ranging from 0.08 to 0.10 indicate moderate fit, and those greater than 0.10 indicate a poor fit
Tucker-Lewis Index (TLI)	0.980	Range from 0 (a fit that is no better than the null model) to 1 (A perfect fit).
Normed Fit Index (NFI)	0.941	Range from 0 (a fit that is no better than the null model) to 1 (A perfect fit).
Relative Fit Index (RFI)	0.890	Range from 0 (a fit that is no better than the null model) to 1 (A perfect fit).
Incremental Fit Index (IFI)	0.990	Range from 0 (a fit that is no better than the null model) to 1 (A perfect fit).
Comparative Fit Index (CFI)	0.989	Range from 0 (a fit that is no better than the null model) to 1 (A perfect fit).
Parsimonious Normed Fit Index (PNFI)	0.852	Higher values of PNFI are better

This set of indices presented in Table 6.4 leads to a common inference about the competence of the fitted model through the use of the observed data. When regarding the figures provided by all the measurement indices, the model clearly fits the data. The model df is equal to 776. Chi-square minimum fit function equal to 3066.98 with a P-value equal to 0.231. This p-value is high to reject the null of a good fit. The standard theory valued the least squares Chi-Square at a number of 3469.56 with a P-value equal to 0.283, which is also high to reject the null of a good fit. The log likelihood chi-square value is relatively small, indicating the presence of no noticeable deviations among the results inferred from the model estimates using observed data points. In order to assess the extent of discrepancy between the fitted covariance matrices and the sample, the chi-square test was used. In addition, a value of 0.972 was assigned through the GFI, Goodness-of-Fit Index, which is high.

On the other hand, all other indices that are used to evaluate the model (a) Incremental Fit Index, (b) Tucker-Lewis Index, (c) Comparative Fit Index, (d) Normed Fit Index, (e) Relative Fit Index, (f) Parsimonious Normed Fit Index, and (g) Root Mean Square Error of Approximation, indicate a flawless fit based on the allowable range from 0 to 1, where I is perfect fit. All the indices' meet the cut-off criteria with a minimum of 0.890 and a maximum of 0.990. Collectively, the results in Table 6.3 lead to the conclusion that the observed data in the study are dependable with the assumptions made by fitted model 1.

Finally, Figure 6.1 shows the fitted model estimates that can be interpreted as follows:

1) Corporate innovation is an unseen latent variable that impacts the corporate performance observed measures: Payout Ratio (PR), Return on Assets (ROA), Market Value (MV), Return on Investment (ROI), Tobin's Q, Return on Equity (ROE), and Sustainable Growth Rate (SGR). However, observed variables for corporate sustainability are also influenced by supplementary sources of disturbance aside from the usual non-observed errors of measurement.

2) Corporate sustainability is a non-observed latent variable that influences the corporate performance observed measures: Payout Ratio (PR), Return on Equity (ROE), Market Value (MV), Return on Investment (ROI), Tobin's Q, Return on Assets (ROA), and Sustainable Growth Rate (SGR). However, observed variables for corporate

sustainability are also influenced by supplementary sources of disturbance aside from the usual non-observed errors of measurement.

3) Latent variables of corporate innovation and corporate sustainability are correlated variables.

4) The coefficients relating the latent variable of corporate performance to the observed measures of corporate innovation are estimates of the correlations between the supplementary sources of disturbance on top of the non-observed errors. In this instance, the coefficients are big, suggesting robust links between research and development expenditure from the previous year, corporate innovation capabilities expressed in annual research and development dollars spent, patent applications within North America, granted patents within North America, and research and development intensity and the non-observed latent variable.

5) Similarly, the coefficients connecting the observed and gathered corporate sustainability data to the latent variable of corporate sustainability are estimates of the association between the manifest indicators and the latent construct. For example, the numbers shown in table 6.1 for Total greenhouse gas (GHG) measured in Tonnes of carbon dioxide equivalent (co_2e), Total energy consumption measured in Gigajoules, and Employees and contractors' number of fatalities per year, and their association with corporate sustainability are (0.88, 0.51, and 0.64 respectively) which propose that there exists a strong correlation between the latent variable and the observed values for different categories of corporate sustainability (i.e., social responsibly and/or environmental stewardship), indicating a consistency in the observed values among the firms drawn from the same industry sector.

6) The coefficient relating corporate innovation to corporate sustainability is an approximation of the degree to which corporate innovation impacts corporate sustainability, independent of the influence corporate sustainability on innovation. These coefficients are expressed as a value and direction. As shown in table 6.2, corporate innovation will impact corporate sustainability by 24 percent while corporate sustainability can affect corporate innovation by 28 percent. These results suggest a

strong and detectable impact in both directions. Corporate ability to innovate will increase due to the firm's tendency to behave responsibly in its operating environment. Corporate sustainability will be impacted by the degree of innovativeness that a firm has embedded in its operating culture and its strategy to foster innovation over years of business.

7) Finally, the model shows that despite the strong and obvious relationship between corporate innovation and corporate sustainability in both directions and regardless of the magnitude, there is evidence of a strong positive correlation between corporate innovation and corporate performance. In the same vein, corporate sustainability and corporate performance are also strongly correlated. This correlation was found to be direct and positive between corporate innovation and the corporations' financial performance with a correlation coefficient of 10 per cent. The model also exhibited that corporate sustainability has a significantly greater association with corporate financial performance with a correlation coefficient of 20 per cent. This correlation is somewhat smaller between corporate innovation and corporate performance. This is described through the truth that the correlations between corporate innovation and corporate performance are overblown by an inclination for the firms not to innovate unless there is an external force excreted from its environment. At the same time, the correlation between corporate sustainability and corporate performance is somewhat larger than the correlation between corporate innovation and corporate performance. This may be explained by the fact that firms are responding much faster to current pressures coming from different stakeholders and governmental agencies as compared to its innovation capabilities that require time to be established.

In general, the model in Figure 6.1 provides a dependable account of the relations between corporate performance, corporate sustainability, and corporate innovation, which takes into account issues of errors of measurement in the sustainability performance which experientially gathered and publicly available reported data. This disallows the possibility of corruption of innovation reported data collected from different sources. The data are consistent with the proposed theory that assumes that while firms' ultimate goals are to maximize profits, (a) sustainability is not as much of a burden on the bottom line as believed by many executives. In fact, pursuing the goal of becoming an environment-friendly company can help to reduce costs and increase revenues. As a result, sustainability should be linked to innovation as an integral part of the corporate strategy for improved overall performance of the firm. It is commonly believed that, at some time in the near future, companies that actively pursue sustainability will have a competitive advantage. As a result, companies should rethink their business products, models, processes, and technologies (Nidumolu, Rangaswami, and Prahalad, 2009). (b) The challenge of innovation is founded in search processes for innovation triggering signals, implementation, and selection (resource allocation). As noted by Arrow (1962) and Winter and Nelson (1982), organizations develop routines for their innovation activities, which eventually become rooted and secured into their policies, processes and structures.

In addition, the above model analysis has considered a collection of potential models of the relationship between corporate innovation, corporate sustainability and corporate performance. While it is experimentally proven that these data are reliable with a particular theory of the associations between variables, this does not suggest that alternative models of this relationship should not be proposed. Particularly, in an evaluation of the proofs on the link between corporate innovation and corporate sustainability, debates about reducing environmental degradation under industrial development have featured the promise of greener innovation (Jänicke, 1985). Critical responses to the report on Malthusian Limits to Growth done by the Club of Rome in the 1970s emphasized innovative capabilities (Meadows, 1972). Critics stated that the Club's modeling paid too little attention to the possibility that innovation could stretch and redefine limits, which could help to prevent environmental and social collapse (Freeman and Soete, 1997). Also, Vergragt and Jansen (1993) discussed ecological modernization and how innovation could redirect the energy-intensive materials production and energy sectors toward environmental goals, as well as separate economic growth from environmental degradation. Therefore, there is a definitive need for more testing of the assumption that innovation can help those interested in ensuring the development of new products, processes, and services that can improve human well-being without detrimentally affecting environmental life support systems.

6.11 Discussions

Given many aspects of business are changing at the same time, innovation and sustainability are believed to be essential to effective organizational transformation. All industries are making significant changes due to the growing importance of sustainability. Organizations and industries are moving away from a singular focus on creating financial value for a new type of value creation that involves the simultaneous creation of ecological, social, and financial value. This is now creating a demand for innovation across all sectors, particularly in energy and energy-intensive materials production, which are responsible for the significant emission of greenhouse gasses (GHG) with consequential impacts on climate change (Allwood and Cullen, 2012). In light of the rate of change and the extent of change taking place, opportunities to focus on innovation as primary drivers of positive change is becoming more common. This puts emphasis on implementing best practices in innovation to support the transformation process.

Looking at low carbon energy technologies and their role is contributing to a more sustainable energy future. There is still a lag in tapping inexhaustible clean energy sources such as solar, wind, biomass and enhanced geothermal (Daim, Yates, Peng, and Jimenez, 2009). The literature on energy transition suggests that innovation can help with using inexhaustible energy sources as an alternative to fossil fuel (e.g., Verbong and Geels, 2007; Leach, 1992). Sustainable energy solutions can be directed to decarbonize current business activities. There are several justifiable reasons that indicate radical transformation will be inevitable over the next few decades.

Sustainable materials comprise natural or synthetic elements. In either case, there is a cost attached to the management of a material's life cycle, including extraction, processing, production, shipping, installing, use, and discarding of those resources. The literature on materials transition suggests a comprehensive approach that incorporates social, environmental, and economic factors to support decisions about appropriate material use. There are high stakes involved in pursuing a sustainable materials future, and there are significant opportunities for making both incremental and transformative changes through innovation. Innovation must be responsible for providing the requisite materials and technologies to reflect tomorrow's evaluation of economic, social, environmental, operational and technical considerations (WBCSD, 2010).

Weaver et al. (2000) argued that innovation is an obvious contributor to sustainable development. Leach et al. (2012) added that different experts have varying opinions on which innovation will be most effective in delivering the sustainable materials required in the future. They added that current innovation processes must be placed in a broader, more sustainable development context to produce more sustainable outcomes. Moreover, current innovation processes require significant innovations (as opposed to simply modifying existing conditions) to produce significantly transformative innovations that can lead to step changes in how materials perform in a sustainable environment.

According to Nidumolu, Prahalad, and Rangaswami (2009), sustainability is having a significant impact on the competitive landscape, which means that companies must change how they think about their products, technologies, processes, and business models. By making sustainability a goal, early movers will be able to develop competencies that competitors will have difficulty matching. Establishing this competitive advantage will ensure that sustainability remains an integral part of the organization's development. Schmidheiny (1992) stated that, once corporations accept these ethical arguments, they must make a sincere commitment to achieving sustainability. Wheeler and Sillanpaa (1997) argued that a firm must also be concerned about planetary sustainability and seek out solutions to environmental and social problems. Therefore, its approach to sustainable development should combine both self-interest and social interest (Wheeler, Colbert, and Freeman, 2003).

According to Law and Gunasekaran (2012), organizations have taken different paths to making sustainability part of their mission statements, the foundation for their funding priorities, the result of different goals and projects, and a driver for their competitive advantage. When any or all of these factors come into focus for an organization's strategy, it will seek to determine how their products and processes impact social and natural environments. Developing this awareness and sense of responsibility for protecting natural resources can encourage individuals and companies to recognize that we all share a global and local "commons" that determines whether we all succeed or fail. Business operations will then become more socially responsible and engage in more sustainable development.

Corporate sustainability is an emerging business approach that functions as an alternative to the traditional profit maximization business model. Companies have been diligently and universally trying to adopt this new approach, but evidence of its existence and increased popularity can be seen in the growing body of literature, academic interest and research, high-profile attention from international business organizations, and corporations' active measurement and reporting on sustainability performance. Increasing corporate adoption of this sustainability paradigm should produce newer approaches to business, which includes creating policies and programs that affect the company's economic, social, and environmental performance, and enable performance measurement and reporting to stakeholders. Corporations might be identified as taking a lead role for three reasons:

1) industrial activity has contributed to environmental and social problems that now must be addressed, and therefore they have an ethical responsibility to take action;

2) corporations have greater access to the resources that are required to address these issues, and

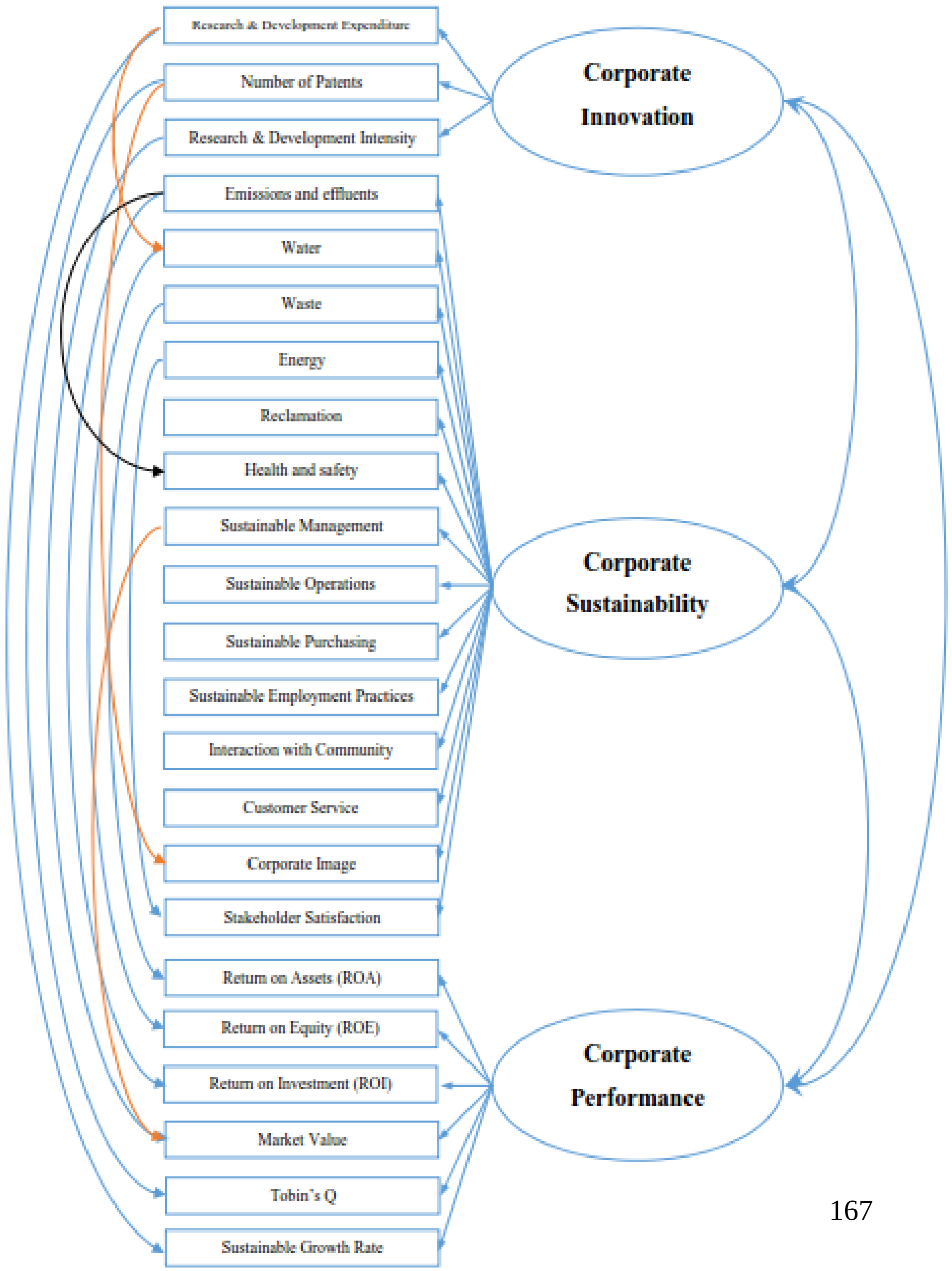
3) corporations might determine that it is in their best interest to address the problems because an increasing number of stakeholders – including investors and customers – consider corporations' social and environmental performance when making investment and purchasing decisions.

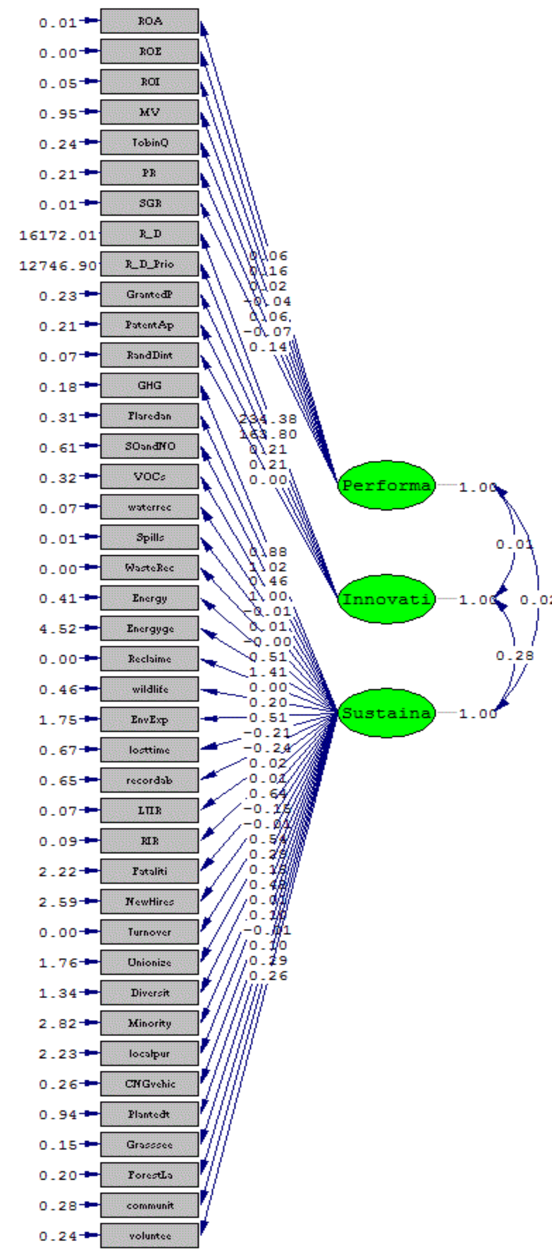
Therefore, sustainability is currently viewed as a key for innovation and should play a significant role in improving current technologies and introducing new innovations. On the other hand, sustainability practices are essential in shaping future corporate innovations. Understanding this complex reciprocal relationship is essential for firms' future success.

6.11.1 Hypotheses Testing

Sustainability practices are essential in shaping future corporate innovations. It is becoming more acceptable that innovation can help reduce further impacts on climate change. Understanding this complex reciprocal relationship is essential for firms' future success. There are many justifiable reasons why innovation and sustainability can work hand in hand over the next few decades. Figure 6.2 presents the two models (i.e., proposed model and the analyzed model) side by side for proper comparison purposes. The covariance matrix presented in Table 6.3 for the model shown in Figure 6.1 illustrated the most influential observed variables that help explain the relationship under investigation. The coefficients obtained in the covariance matrix were used to understand the pairwise comparisons between correlated observed variables, which will help in simplifying the complexity of the relationships between the three different latent constructs. All the hypotheses presented in Chapter Four were validated using the covariance coefficients. In this section, all the propositions made will be validated for theory validation.

Figure 6.2 - Two models (i.e., proposed model and the analyzed model) side by side for comparison purposes





Several empirical studies demonstrate a relationship between innovativeness scale adopted from Capon, Farley and Hulbert (1998) and firm profitability, size, and market share (e.g., Deshpande, Farley, and Frederick, 1993; Baldwin and Johnson, 1996; Aboody and Lev, 2000; Koc and Ceylan, 2007). Also, more studies find a positive and strong linear relationship between types of innovations and operating earnings and sales (e.g., Forsman and Temel, 2011; Love and Mansury, 2008; Klomp and Van Leeuwen, 2001; Damanpour, Szabat, and Evans, 1989; Damanpour and Evan, 1984). In general, research has demonstrated that innovativeness can be tied to organizational performance when measured according to profitability, return on investment, market share, and growth rate. However, innovation does not always positively impact a firm's performance. Likewise, a constructive relationship between corporate innovation and the corporations' financial performance was discovered with a correlation coefficient of 5 per cent.

Several researchers have investigated firm value when it has involved different firms' attempts to take social and environmental responsibility (McGuire, Sundgren, and Schneeweis, 1988). Salzmann, Ionescu-somers and Steger (2005) and Willard (2005) stated that corporate sustainability pays off for corporations. A socially responsible company can use sustainability to produce short- and long-term financial benefits (Manning, 2004). There is growing evidence that suggest there exists a progressive relationship between firm performance and proactive sustainability strategies (e.g., Gabriel and Nathwani, 2014 and Fujii et al., 2013). Similarly, the model exhibited that corporate sustainability has a significant association with corporate financial performance with a correlation coefficient of 6 per cent.

It has been established that use of fossil fuels contributes to global warming, and there is growing concern that climate change has the potential to create havoc (Ash et al., 2013). Corporations are well aware of the serious long-term impact of emissions on the environment (Wilkinson, Hill, and Gollan, 2001) and are striving to reduce and/or eliminate their operations' detrimental environmental effect and emphasizing sustainability initiatives that might help to improve the Earth's climate (Griffiths and Petrick, 2001). It is becoming increasingly clear that innovation and sustainability can go hand in hand to reduce further impacts on climate change (Meinshausen et al., 2009, 2011). The study showed a combined relationship of corporate innovation and corporate sustainability with corporate financial performance equal to 11 percent in the positive direction.

Consumers willing to increase the budget for eco-friendly products and processes to contribute to the fight against climate change and limit mean global surface warming to 2°C are being recognized as important social factors that will influence corporate behavior. Firms are open to unconventional solutions that could reduce the severity of climate change issues (Lodhia, 2011; Neil, Arnell, and Tompkins, 2005). Some researchers (e.g., Fussier, 1996; Rennings, 2000) have examined new ideas, behaviors, products and processes that have been shown to reduce environmental impacts and/or meet ecologically sustainability targets. There has been relatively little research on how innovation can help firms to achieve sustainability. There is no empirical research on identifying and analyzing how innovation can support and promote corporate sustainability.

Based on the literature review, innovation can be considered a valid argument for sustainability (Asongu, 2007a). It has been argued that a firm's sustainable development program can help develop innovative products or processes (Forsman, 2013). Corporations currently view sustainability as a legitimate source of innovation (Husted and Allen, 2006; Asongu, 2007b). According to Stigson (2002), sustainability strategies can help to ensure efficiency and promote innovation. Firms are leveraging innovation mainly because of sustainability pressure. The analysis results exhibited that there is a robust relationship between sustainability and innovation. It showed that the relationship is valid in both directions. Sustainability can drive innovation, and vice versa. Innovation can impact sustainability by 24 percent while sustainability can affect innovation by 28 per cent.

In particular, the covariance matrix presented in Table 6.3 shows the pairwise correlation between corporate innovation and corporate financial performance indices. Table 6.5 shows the covariance coefficients between corporate financial performance observed variables and corporate innovation observed indicators.

Table 6.5 - corporate innovation and corporate financial performance observed variables covariance coefficients

	ROA	**ROE**	**ROI**	**MV**	**TobinQ**	**PR**	**SGR**
R_D	-0.90	0.33	-1.78	58.11	5.50	-6.35	-2.80
R_D_Prio	0.13	1.34	-1.25	49.14	10.72	-6.23	-0.48
GrantedP	0.01	0.00	0.00	0.05	0.01	-0.01	0.00

PatentAp	0.00	0.00	0.00	0.06	0.01	-0.01	0.00
RandDint	0.00	0.00	0.00	-0.01	0.01	0.00	0.00

According to Zhang, Baden-Fuller and Mangematin (2007), organizations can capture rents from R&D when they are able to address appropriability that is tied to innovation. As per Table 6.5, there is a negative relationship between research and development expenditure and return on assets, return on investment, dividend payout ratio, and sustainable growth rate. It is clear that the more the firm will spend in innovation, the lower the return on its assets and its investments. If the available funds are used to spend on research and development, the lower the payout ratio, which indicates the finances a company returns to its own shareholders versus how much it keeps available for reinvesting into growth, adding to cash reserves, paying off debt and the sustainable growth rate, which measures a firm's ability to grow without borrowing additional funds. After a firm exceeds its sustainable growth rate, it must borrow funds from to support additional growth.

According to Aboody and Lev (2000), investing in R&D leads to new products and process efficiencies, which creates a competitive advantage that improves performance. As shown in Table 6.5, there is a beneficial relationship between development expenditure, research, and return on equity along with market value, and Tobin's Q. The more the company will spend on research and development, the higher the return on shareholders' equity and the better it will be perceived by the market. This is reflected in its current market value. The current market of the firm is equal to the number of outstanding shares multiplied the firm's current share price, and the Tobin's Q ratio, which is calculated as a firm's market value divided by the value it takes to replace its assets.

According to Mogee (1991), patents are an ideal proxy measure for technological innovation. Patents have been widely written about and researched in evaluating the state of a firm's innovation efforts, determine its future direction, and support its R&D decision-making (Beneito, 2006). Patents are a significant method of protecting innovation, and there is a growing understanding of the importance of patent data. As presented in Table 6.5, granted patents and patent applications are associated with the return on assets, market value and Tobin's Q. It is obvious that the more patents the company owns, whether granted or applied for, the higher the impact will be on its ROA. This is a good indicator of management's efficiency in using the firm's assets to generate earnings, as well as its market value and its Tobin's Q.

The covariance matrix presented in Table 6.3 shows the pairwise correlation between corporate sustainability's three sub-constructs (i.e., environmental stewardship, social responsibility, and community involvement) and corporate financial performance indices. Table 6.6 shows the covariance coefficients between corporate financial performance observed variables and environmental stewardship observed indicators.

Table 6.6 - Environmental stewardship and corporate financial performance observed variables covariance coefficients

	ROA	ROE	ROI	MV	TobinQ	PR	SGR
GHG	-0.01	0.00	0.00	0.17	-0.01	0.02	0.00
FandV	0.00	0.00	-0.01	0.12	0.01	0.00	0.00
SOandNO	-0.01	0.00	0.01	0.19	-0.04	0.06	0.00
VOCs	0.00	0.01	0.00	0.08	-0.02	0.03	0.01
waterrec	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Spills	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WasteRec	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.00	0.00	-0.01	0.11	-0.01	0.01	0.00
Energyge	0.01	0.02	-0.01	0.14	0.08	0.01	0.05
Reclaime	0.00	0.00	0.00	0.00	0.00	0.00	0.00
wildlife	0.00	0.00	0.00	-0.02	-0.01	0.05	0.00
EnvExp	-0.01	-0.01	0.03	0.45	-0.06	0.11	0.01

In Table 6.6, the observed indicators of environmental stewardship are shown in the first column (i.e., total greenhouse gas (GHG) measured in tonnes of carbon dioxide equivalent (CO_2e), total flared and vented gases measured in metric tonnes of CO2 equivalent, sulphur dioxide and nitrogen oxides measured in tonnes, volatile organic compounds (VOCs) measured in tonnes, total volume of water recycled as a percentage of the total water used expressed in percent (%), total number of spills in thousands of barrels, waste recycled as a percentage of the total waste in percent (%), total energy consumption measured in gigajoules, total non-carbon energy generated in MWh, total reclaimed land as a percentage of the total land use expressed in percent (%), protected wildlife habitat in acres, and environmental expenditures in dollars). The association of the indicator and its relationship to corporate financial performance observed variables (i.e., ROA, ROE, ROI, Market Value, Tobin's Q, Dividend Payout Ratio, and Sustainable Growth Rate) is also showing in table 6.6.

According to Gupta (1995), organizations tend to create sustainable operations that satisfy environmental needs. The most significant and positive relationships are between the environmental expenditures in dollars and the company's market value, which serve as strong indicators of investors' perceptions of the firm's business prospects. According to Jose and Lee (2007), there is increasing pressure on organizations to report their environmental footprint. There has been greater publicity for initiatives that focus on reducing GHG emissions. Wagner (2005) stated that firms that focus on pollution prevention achieve a positive impact on their economic performance. As shown in Table 6.6, total greenhouse gas (GHG) measured in tonnes of carbon dioxide equivalent (CO_2e), total flared and vented gases measured in metric tonnes of CO2 equivalent, volatile organic compounds (VOCs) measured in tonnes, sulphur dioxide and nitrogen oxides measured in tonnes, total energy consumption measured in gigajoules and total non-carbon energy generated in MWh in relation to the firm's market value, which fluctuates over periods of time, and is substantially influenced by business decisions like GHG, flared and vented gases, VOCs, SOx, NOx emissions elimination, smart energy usage and renewable energy generation. Also, total non-carbon energy generated in MWh is associated with return on assets, volatile organic compounds (VOCs) measured in tonnes is correlated with return on equity, environmental expenditures in dollars is interrelated with return on investment, total volume of water recycled as a percentage of the total water used expressed in percent (%), and total non-carbon energy generated in MWh is associated with Tobin's Q.

Organizations must focus on renewable and sustainable energy sources to manage this demand using environmentally friendly methods (Fischedick, and Hennicke 2006; Takeda, Yoshikawa, Kajikawa, and Matsushima, 2008). As shown in Table 6.6, total greenhouse gas (GHG) measured in tonnes of carbon dioxide equivalent (CO_2e), sulphur dioxide and nitrogen oxides measured in tonnes, volatile organic compounds (VOCs) measured in tonnes, total energy consumption measured in gigajoules, total non-carbon energy generated in MWh, protected wildlife habitat in acres, and environmental expenditures in dollars are positively correlated with the dividend payout ratio. Moreover, volatile organic compounds (VOCs) measured in tons and total non-carbon energy generated in MWh are positively associated with sustainable growth rate.

A firm's social responsibility is deeply connected with its financial performance. Various research studies form the basis for social sustainability (e.g., Kok et al., 2001; Welford, 2005; Labuschagne and Brent, 2006). Similarly, the covariance matrix presented in Table 6.3 shows the pairwise connection between corporate financial performance indices and corporate social responsibility. Table 6.7 shows the covariance coefficients between corporate monetary performance observed variables and social accountability observed indicators (i.e., employees and contractors' lost-time injuries expressed in number of injuries, employees and contractors' lost-time injury rate measured in number of cases/200,000 hours worked, employees and contractors' recordable injuries expressed in number of injuries, employees and contractors' recordable injury rate measured in number of cases/200,000 hours worked, employees and contractors' fatalities per year, new hires expressed as a percentage of the total number of employees (%), voluntary turnover rate expressed in percentage (%), employees in employee unions or associations expressed in percentage (%), diversity expressed in percentage of women in the workforce (%), minority employees expressed in percentage (%), purchase of goods and services locally as percentage of total sales (%), and compressed natural gas (CNG) vehicles in fleet measured in number of vehicles).

Table 6.7 - Social responsibility and corporate financial performance observed variables covariance coefficients

	ROA	ROE	ROI	MV	TobinQ	PR	SGR
losttime	0.00	0.00	0.01	0.09	-0.01	0.01	-0.01
recordab	0.00	-0.01	0.00	0.07	-0.01	-0.01	-0.01
LTIR	0.00	0.00	0.00	0.02	0.00	0.01	0.00
RIR	0.00	0.00	0.00	-0.01	-0.01	0.01	0.00
Fatalitiy	0.01	0.01	0.01	-0.07	0.03	0.00	0.02
NewHires	-0.02	-0.02	-0.01	0.39	-0.05	0.03	-0.01
VTurnover	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unionize	-0.01	-0.01	-0.02	0.33	-0.01	0.05	-0.01
Diversity	-0.01	0.00	-0.01	0.29	0.00	0.04	0.01
Minority	-0.02	0.00	0.00	0.22	0.02	0.00	0.01
localpur	-0.01	-0.01	0.01	0.50	-0.08	0.10	0.00

CNGvehic	0.00	0.00	0.00	-0.01	0.00	0.00	0.00

According to Min and Galle (2001), companies should establish procurement policies that favor vendors of sustainable products when conducting business transactions. Consideration of corporate sustainability issues in purchasing revolves around creating a sustainable supply chain, as well as awareness and consideration for the related issues (Marchi, Maria, and Micelli, 2013). As shown in Table 6.7, purchase of goods and services locally as a percentage of total sales (%) is positively and significantly correlated with the firm's market value, which positively correlates with investors' perceptions of the firm's business prospects, and the Dividend Payout Ratio. A new growth-oriented company, which intends to move into new markets, increase its operations, develop new products, and reinvest most or all of its earnings, is expected to have a low or zero payout ratio. However, a longer existing, more recognized company that returns very little to its stakeholders would test its investors' patience and could encourage shareholders to interfere.

Baumgartner and Ebner (2010) argued that socially responsible organizations will focus on fulfilling their stakeholders' needs to assure their long-term loyalty. Similarly, diversity expressed in percentage of women in the workforce (%) and minority employees expressed in percentage (%) are positively correlated with the organization's market value, which are solid indicators of investors' perceptions of the firm's business prospects. Likewise, employees and contractors' fatalities per year and purchase of goods and services locally as a percentage of total sales (%) are positively associated with the return on investment. Employees and contractors' fatalities per year and minority employees expressed in percentage (%)are correlated with the Tobin's Q ratio, which measures stock valuation and drives investment decisions in Tobin's model. Also, most of these indicators have a positive correlation with Dividend Payout Ratio, which means that with a high payout ratio the firm's share prices are likely to appreciate slowly. Finally, employees and contractors' fatalities per year, diversity expressed in percentage of women in the workforce (%), and diversity expressed in percentage of women in the workforce (%) are positively interrelated to sustainable growth rate, which measures the rate at which a firm can grow without borrowing additional funds.

To be a good corporate citizen, a firm must increase its support for its stakeholders and their issues, increase involvement in society's régime, and contribute to and/or create sustainability-related activities for their local community (Donaldson and Preston, 1995). The covariance matrix presented in Table 6.3 shows the pairwise correlation between community involvement and corporate financial performance indices. Table 6.8 shows the covariance coefficients between corporate financial performance observed variables and community involvement observed indicators (i.e., planted trees expressed in number of trees, grass seed planted presented in acres, forest land established in acres, funding, donations, sponsorship and community investments expressed in millions of dollars, and employee volunteer hours showed in number of hours).

Table 6.8 - Community involvement and corporate financial performance observed variables covariance coefficients

	ROA	ROE	ROI	MV	TobinQ	PR	SGR
Plantedt	0.00	0.00	0.00	-0.05	0.01	-0.03	0.01
Grasssee	0.00	0.00	-0.01	-0.01	0.02	0.01	0.00
ForestLa	0.00	0.00	-0.01	-0.03	0.01	0.02	0.00
communit	0.00	0.00	0.00	0.14	0.01	0.01	-0.01
voluntee	0.00	0.00	0.00	0.07	0.01	0.02	0.00

Community involvement aspects also consider the firm's ethical behavior toward external stakeholders such as community members. Basic social ethical behavior assumptions and principles include, but are not limited to, establishing a culture of community involvement, giving serious consideration to external stakeholders' needs and creating a culture of community perseveration (Herbig and Dunphy, 1998). As shown in Table 6.8, funding, donations, sponsorship and community investments expressed in millions of dollars and employee volunteering shown in a number of hours are highly associated with the market value of the firm, which is a good indication of investors' perceptions of the firm's business prospects. Likewise, planted trees expressed in number of trees, grass seed planted presented in acres, forest land established in acres, funding, donations, sponsorship and community investments expressed in millions of dollars, and employee volunteer hours shown in number of hours are positively associated with the Tobin's Q ratio, which measures stock valuation and drives investment decisions in Tobin's model. Similarly, forest land established in acres, funding, donations, sponsorship and community investments expressed in millions of dollars, and employee volunteer hours shown in a number of hours are positively interrelated with the percentage of earnings paid to shareholders in dividends, more commonly known as the Dividend Payout Ratio. Also, the number of planted trees is directly associated with the sustainable growth rate, which measures the rate at which a firm can grow without borrowing additional funds.

The impact of sustainability on innovation was not yet clearly defined until this research was conducted. It is becoming more important to integrate sustainability into the innovation process, but there has been no substantial effort to study this relationship. However, there is a strong belief that sustainability practices inspire innovation, and that sustainability is a key driver of innovation. Kolk and Pinkse, (2007) debated that the current literature on innovation has overlooked how sustainability can be used to describe and predict corporate innovation. Keeble et al. (2003) stated that more companies are interested in integrating corporate social responsibility into their core business activities. According to Garriga and Melé (2004), corporate social responsibility is based upon the concept of sustainable development.

Additionally, many researchers have claimed that innovation can be the tool by which companies can achieve their sustainability goals (Hines and Marin, 2004). However, the relationship between corporate innovation and sustainability at a corporate level is uncertain. Organizational innovative behavior can enable corporations to take the right actions toward sustainable development. Hart and Dowell (2011) stated that there are many gaps in the research on corporate sustainability, which could be closed through empirical investigations. Research that focuses on explaining the relationship between different corporate sustainability practices and its innovativeness is still sparse. Managing corporate sustainability requires the examination of the impact of innovation on its social and environmental goals (Wong, 2013). Innovation can be the strategic driver of sustainability.

The covariance matrix presented in Table 6.3 shows the pairwise correlation between corporate sustainability’s three sub-constructs’ observed variables (i.e., environmental stewardship, social responsibility, and community involvement) and corporate innovation indices.

Table 6.9 - Corporate innovation observed indicators and corporate environmental stewardship observed variables covariance coefficients

	GHG	FandV	SOandNO	VOCs	waterrec	Spills	WasteRec	Energy	Energyge	Reclaime	wildlife	EnvExp
R_D	48.95	46.75	40.93	70.49	6.03	4.37	0.07	31.82	40.15	0.03	-12.65	117.01
R_D_Prio	35.81	31.93	23.45	35.28	5.37	1.93	0.01	16.89	48.07	0.15	-0.54	57.50
GrantedP	0.08	0.07	0.04	0.10	0.00	0.00	0.00	0.03	0.12	0.00	-0.02	0.09
PatentAp	0.06	0.05	0.05	0.07	0.01	0.00	0.00	0.03	0.10	0.00	-0.02	0.07
RandDint	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	-0.01	0.00

Table 6.10 - Corporate innovation observed indicators and corporate social responsibility observed variables covariance coefficients

	losttime	recordab	LTIR	RIR	Fatalitiy	NewHires	VTurnover	Unionize	Diversity	Minority	localpur	CNGvehic
R_D	-5.19	-8.82	-5.53	-0.39	-75.30	-21.38	-1.41	-57.50	-43.59	-10.52	-193.84	-22.19
R_D_Prio	-7.19	-6.69	-2.02	-1.95	-47.54	-13.90	-0.72	-35.99	-34.09	-14.25	-97.62	-3.91
GrantedP	-0.02	-0.01	-0.00	-0.01	-0.06	-0.07	0.00	-0.02	0.00	-0.02	-0.03	-0.01
PatentAp	-0.01	-0.01	0.00	-0.01	-0.09	-0.14	0.00	-0.01	-0.02	0.00	-0.06	-0.01
RandDint	0.00	0.00	-0.01	0.00	-0.03	-0.03	0.00	-0.02	-0.04	0.00	-0.01	-0.02

Table 6.11 - Corporate innovation observed indicators and corporate community involvement observed variables covariance coefficients

	Plantedt	Grasssee	ForestLa	communit	voluntee
R_D	-20.16	-0.42	-0.90	61.39	-43.00
R_D_Prio	-6.90	-4.02	-3.68	33.39	-20.32
GrantedP	-0.01	-0.01	0.00	0.03	-0.02
PatentAp	-0.01	0.00	0.00	0.04	-0.02
RandDint	-0.06	0.00	0.00	-0.01	0.00

Table 6.12 - Corporate environmental stewardship observed indicators and corporate innovation observed variables covariance coefficients

	R_D	R_D_Prio	GrantedP	PatentAp	RandDint
GHG	48.95	35.81	0.08	0.06	0.00
FandV	46.75	31.93	0.07	0.05	0.01
SOandNO	40.93	23.45	0.04	0.05	0.00
VOCs	70.49	35.28	0.10	0.07	0.01
waterrec	6.03	5.37	0.00	0.01	0.00
Spills	4.37	1.93	0.00	0.00	0.00
WasteRec	0.07	0.01	0.00	0.00	0.00
Energy	31.82	16.89	0.03	0.03	0.00
Energyge	40.15	48.07	0.12	0.10	0.01
Reclaime	0.03	0.15	0.00	0.00	0.00
wildlife	12.65	0.54	0.02	0.02	0.01
EnvExp	117.01	57.50	0.09	0.07	0.00

Table 6.13 - Corporate social responsibility observed indicators and corporate innovation observed variables covariance coefficients

	R_D	R_D_Prio	GrantedP	PatentAp	RandDint
losttime	-5.19	-7.19	-0.02	-0.01	0.00
recordab	-8.82	-6.69	-0.01	-0.01	0.00
LTIR	-5.53	-2.02	0.00	0.00	-0.01
RIR	-0.39	-1.95	-0.01	-0.01	0.00
Fatalitiy	-75.30	-47.54	-0.06	-0.09	-0.03
NewHires	-21.38	-13.90	-0.07	-0.14	-0.03
VTurnover	-1.41	-0.72	0.00	0.00	0.00
Unionize	-57.50	-35.99	-0.02	-0.01	-0.02
Diversity	-43.59	-34.09	0.00	-0.02	-0.04
Minority	-10.52	-14.25	-0.02	0.00	0.00
localpur	-193.84	-97.62	-0.03	-0.06	-0.01
CNGvehic	-22.19	-3.91	-0.01	-0.01	-0.02

Table 6.14 - Corporate community involvement innovation observed indicators and corporate innovation observed variables covariance coefficients

	R_D	R_D_Prio	GrantedP	PatentAp	RandDint
Plantedt	-20.16	-6.90	-0.01	-0.01	-0.06
Grasssee	-0.42	-4.02	-0.01	0.00	0.00
ForestLa	-0.90	-3.68	0.00	0.00	0.00
communit	61.39	33.39	0.03	0.04	-0.01
voluntee	-43.00	-20.32	-0.02	-0.02	0.00

Table 6.9 shows the covariance coefficients between corporate innovation observed indicators and environmental stewardship observed indicators. It is clear that research and development expenditure, research and development expenditure prior (i.e., previous year), total granted patents within North America, total patent applications in North America, and research and development intensity are positively correlated with total greenhouse gas (GHG) measured in tonnes of carbon dioxide equivalent (CO_2e), total flared and vented gases measured in metric tonnes of CO2 equivalent, sulphur dioxide and nitrogen oxides measured in tonnes, volatile organic compounds (VOCs) measured in tonnes, total volume of water recycled as a percentage of the total water used expressed in percent (%), total number of spills in thousands of barrels, waste recycled as a percentage of the total waste in percent (%), total energy consumption measured in gigajoules, total non-carbon energy generated in MWh, total reclaimed land as a percentage of the total land use expressed in percent (%), and environmental expenditures in dollars.

Likewise, Table 6.10 shows the covariance coefficients between corporate innovation observed indicators and social responsibility observed indicators. The research and development expenditure, research and development expenditure prior (i.e., previous year), total granted patents within North America, total patent applications in North America, and research and development intensity are not correlated with employees and contractors' lost-time injuries expressed in number of injuries, employees and contractors' lost time injury rate measured in number of cases/200,000 hours worked, employees and contractors' recordable injuries expressed in number of injuries, employees and contractors' recordable injury rate measured in number of cases/200,000 hours worked, employees and contractors' fatalities per year, new hires expressed as a fraction of the total number of employees (%), voluntary turnover rate expressed in percentage (%), employees in employee unions or associations expressed in percentage (%), diversity expressed in percentage of women in the workforce (%), minority employees expressed in percentage (%), purchase of goods and services locally as percentage of total sales (%), and compressed natural gas (CNG) vehicles in fleet measured in number of vehicles.

Similarly, Table 6.11 shows the covariance coefficients between corporate innovation observed indicators and community involvement observed indicators. It indicates that research and development expenditure, research and development expenditure prior (i.e., previous year), total granted patents within North America, total patent applications in North America, and research and development intensity are correlated with funding, donations, sponsorship and community investments expressed in millions of dollars and has no correlation with planted trees expressed in number of trees, grass seed planted presented in acres, forest land established in acres, and employee volunteer hours showed in number of hours.

While there is a clear agenda for making sustainability an integral component of the innovation process, there is no significant effort to study whether it is, or should be, managed differently (Smith, Voß, and Grin, 2010). Therefore, it is important to look at different sustainability practices that inspire innovation. Sustainability is currently viewed as a key component of innovation and should become a significant factor in improving how innovation works. According to Kolk and Pinkse (2007), existing literature on innovation has overlooked the role of sustainability as a means to explain and predict corporate innovation. Subsequently, Table 6.12 shows the covariance coefficients between corporate environmental stewardship observed indicators and innovation observed indicators. It is clear that total greenhouse gas (GHG) measured in tonnes of carbon dioxide equivalent (CO_2e), total flared and vented gases measured in metric tonnes of CO2 equivalent, sulphur dioxide and nitrogen oxides measured in tonnes, volatile organic compounds (VOCs) measured in tonnes, total volume of water recycled as a percentage of the total water used expressed in percent (%), total number of spills in thousands of barrels, waste recycled as a percentage of the total waste in percent (%), total energy consumption measured in gigajoules, total non-carbon energy generated in MWh, total reclaimed land as a percentage of the total land use expressed in percent (%), and environmental expenditures in dollars are correlated positively with research and development expenditure, research and development expenditure prior (i.e., previous year), total granted patents within North America, total patent applications in North America, and research and development intensity.

Likewise, Table 6.13 shows the covariance coefficients between corporate social responsibility observed indicators and corporate innovation observed indicators. There is no relationship between employees and contractors' lost-time injuries expressed in number of injuries, employees and contractors' lost-time injury rate measured in number of cases/200,000 hours worked, employees and contractors' recordable injuries expressed in number of injuries, employees and contractors' recordable injury rate measured in number of cases/200,000 hours worked, employees and contractors' fatalities per year, new hires expressed as a ratio of the total number of employees (%), voluntary turnover rate expressed in percentage (%), employees in employee unions or associations expressed in percentage (%), diversity expressed in percentage of women in the workforce (%), minority employees expressed in percentage (%), purchase of goods and services locally as percentage of total sales (%), and compressed natural gas (CNG) vehicles in fleet measured in number of vehicles and the firm's research and development expenditure, the research and development expenditure prior (i.e., previous year), the total granted patents within North America, the total patent applications in North America, and the research and development intensity.

Similarly, Table 6.14 shows the covariance coefficients between community involvement innovation observed indicators and corporate innovation observed indicators. It indicates that funding, donations, sponsorship and community investments expressed in millions of dollars are positively correlated with the research and development expenditure, the research and development expenditure prior (i.e., previous year), the total granted patents within North America, the total patent applications in North America, and the research and development intensity. Also, the same table showed that planted trees expressed in number of trees, grass seed planted presented in acres, forest land established in acres, and employee volunteer hours showed in number of hours have no correlation with the research and development expenditure, the research and development expenditure prior (i.e., previous year), the total granted patents within North America, the total patent applications in North America, and the research and development intensity.

These findings support previous research about the importance of innovation in creating new products and improving process efficiencies (Aboody and Lev, 2000). It also provides evidence regarding organizations realizing rents from innovation by addressing appropriability issues tied to innovation (Zhang, Baden-Fuller, and Mangematin, 2007). For the first time, the research demonstrated how some firms have managed to successfully leverage sustainability to create and sell new and environmentally friendly innovations. The model showed that moving to these revolutionary sustainable energy solutions can create a low carbon economy. Based on the research findings, there are many proposed carbon-free alternatives to conventional energy sources, which suggests new avenues for researchers and policy makers. The research results established empirically the combined payoff of innovation (e.g., Cohen and Levinthal, 1990; Kurapatskie and Darnall, 2013) and sustainability on the firm's monetary performance (e.g., Siegel, McWilliams, and Wright, 2006;

McWilliams and Siegel, 2000; McWilliams and Siegel, 2001; Wright, McWilliams, and Siegel, 2006; Salzmann, Ionescu-somers and Steiger, 2005; Willard, 2005; Sariannidis et al., 2013). The link between corporate innovation and corporate sustainability and their combined impact on corporate performance has been quantitatively defined.

The research indicates that energy and energy-intensive materials production firms have established specific performance goals for their innovation practices and sustainability activities and they are readily utilizing their firms' core competencies. Furthermore, these firms are actively working to establish their innovation capabilities and proactively seeking environmental recognition, social acceptance, and community appreciation. They are successfully leveraging their current resources for financial substantiation. According to Busch, Stinchfield, and Wood (2010), innovation and sustainability reinforce each other and can contribute to a firm's long-term survival within its natural and social environment and in competitive markets. Energy and energy-intensive materials production firms are constantly looking for predictable long-term growth and performance; sustainability can be infused concurrently into innovation-focused programs. A firm's innovation approach would be preferential to investing in resources that enhance the firm's sustainability. Both will work hand in hand to enhance the firm's financial performance as long as they are viewed as an obligation on one side and incentive on the other side. Based on the research findings, companies will seriously consider both approaches. Firms that treat climate change as an opportunity will realize the benefits from taking action on both fronts. Firms are currently taking different approaches and pursuing different initiatives. This might reflect variations in corporate culture and circumstances, but might also be a result of the lack of opportunities to share best practices.

6.11.2 Indices Modified

Research findings demonstrate that different companies take different approaches, as each firm has different levels of action, priorities, initiatives, and programs. Our research proposes a continuum of strategies, which would allow a firm to participate in a particular effort that best suits its circumstances. Pursuing a flexible approach would support continual strategic improvement as information becomes available or there are changes in the corporate situation.

The LISREL output file suggested that to modify the indices, an error covariance should be added from to decrease the Chi-Square and, in that case, the new estimates are as follows (refer to Table 6.15).

Table 6.15 - The modification indices suggested by LISREL

From	To	Decrease in Chi-Square	New Estimate
MV	ROE	21.4	0.03
PR	MV	11.2	0.08
SGR	MV	13.7	-0.02
GrantedP	ROA	10.2	0.01
GrantedP	R_D	20.4	-28.14
PatentAp	R_D	10.0	-19.42
PatentAp	R_D_Prio	14.3	-16.32
PatentAp	GrantedP	206.9	0.17
GHG	R_D	11.6	15.81
Flaredan	GHG	189.8	0.31
SOandNO	GHG	89.8	0.20
Energy	Flaredan	8.9	0.07
Energy	SOandNO	12.3	0.09
Energyge	MV	13.0	0.39
Energyge	GHG	35.0	0.35
Energyge	SOandNO	100.7	0.88
Energyge	Energy	49.3	0.51
Reclaime	Spills	15.3	0.00
wildlife	GHG	10.1	-0.06
EnvExp	MV	30.5	0.37
EnvExp	PR	9.8	0.10
EnvExp	R_D	15.4	47.59
EnvExp	GHG	9.4	0.11
EnvExp	Flaredan	39.5	0.28

losttime	MV	10.2	0.13
losttime	GHG	8.3	0.06
losttime	SOandNO	31.9	0.19
losttime	Energyge	23.4	-0.44
recordab	Energyge	11.8	-0.31
recordab	losttime	93.1	0.33
Fataliti	GHG	11.0	-0.13
Fataliti	SOandNO	26.9	-0.31
Fataliti	Energyge	17.4	-0.69
NewHires	MV	26.0	0.41
NewHires	PatentAp	15.0	-0.15
NewHires	Flaredan	15.7	-0.21
NewHires	SOandNO	14.3	-0.25
NewHires	Energyge	18.8	-0.77
NewHires	EnvExp	13.5	-0.40
NewHires	Fataliti	13.2	-0.45
Unionize	MV	13.2	0.24
Unionize	GHG	11.2	-0.12
Unionize	Flaredan	12.5	-0.16
Unionize	EnvExp	16.5	-0.37
Unionize	NewHires	92.5	1.06
Diversit	MV	16.9	0.24
Diversit	RandDint	8.1	0.04
Diversit	Flaredan	11.1	-0.13
Diversit	EnvExp	11.1	-0.26
Diversit	NewHires	141.2	1.14
Diversit	Unionize	170.9	1.04
Minority	Flaredan	12.1	-0.19
Minority	NewHires	64.4	1.11
Minority	Unionize	89.7	1.09
Minority	Diversit	91.6	0.96

localpur	MV	30.8	0.42
localpur	R_D	49.2	95.75
localpur	GrantedP	9.0	-0.11
localpur	Flaredan	38.2	-0.31
localpur	EnvExp	130.7	1.17
localpur	NewHires	20.7	-0.56
localpur	Unionize	24.3	-0.51
localpur	Diversit	18.5	-0.38
CNGvehic	R_D	13.1	16.93
CNGvehic	Spills	8.1	-0.01
Plantedt	RandDint	23.8	-0.06
Plantedt	GHG	11.3	0.09
Grasssee	Plantedt	8.3	0.06
ForestLa	Energy	11.2	0.05
ForestLa	Energyge	18.5	0.21
communit	MV	10.6	0.09
communit	R_D	21.5	22.49
communit	GHG	32.2	0.08
communit	Flaredan	31.2	0.10
communit	VOCs	12.6	0.06
communit	EnvExp	14.8	0.14
communit	NewHires	8.1	0.13
communit	Unionize	10.6	0.12
communit	localpur	16.0	0.16
voluntee	R_D	15.0	17.42
voluntee	GHG	29.6	-0.07
voluntee	Flaredan	23.2	-0.08
voluntee	Energy	10.3	-0.05
voluntee	EnvExp	15.9	-0.13
voluntee	Fataliti	10.1	-0.12
voluntee	localpur	9.6	-0.12

voluntee	communit	101.2	0.14

As shown in Table 6.15, by adding an error covariance, the relationship between total non-carbon energy generated in MWh, environmental expenditures in dollars, employees and contractors' lost-time injuries expressed in number of injuries, new hires expressed as a fraction of the total number of employees (%), employees in employee unions or associations expressed in percentage (%), diversity expressed in percentage of women in the workforce (%), purchase of goods and services locally as percentage of total sales (%), and funding, donations, sponsorship and community investments expressed in millions of dollars and the market value is reassured to be strong and positive, which is a positive indicator of investors' perceptions of a firm's business prospects. The good combination of corporate sustainability observed variables that have a direct impact on the market value might be very helpful in future allocation of firm resources.

Likewise, the total greenhouse gas (GHG) measured in tonnes of carbon dioxide equivalent (CO_2e) is positively correlated with total non-carbon energy generated in MWh, environmental expenditures in dollars, employees and contractors' lost-time injuries expressed in number of injuries, employees and contractors' fatalities per year, employees in employee unions or associations expressed in percentage (%), and planted trees expressed in number of trees. It is obvious the GHG emissions could have a negative impact on the firm's employment practices and a positive impact on its operational activities. Also, funding, donations, sponsorship and community investments expressed in millions of dollars are positively correlated with research and development expenditure, total greenhouse gas (GHG) measured in tonnes of carbon dioxide equivalent (CO_2e), total flared and vented gases measured in metric tonnes of CO2 equivalent, volatile organic compounds (VOCs) measured in tonnes, environmental expenditures in dollars, new hires expressed as a portion of the total number of employees (%), employees in employee unions or associations expressed in percentage (%), and purchase of goods and services locally as percentage of total sales (%). It is clear that community investments have a positive impact on reducing emissions, reflect a good image for newly hired employees, and encourage local purchases of goods and services.

Similarly, diversity expressed in percentage of women in the workforce (%) is positively correlated with research and development intensity, new hires expressed as a percentage of the total number of employees (%), and employees in employee unions or associations expressed in percentage (%). The higher the percentage of women in the workforce, the better the payback in terms of research and development intensity, as well as attracting new hires and employee unions to participate. Also, employee volunteer hours showed in a number of hours is directly and strongly correlated to research and development expenditure, and funding, donations, sponsorship and community investments expressed in millions of dollars. Volunteering might help with generating new ideas and hence transform them into new products and services. It is also regarded as financial resources contributing to donations and community investments.

6.11.3 Data Multiple Sources

A comparison of the research findings with our common understanding for such a phenomenon has confirmed that corporate innovation expressed in development and research expenditure, research and development expenditure prior (i.e., previous year), total granted patents within North America, total patent applications in North America, and research and development intensity and corporate sustainability explained by total greenhouse gas (GHG) measured in tonnes of carbon dioxide equivalent (CO_2e), total flared and vented gases measured in metric tons of CO2 equivalent, sulphur dioxide and nitrogen oxides measured in tonnes, volatile organic compounds (VOCs) measured in tonnes, total volume of water recycled as a percentage of the total water used expressed in percent (%), total number of spills in thousands of barrels, waste recycled as a percentage of the total waste in percent (%), total energy consumption measured in gigajoules, total non-carbon energy generated in MWh, total reclaimed land as a percentage of the total land use expressed in percent (%), protected wildlife habitat in acres, and environmental expenditures in dollars, employees and contractors’ lost-time injuries expressed in number of injuries, employees and contractors’ lost-time injury rate measured in number of cases/200,000 hours worked, employees and contractors’ recordable injuries expressed in number of injuries, employees and contractors’ recordable injury rate measured in number of cases/200,000 hours worked, employees and contractors’ fatalities per year, new hires expressed as a fraction of the total number of employees (%), voluntary turnover rate expressed in percentage (%), employees in employee unions or associations expressed in percentage (%), diversity expressed in percentage of women in the workforce (%), minority employees expressed in percentage (%), purchase of goods and services locally as percentage of total sales (%), and compressed natural gas (CNG) vehicles in fleet measured in number of vehicles, planted trees expressed in number, grass seed planted presented in acres, forest land established in acres, funding, donations, sponsorship and community investments expressed in millions of dollars, and employee volunteer hours showed in number of hours are influential on the firm's financial performance. Both concepts are interrelated and impact each other positively and strongly in both directions.

Data collected from Compustat, corporate sustainability information retrieved from publicly available corporate responsibility reports and patent information acquired from the Lens database demonstrated a strong correlation, which confirmed the reliability of research findings. On the other hand, comparison of data from the final model analyzed versus the proposed model has determined that innovation and sustainability are strongly correlated and have an influential impact on the firm's financial performance. Results show that innovation and sustainability can have a unique impact that makes them both attractive venues for a firm. Using multiple sources of information enriched the study and supported our research findings.

6.12 Summary

The goal of this research was mainly to investigate the complex, reciprocal and causal relationship between corporate innovation and corporate sustainability and identify any critical influences on corporate financial performance. In this chapter, a thorough discussion is provided on whether the data collected from different sources, either public or private, to support the hypotheses developed in Chapter Four. The discussion also highlights any discrepancies that might support future research. Discussion on the value of combining the three latent constructs - corporate innovation, corporate sustainability, and corporate financial performance - along with their associated observed variables to understand the mechanics of such complicated relationships has been provided. The focus of the next chapter is to highlight the research contribution, implications for future practice, and limitations in order to provide a robust basis for general applications for all business sectors. Finally, the recommendations section for future research is presented.

Chapter 7

Conclusions and Recommendations

7.1 Conclusions

The research reveals new insights and details in our current understanding of the role of innovation and sustainability in the evolution and co-evolution of energy and energy-intensive materials production firms. It provides a detailed snapshot of the evolution process of firms in the energy and energy-intensive materials production sectors within a given timeframe. The contribution to the body of knowledge that is detailed as follows.

a) The study provides a solid foundation based on a robust statistical analysis technique with a comprehensive data set to back up qualitative discussions of energy and energy-intensive materials production firms' evolution over time.

b) The study provides a detailed understanding of how energy and energy-intensive materials production firms can evolve or co-evolve.

This is an important contribution to a broad base of literature that examines the evolution of the energy and energy-intensive materials production sectors within North America.

This type of knowledge can be used at the firm level in the management of its transition toward decarbonizing its current activities. Fossil fuels have long been the world's primary source of energy, and this has increased greenhouse gas emissions especially carbon dioxide. Global warming, a world well-known problem, and air pollution, among the world routine dialogues, are primarily related to exhaust from burning fossil fuels during energy production and use and are directly correlated to climate change. It became increasingly evident that new strategies are required to meet future energy requirements, to reduce greenhouse gas emissions. Most theories that attempt to describe the relationship between a firm's innovation capabilities and sustainability schemes and their combined impact on corporate performance suggest that there is not enough evidence to produce generalizable conclusions.

This research has examined this relationship in depth using two separate samples of firms that have been isolated using the NAICS code. The first sample is of North American energy companies (i.e., Canadian, American, and International companies that are actively present in North American Market). This includes portions of the following sectors: mining, and oil/gas extraction from NAICS code number 21, utilities from NAICS code number 22, manufacturing from NAICS code number 31 to 33 and transportation and warehousing from NAICS code number 48 and 49. The second sample is of North American energy-intensive materials production firms. Firms producing steel, cement, plastic, paper and aluminum products were isolated from the NAICS. The sample included Subsectors: paper manufacturing from NAICS code number 322; petroleum and coal products manufacturing from NAICS code number 324; chemical manufacturing from NAICS code number 325; plastics and rubber products manufacturing from NAICS code number 326; nonmetallic mineral product manufacturing from NAICS code number 327; and primary metal manufacturing from NAICS code number 331. The sample size obtained is well over 400 companies which account for approximately 50 percent of total GHG emissions in North American. The research provides a comprehensible and exhaustive empirical approach of testing the relationship between corporate innovation, corporate sustainability and corporate financial performance.

The research explored the role of the firm's innovation capacities and sustainability practices in addressing climate change while maintaining a profitable business portfolio. Moreover, the study revealed new and interesting details in the current understanding of the role of innovation and sustainability in the evolution and co-evolution of energy and energy-intensive firms represented by the five sustainable materials' manufacturing processes. In addition to the static focus on a specific year, the research articulated the evolution of the relationships using a comprehensive list of observed variables to enrich the phenomena. This has important implications for policymakers as it highlights the support needed for businesses to change as they pass through different stages.

The study is a new contribution to the literature that links, in a quantitative manner, key elements of corporate innovation, corporate sustainability, and corporate financial performance. Previous studies had shown partial linkages between corporate innovation and a firm's performance. Several other researchers have also investigated the contributions of innovation to a firm's value when it attempts to take social and environmental factors into account. A general belief has been that corporate sustainability can pay off for corporations. A socially responsible company can use sustainability to produce short- and long-term financial benefits. While several studies found either a negative relationship or no significant association between corporate sustainability and overall corporate performance, there has been some evidence that a positive relationship exists. In this research, the major contribution has been to quantify the combined impacts of corporate innovation and corporate sustainability on corporate financial performance.

The current literature on innovation has overlooked the role of sustainability as a means to explain and predict corporate innovation. In general, there is little research on how sustainability influences innovation. In addition, there is no clear agenda for making sustainability an integral part of the innovation process. No significant effort is being made to understand how this relationship works. On the other hand, innovation is now perceived to be the key driver of sustainability. Innovative behaviour can enable corporations to take appropriate action toward sustainability. Researchers argue that progressive organizations can take advantage of the opportunities created by the sustainable development concept, and they can use innovation to achieve their predefined sustainability goals. However, less attention had been given to understanding the impact of corporate innovation on sustainability at a corporate level. This study provides an empirical evidence on the relationship between corporate innovation and corporate sustainability with respect to its strength and direction. This research has shown how innovation can foster and promote sustainability and sustainability can have an important impact on innovation.

This study expands on the existing knowledge of corporate innovation and corporate sustainability and quantifies our understanding of the significant relationship between them. The research also provides an empirical assessment in an attempt to better understand the impact of innovation and sustainability on a firm’s financial performance. This study adds to research and practice in multiple ways. It addresses the gap in our knowledge of the role that innovation and sustainability play in a firm’s evolutionary process. New and interesting details are revealed through the empirical examination discussed in Chapter Six about the link between corporate innovation and corporate sustainability and in the same Chapter’s discussions section.

This research contributes to the literature on the relationship between corporate innovation and corporate sustainability by identifying their influence on each other through a detailed analysis of specific indicators and metrics. Previous studies have not revealed the reciprocal relationship between the concepts. In this study, emphasis on the key observed variables, such as:

1) Research and development expenditure in Millions of Dollars,

2) Research and development expenditure prior (i.e., previous year) in Millions of Dollars,

3) Total number of granted patents within North America,

4) Total number of patent applications in North America,

5) Research and development intensity in percent (%),

6) Total greenhouse gas (GHG) measured in Tonnes of carbon dioxide equivalent (co_2e),

7) Total flared and vented gases measured in metric Tonnes of co_2 equivalent,

8) Sulphur dioxide and nitrogen oxides measured in Tonnes,

9) Volatile organic compounds (VOCs) measured in Tonnes,

10) Total volume of water recycled as a percentage of the total water used expressed in percent (%),

11) Total number of spills in Thousands of Barrels,

12) Waste recycled as a percentage of the total waste in percent (%),

13) Total energy consumption measured in Gigajoules,

14) Total non-carbon energy generated in MWh,

15) Total reclaimed land as a percentage of the total land use expressed in percent (%),

16) Protected wildlife habitat in Acres,

17) Environmental expenditures in Dollars,

18) Employees and contractors' lost-time injuries expressed in Number of Injuries,

19) Employees and contractors' lost-time injury rate measured in Number of Cases/200,000 hours worked,

20) Employees and contractors' recordable injuries expressed in Number of Injuries,

21) Employees and contractors' recordable injury rate measured in Number of Cases/200,000 hours worked,

22) Employees and contractors' number of fatalities per year,

23) New hires expressed as a percentage of the total number of employees (%),

24) Voluntary turnover rate expressed in percentage (%),

25) Employees in employee unions or associations expressed in percentage (%),

26) Diversity expressed in percentage of women in the workforce (%),

27) Minority employees expressed in percentage (%),

28) Purchase of goods and services locally as percentage of total sales (%),

29) Compressed natural gas (CNG) vehicles in fleet measured in Number of Vehicles,

30) Planted trees expressed in Number of Trees,

31) Grass seed planted presented in Acres,

32) Forest land established in Acres,

33) Funding, donations, sponsorship and community investments expressed in Millions of Dollars, and

34) Employee volunteer hours showed in Number of Hours as the main antecedents

have provided a comprehensive appreciation of how this complex relationship works. Para selection of these variables helped us develop an understanding how a firm's financial decisions can be driven in competitive market conditions.

In the literature, there is no distinctive model or characterization of how to describe or predict corporate innovation combined with corporate sustainability and its linkage to financial performance. Most studies tend to adopt different indicators to help explain this relationship within different contexts and business sectors. This study makes a significant contribution by generating a new model and a theory to explain this behaviour for energy and energy-intensive materials production firms. This model clarifies our understanding of this complicated relationship and where successful strategies could play a significant role. The difference is that in previous research, the common view is that sustainability is legislatively driven while innovation is voluntary.

The research adds new perspectives to our current understanding of the capability approach by providing empirical evidence. Research findings confirmed that innovation is a dynamic capability where sustainability routines can be embedded to alter the firm's innovation capabilities. In this perspective, sustainability can renew internal innovation capabilities to create a new competitive edge. The research emphasis firm's diligent effort to establish new innovative approaches that have unique features to achieve its pre-set sustainability goals. In other words, a firm's new competitive advantage can be built based on the way an organization can bundle its current resources. For example, an energy firm will deploy new non-carbon technologies innovatively to achieve a certain environmental stewardship objective through applying that proposed combined approach called "inno-sustainable" process. A new innovative way, which looks at upgrading current processes to become more sustainable.

The findings of this research contribute to the strategic management literature by demonstrating how effective the firms could be in applying their resources to achieve desired financial positions while maintaining a culture of innovation and sustainability regime. Contrary to the current belief that sustainability will undermine the firm's financial performance, sustainability provides strong incentives for firms to innovate and establish a strong financial position, through providing them with advanced capabilities that leverage significant advantages from their surrounding external/internal environment. It also shows that various strategies can be useful to reduce the negative impact of costs, such as environmental expenditures and provide a smooth transition to other levels of performance. These strategies have to be identified accurately for different sectors (i.e., energy or energy-intensive materials production) to select the most effective strategies that help achieve the highest performance.

Energy sources can be classified to nonrenewable versus renewable energy. Traditional energy includes bituminous coal, gasoline, natural gas, and nuclear energy. Renewable energy includes hydro, tidal, biomass, solar, wind, geothermal, hydrogen, and enhanced geothermal. Table 7.1 shows different classes of energy technology and associated types. Energy storage solutions include thermal energy and flow cells. Other energy storage solutions vary from combustion, heat pumps, to power systems. Table 7.2 shows different solutions for energy generation and storage.

Table 7.1 **-** Different classes of energy technologies and associated types

Type	**Technology**	**Sub**
Renewables	Wind	Onshore and offshore
	Solar Photovoltaic	Crystalline silicon
	Solar Thermal	Parabolic, tower and heliostat with and without storage
	Marine	Tidal or wave
	Hydro	Large or small
	Biomass	Incineration, landfill gas, municipal solid waste, biogas
	Geothermal	Binary, flash
Conventional	Coal	Coal
	Gas	Natural Gas
	Nuclear	Nuclear

Table 7.2 - Different solution of energy generation and storage

Class	Type	Sub-types	Solutions
Energy Generation And Storage Technologies	storage	Electrical storage	Battery
			Flow cell
		Thermal storage	Thermal storage
	generation	Others	Heat pump
			Power system
			Combustion

This research confirms the findings of previous researchers that nonconventional energy sources can play a significant role in the firm's success to meet its targets for the total greenhouse gas (GHG) measured in tonnes of carbon dioxide equivalent (CO_2e), total flared and vented gases measured in metric tonnes of CO_2 equivalent, sulphur dioxide and nitrogen oxides measured in tonnes, and volatile organic compounds (VOCs) measured in tonnes. Since the environmental landscape is always changing and the global energy requirements are highly dynamic, then identifying nonconventional energy technologies became a challenging task. As a result, it is difficult to define preferences or recommend certain energy technologies that meet certain legislative regimes. This challenge in the development process of new strategies can be mitigated by integrating best practices from lead firms within the sample that were investigated. The research demonstrates that those firms who spend heavily involved in research and development to create new or deploy existing low-carbon technologies have had improved financial performance. These firms were investigated and used as a benchmark to enhance other firms' innovative capacities and sustainability practices within the sample to generate more profits that are reflected in their bottom line.

Corporate innovation and corporate sustainability are responsible for more than one-third of a firm's financial behavior, which has a significant influence on its overall performance and viability. This research uses empirical data to demonstrate the influence of corporate innovation and corporate sustainability on corporate financial performance for energy and energy-intensive firms. This study bridges the gap between what researchers have learned about firm innovativeness and corporate sustainability performance. While the existing literature supports the premise that firms pursue innovation to achieve more economic rents, researchers have been called to determine how sustainability can improve a firm's "breakthrough" innovative capabilities. This research explored the dynamic phenomenon of firms' corporate innovativeness and sustainability, paying specific attention to improving the financial performance of firms in the North American energy and energy-intensive materials production sectors.

Important practical implications for management decisions are highlighted. It has been difficult to develop a combined approach that integrates corporate innovation and corporate sustainability. This study clearly indicates that both concepts are necessary for a firm's long-term viability. For managers who want to achieve greater impact within their organizations, this study shows that the scorecard presented in Figure 7.1 is the most important determinant or contributing factor. While there is uncertainty around the innovation process and sustainability practices, this study shows that leading North American energy and energy-intensive materials production firms can improve their financial performance by measuring the following key indicators:

i. Research and development expenditure expressed in Millions of Dollars,

ii. Research and development expenditure prior (i.e., previous year) expressed in Millions of Dollars,

iii. Total number of granted patents in North America,

iv. Total number of patent applications within North America,

v. Research and development intensity in percent (%) expressed as Research and development expenditure divided by Total revenues of a firm in a specific year,

vi. Total greenhouse gas (GHG) measured in Tons of carbon dioxide equivalent (co_2e),

vii. Total flared and vented gasses measured in metric Tons of co_2 equivalent,

viii. Sulfur dioxide and nitrogen oxides measured in Tonnes,

ix. Volatile organic compounds (VOCs) measured in Tonnes,

x. Total volume of water recycled as a percentage of the total water used expressed in percent (%),

xi. Total number of spills in Thousands of Barrels,

xii. Waste recycled as a percentage of the total waste in percent (%),

xiii. Total energy consumption measured in Gigajoules,

xiv. Total non-carbon energy generated in MWh,

xv. Total reclaimed land as a percentage of the total land use expressed in percent (%),

xvi. Protected wildlife habitat in Acres,

xvii. Environmental expenditures in Dollars,

xviii. Employees and contractors’ lost-time injuries expressed in Number of Injuries,

xix. Employees and contractors’ lost-time injury rate measured in Number of Cases/200,000 hours worked,

xx. Employees and contractors’ recordable injuries expressed in Number of Injuries,

xxi. Employees and contractors’ recordable injury rate measured in Number of Cases/200,000 hours worked,

xxii. Employees and contractors’ number of fatalities per year,

xxiii. New hires expressed as a percentage of the total number of employees (%),

xxiv. Voluntary turnover rate expressed in percentage (%),

xxv. Employees in employee unions or associations expressed in percentage (%),

xxvi. Diversity expressed in percentage of women in the workforce (%),

xxvii. Minority employees expressed in percentage (%),

xxviii. Purchase of goods and services locally as percentage of total sales (%),

xxix. Compressed natural gas (CNG) vehicles in fleet measured in Number of Vehicles,

xxx. Planted trees expressed in Number of Trees,

xxxi. Grass seed planted presented in Acres,

xxxii. Forest land established in Acres,

xxxiii. Funding, donations, sponsorship and community investments expressed in Millions of Dollars, and

xxxiv. Employee volunteer hours expressed in Number of Hours.

This study integrates traditional innovation concepts from the literature and recent research on sustainable development and finds that a firm’s financial performance depends on upon acquiring innovative capabilities and embedding sustainability into its framework. This study found that focusing on a firm’s sustainability by itself may not be sufficient for strong corporate financial performance but combined with innovation it has better potential, and it is more important to have a strong relationship between innovation and sustainability. The inclusion of R&D capabilities can be one of the most valuable assets for energy and energy-intensive materials production firms. According to our findings, managers should encourage organizational members to invest their resources in innovation and spend greater efforts on sustainability initiatives. This can lead to a distinct competitive advantage where investing in innovation and sustainability and help the firm to find additional ways to increase their value to the shareholders through better overall economic performance.

The study creates a foundation for combining traditional business concepts with recent research on corporate innovation and corporate sustainability. We expect the findings will provide management at firms within the North American energy and energy-intensive materials production sectors with better analytical tools for improved performance. There is great value in developing strong intra-firm ties across national borders, as they can help in developing greater breakthrough innovations within the North American energy and energy-intensive materials production sectors. Our study results provide strong evidence of the real financial advantages that firms can realize from developing specific portfolios from a combination and integration of innovation and sustainability.

This study provides an improved understanding of corporate innovation and corporate sustainability processes, in an attempt that future research can expand upon this empirically established relationship between corporate innovation and corporate sustainability within both industry sectors investigated. The extent literature demonstrates that measuring a firm's innovation and sustainability relation to its financial viability is an evolving phenomenon that needed further investigation. There are several shortcomings in terms of the current understanding of different stakeholders in the firm's performance tracking system, especially when it comes to mapping processes, visioning firm's sustainable future, aggregation of annual results to provide a clear picture of the firm's innovation capabilities, sustainability initiatives, and financial performance to influence the decision-making processes. Therefore, principles of innovation, sustainability, and financial performance were comprehensively addressed in this research to provide sufficient rigor that enabled the creation of the proposed theory.

Subsequently, the research provided a comprehensive evaluation model shown in figure 6.1. The model presents key indicators identified to quantify the relationship between corporate innovation, corporate sustainability, and corporate financial performance for energy and energy-intensive materials production firms. The model is dynamic in nature to inform stakeholders and influence shareholders decision-making. The current organizational management business models are considering only outdated metrics for technical and economic performance. Furthermore, these business models are dominated by reliance on economic performance solely. The research provides a model with different indicators underpinned under each construct (i.e., corporate innovation, corporate sustainability, and corporate financial performance) taking into account a border consideration of the extent system's social aspect, environmental dimension, and economic constraints.

The introduction of the operationalized model including all sustainability aspects (i.e., environmental stewardship, social responsibility, and community involvement), the stakeholders are able now to expand their intervention in the company's progression path to include economic opportunities, environmental prospects, social outlooks, and community participatory efforts. These indicators were selected diligently so they can be integrated easily into the firm's business model. Furthermore, stakeholders can utilize these specific metrics to suit their needs with an emphasis on different principles. Their focus can be on a specific set of indices that are deemed critical for their context of performance assessment.

This study provides a new approach that will help a firm's stakeholders to plan accurately different resources and to allocate them properly. The research developed metrics and corresponding indices were built diligently, in principle, to remove any bias. The thesis provides managers with a reliable model for assessing antecedents underpinning the financial performance of a given firm's innovation hurdles and sustainability challenges within their industrial sector (i.e., energy or energy-intensive materials production). The research model provides a concrete assessment so that managers do not rely on their personal opinions to predict those antecedents based on previous research that shows innovation and sustainability can be vital for organizational survival.

Determining the main factors behind the integration of innovation and sustainability within an existing business model is critical. Especially, when managers try to define a suitable strategy to maintain their extent position in the market and prevent it from eroding. In energy and intensive-energy materials sectors, these factors are related to survival. Also, competitiveness can be maintained by enhancing the firm's internal and external capabilities. However, defining these factors becomes a challenging issue because these sectors are characterized by significant difficulties, given the rapid pace of technology change, the changing environmental legislations regime, and other competitors' moves.

Figure 7.1 presents the suggested annual scorecard that can be used by energy and energy-intensive materials production firms to track their performance for all the indicators, called "CiCs&FP." This annual scorecard will help shape the firm's evolutionary path. Evolutionary process does not necessarily imply gradual, incremental change. An evolutionary process implies a path-dependent change. Therefore, innovation or sustainability, when combined, with the critical financial performance indices for a given firm within both energy or energy-intensive materials production sectors, can result in rapid improvements in overall financial performance.

A multi-level transition can happen when mutually occurring innovative initiatives and sustainability programs are collectively introduced. At that point, a previously dominant business model can collapse enabling the rapid spread of a new business framework. A positive feedback will alter the current market perception of the firm's social and ecological position. These exogenous changes to the system will affect the firm's evolutionary path.

7.2 Recommendations

This study examines the causality and direction of the relationship between corporate innovation and corporate sustainability, as well as their individual and combined effect on corporate financial performance, using a proven structural equation modeling assessment technique. This study establishes a comprehensive basis for future empirical studies to inform other sectors and a deeper examination of these relationships. The following section indicates several key areas of focus required to expand on this body of knowledge. The opportunities for future research lie in addressing some of the limitations described below.

The research introduced a new combination of performance measurement for reporting purposes in order to ease the tension between the firm's obligation to comparability and the industry requirement for standardization. Also, the research tackled the circumstantial facets of organizational sustainability, which varies according to different factors, such as size, and location. Typically, financial performance measures involve a snapshot measurement based on a dollar value or a ratio. Sustainability initiatives are generally qualitative or semi-quantitative. Sustainability involves attitudinal and cultural changes plus a dollar spend on some economic business aspects and environmental expenditures. Measuring qualitative factors makes sustainability performance reporting more complete than financial reporting, which might lack the technical capacity of doing so.

Limitation of the study with respect to measuring sustainability performance involves the determination of organizational boundaries. For example, one must consider the organizational carbon footprint on an upstream versus downstream scale. The research focused on the firm own direct footprint, and not that of its suppliers' and customer'. An expansion to the research current scope could be including both footprints that result in the firm's existing products and activities.

CiCs&FP

Indicator	Units	Year
CORPORATE INNOVATION		
Research and development expenditure	Dollars	
Research and development expenditure prior	Dollars	
Total Granted Patents within North America	Number	
Total Patents' Applications in North America	Number	
Research and development intensity	Percentage	
CORPORATE SUSTAINABILITY		
1- ENVIRONMENTAL STEWARDSHIP		
Total Greenhouse gas (GHG)	Tons of (CO_2e)	
Total Flared and Vented Gases	Tons of (CO_2e)	
Sulphur dioxide and Nitrogen oxides	Tonnes	
Volatile organic compounds (VOCs)	Tonnes	
Total volume of water recycled	Percentage	
Total Number of Spills	Thousands barrels	
Total Waste Recycled	Percentage	
Total energy consumption	Gigajoules	
Total Non-carbon energy generated	MWh	
Total reclaimed land	Percentage	
Protected wildlife habitat	Acres	
Environmental expenditures	Dollars	
2- SOCIAL RESPONSIBILITY		
Total lost-time injuries	Number of injuries	
Lost time injury rate	Number of Cases/200,000 hours worked	
Total recordable injuries	Number of injuries	
Recordable injury rate	Number of Cases/200,000 hours worked	
Fatalities	Number of Fatalities	
New Hires	Percentage	
Voluntary Turnover Rate	Percentage	
Unions or Associations	Percentage	
Diversity (Women in the workforce)	Percenttage	
Minority	Percentage	
Purchase of goods and services locally	Percentage	
Compressed natural gas (CNG) vehicles	Number of vehicles	
3- COMMUNITY INVOLVEMENT		
Planted trees	Number of trees	
Grass seed planted	Acres	
Forest Land	Acres	
Funding, donations, sponsorship	Millions of Dollars	
Employee volunteer hours	Number of hours	
CORPORATE FINANCIAL PERFORMANCE		
Return on assets	Percentage	
Return on equity	Percentage	
Return on investment	Percentage	
Market value	Percentage	
Tobin's Q	Value	
Payout ratio	Percentage	
Sustainable growth rate	Percentage	

NOTES

Research and development expenditure, research and development expenditure prior (i.e., previous year), Total Granted Patents within North America, Total Patents' Applications in North America, and research and development intensity and Total Greenhouse gas (GHG) measured in tonnes of carbon dioxide equivalent (CO_2 e), Total Flared and Vented Gases measured in metric tons of CO_2 equivalent, Sulphur dioxide and Nitrogen oxides measured in tonnes, Volatile organic compounds (VOCs) measured in tonnes, Total volume of water recycled as a percentage of the Total Water Used expressed in per cent (%), Total Number of Spills in Thousands barrels, Waste Recycled as a percentage of the total waste in per cent (%), Total energy consumption measured in Gigajoules, Total Non-carbon energy generated in MWh, Total reclaimed land as a percentage of the total land use expressed in per cent (%), Protected wildlife habitat in acres, and Environmental expenditures in dollars, Employees and Contractors lost-time injuries expressed in number of injuries, employees and contractors Lost time injury rate measured in number of Cases/200,000 hours worked, Employees and Contractors recordable injuries expressed in number of injuries, employees and contractors Recordable injury rate measured in number of Cases/200,000 hours worked, employees and contractors Fatalities per year, New Hires expressed as a percentage of the total number of employees (%), Voluntary Turnover Rate expressed in percentage (%), Employees in Employee Unions or Associations expressed in percentage (%), diversity expressed in percentage of Women in the workforce (%), Minority employees expressed in percentage (%), Purchase of goods and services locally as percentage of total sales (%), and finally Compressed natural gas (CNG) vehicles in fleet measured in number of vehicles, Planted trees expressed in number, Grass seed planted presented in acres, Forest Land Established in acres, Funding, donations, sponsorship and community investments expressed in Millions of Dollars, and Employee volunteer hours showed in number of hours, ROA equal to Profit after tax / Total assets, ROE equal to Profit after tax / Shareholders' funds, ROI equal to (Profit after tax – Dividends) / Invested capital, Market Value equal to Ln (Year-end closing stock price) * (Common shares outstanding), Tobin's Q equal to (Market value of

For future research consideration, the organization measurement of its upstream and downstream footprint must be designed in a way that avoids double-counted activities based on the assumption that it is feasible for the organization to measure its upstream and downstream footprints. There are also several qualitative challenges that are worthwhile mentioning. Sustainable behaviors (e.g., recycling) beyond the firm's borders should be evaluated and their benefits should be measured. These can be the types of challenges that can be associated with adding such sustainability observed variables that can be used to enhance the current model.

In addition to improving the model's internal validity, one could improve its external validity by horizontally expanding the study. The cross-sectional research uses data from 2014 as a snapshot. Engaging in the longitudinal expansion, doing a year-to-year comparison between sample firms, might help to improve the proposed model's external validity, this would enable measurement of the relationship between corporate innovation and corporate sustainability and their collective impact on firms' financial performance within the energy and energy-intensive materials production sectors.

This study involved North American firms and international firms with subsidiaries in North America. While the study's conclusions might not apply to firms in other countries, one could test the model's external validity by collecting data from countries with similar situations as Canada and the US, particularly those nations in the European Union with large domestic markets and relatively strong research capacity.

When attempting to generalize the research findings of this study to other industries and other contexts, caution should be exercised. For example, innovation and sustainability may have different impacts on firms and industries such as the biomedical and transportation sectors. The energy and energy-intensive materials production sectors were selected for their combined impact on climate change, which accounts for about 50 percent of annual greenhouse gas emissions. It is important to have a point of commonality between two or more sectors, which allows running the same analysis on those sectors at the same time. Keeping the observed variables in the same category will enable one to perform this study again on other industries that have similar characteristics, which will enable one to generalize research finding with high levels of certainty.

Future researchers may want to use more sophisticated models of innovation and sustainability that examine more than breakthrough and incremental innovations. Researchers may want to examine corporate innovativeness strategies in more detail separate from sustainability or the other way round and determine how they affect firm performance. Developing a greater understanding of different types of innovation possibilities might produce a greater understanding of how the relationship between corporate innovativeness and corporate sustainable development affect firm performance.

Another issue of note is that this research uses numerical primary data published by legally constituted organizations. As a result, this study cannot accurately measure the firm's attitudes, opinions and perceptions about the relative success or failure of its innovation strategies and sustainability initiatives. On the other hand, collecting this type of data enables the researcher to acquire information over a one-year time period, as well as access a larger representative sample of the studied population. For future studies, we encourage the use of customized surveys in data collection to examine the determinants and outcomes of corporate innovation, corporate sustainability, and corporate financial performance described in this research.

The goal is to help shape research focus that does not rely solely on contemporary innovative behavior or sustainability practices. There is a need to examine their combined and joint impacts for an improved understanding of a firm's performance. This study involved determining whether both constructs can affect a firm's financial performance. In the future, researchers will need to expand the scope going forward, which will require additional testing and tracking of innovative and sustainable citizenship behaviors. To increase this body of knowledge, and to support the success of corporations pursuing innovation strategies and sustainability tactics, future research must study all of a firm's behaviors that involve integrating innovation and sustainability with their current business models.

Appendices

Appendix A

NAICS Code	Description Level 1	Description Level 2	Description Level 3	Description Level 4	Description Level 5
111110	Agriculture, Forestry, Fishing and Hunting	Crop Production	Oilseed and Grain Farming	Soybean Farming	Soybean Farming
111120	Agriculture, Forestry, Fishing and Hunting	Crop Production	Oilseed and Grain Farming	Oilseed (except Soybean) Farming	Oilseed (except Soybean) Farming
111130	Agriculture, Forestry, Fishing and Hunting	Crop Production	Oilseed and Grain Farming	Dry Pea and Bean Farming	Dry Pea and Bean Farming
111140	Agriculture, Forestry, Fishing and Hunting	Crop Production	Oilseed and Grain Farming	Wheat Farming	Wheat Farming
111150	Agriculture, Forestry, Fishing and Hunting	Crop Production	Oilseed and Grain Farming	Corn Farming	Corn Farming
111160	Agriculture, Forestry, Fishing and Hunting	Crop Production	Oilseed and Grain Farming	Rice Farming	Rice Farming
111191	Agriculture, Forestry, Fishing and Hunting	Crop Production	Oilseed and Grain Farming	Other Grain Farming	Oilseed and Grain Combination Farming
111199	Agriculture, Forestry, Fishing and Hunting	Crop Production	Oilseed and Grain Farming	Other Grain Farming	All Other Grain Farming
111211	Agriculture, Forestry, Fishing and Hunting	Crop Production	Vegetable and Melon Farming	Vegetable and Melon Farming	Potato Farming
111219	Agriculture, Forestry, Fishing and Hunting	Crop Production	Vegetable and Melon Farming	Vegetable and Melon Farming	Other Vegetable (except Potato) and Melon Farming
111310	Agriculture, Forestry, Fishing and Hunting	Crop Production	Fruit and Tree Nut Farming	Orange Groves	Orange Groves

111320	Agriculture, Forestry, Fishing and Hunting	Crop Production	Fruit and Tree Nut Farming	Citrus (except Orange) Groves	Citrus (except Orange) Groves
111331	Agriculture, Forestry, Fishing and Hunting	Crop Production	Fruit and Tree Nut Farming	Noncitrus Fruit and Tree Nut Farming	Apple Orchards
111332	Agriculture, Forestry, Fishing and Hunting	Crop Production	Fruit and Tree Nut Farming	Noncitrus Fruit and Tree Nut Farming	Grape Vineyards
111333	Agriculture, Forestry, Fishing and Hunting	Crop Production	Fruit and Tree Nut Farming	Noncitrus Fruit and Tree Nut Farming	Strawberry Farming
111334	Agriculture, Forestry, Fishing and Hunting	Crop Production	Fruit and Tree Nut Farming	Noncitrus Fruit and Tree Nut Farming	Berry (except Strawberry) Farming
111335	Agriculture, Forestry, Fishing and Hunting	Crop Production	Fruit and Tree Nut Farming	Noncitrus Fruit and Tree Nut Farming	Tree Nut Farming
111336	Agriculture, Forestry, Fishing and Hunting	Crop Production	Fruit and Tree Nut Farming	Noncitrus Fruit and Tree Nut Farming	Fruit and Tree Nut Combination Farming
111339	Agriculture, Forestry, Fishing and Hunting	Crop Production	Fruit and Tree Nut Farming	Noncitrus Fruit and Tree Nut Farming	Other Noncitrus Fruit Farming
111411	Agriculture, Forestry, Fishing and Hunting	Crop Production	Greenhouse, Nursery, and Floriculture Production	Food Crops Grown Under Cover	Mushroom Production
111419	Agriculture, Forestry, Fishing and Hunting	Crop Production	Greenhouse, Nursery, and Floriculture Production	Food Crops Grown Under Cover	Other Food Crops Grown Under Cover
111421	Agriculture, Forestry, Fishing and Hunting	Crop Production	Greenhouse, Nursery, and Floriculture Production	Nursery and Floriculture Production	Nursery and Tree Production
111422	Agriculture, Forestry, Fishing and Hunting	Crop Production	Greenhouse, Nursery, and Floriculture Production	Nursery and Floriculture Production	Floriculture Production
111910	Agriculture, Forestry, Fishing and Hunting	Crop Production	Other Crop Farming	Tobacco Farming	Tobacco Farming

111920	Agriculture, Forestry, Fishing and Hunting	Crop Production	Other Crop Farming	Cotton Farming	Cotton Farming
111930	Agriculture, Forestry, Fishing and Hunting	Crop Production	Other Crop Farming	Sugarcane Farming	Sugarcane Farming
111940	Agriculture, Forestry, Fishing and Hunting	Crop Production	Other Crop Farming	Hay Farming	Hay Farming
111991	Agriculture, Forestry, Fishing and Hunting	Crop Production	Other Crop Farming	All Other Crop Farming	Sugar Beet Farming
111992	Agriculture, Forestry, Fishing and Hunting	Crop Production	Other Crop Farming	All Other Crop Farming	Peanut Farming
111998	Agriculture, Forestry, Fishing and Hunting	Crop Production	Other Crop Farming	All Other Crop Farming	All Other Miscellaneous Crop Farming
112111	Agriculture, Forestry, Fishing and Hunting	Animal Production	Cattle Ranching and Farming	Beef Cattle Ranching and Farming, including Feedlots	Beef Cattle Ranching and Farming
112112	Agriculture, Forestry, Fishing and Hunting	Animal Production	Cattle Ranching and Farming	Beef Cattle Ranching and Farming, including Feedlots	Cattle Feedlots
112120	Agriculture, Forestry, Fishing and Hunting	Animal Production	Cattle Ranching and Farming	Dairy Cattle and Milk Production	Dairy Cattle and Milk Production
112130	Agriculture, Forestry, Fishing and Hunting	Animal Production	Cattle Ranching and Farming	Dual-Purpose Cattle Ranching and Farming	Dual-Purpose Cattle Ranching and Farming
112210	Agriculture, Forestry, Fishing and Hunting	Animal Production	Hog and Pig Farming	Hog and Pig Farming	Hog and Pig Farming
112310	Agriculture, Forestry, Fishing and Hunting	Animal Production	Poultry and Egg Production	Chicken Egg Production	Chicken Egg Production
112320	Agriculture, Forestry, Fishing and Hunting	Animal Production	Poultry and Egg Production	Broilers and Other Meat Type Chicken Production	Broilers and Other Meat Type Chicken Production

112330	Agriculture, Forestry, Fishing and Hunting	Animal Production	Poultry and Egg Production	Turkey Production	Turkey Production
112340	Agriculture, Forestry, Fishing and Hunting	Animal Production	Poultry and Egg Production	Poultry Hatcheries	Poultry Hatcheries
112390	Agriculture, Forestry, Fishing and Hunting	Animal Production	Poultry and Egg Production	Other Poultry Production	Other Poultry Production
112410	Agriculture, Forestry, Fishing and Hunting	Animal Production	Sheep and Goat Farming	Sheep Farming	Sheep Farming
112420	Agriculture, Forestry, Fishing and Hunting	Animal Production	Sheep and Goat Farming	Goat Farming	Goat Farming
112511	Agriculture, Forestry, Fishing and Hunting	Animal Production	Animal Aquaculture	Animal Aquaculture	Finfish Farming and Fish Hatcheries
112512	Agriculture, Forestry, Fishing and Hunting	Animal Production	Animal Aquaculture	Animal Aquaculture	Shellfish Farming
112519	Agriculture, Forestry, Fishing and Hunting	Animal Production	Animal Aquaculture	Animal Aquaculture	Other Animal Aquaculture
112910	Agriculture, Forestry, Fishing and Hunting	Animal Production	Other Animal Production	Apiculture	Apiculture
112920	Agriculture, Forestry, Fishing and Hunting	Animal Production	Other Animal Production	Horses and Other Equine Production	Horses and Other Equine Production
112930	Agriculture, Forestry, Fishing and Hunting	Animal Production	Other Animal Production	Fur-Bearing Animal and Rabbit Production	Fur-Bearing Animal and Rabbit Production
112990	Agriculture, Forestry, Fishing and Hunting	Animal Production	Other Animal Production	All Other Animal Production	All Other Animal Production
113110	Agriculture, Forestry, Fishing and Hunting	Forestry and Logging	Timber Tract Operations	Timber Tract Operations	Timber Tract Operations

113210	Agriculture, Forestry, Fishing and Hunting	Forestry and Logging	Forest Nurseries and Gathering of Forest Products	Forest Nurseries and Gathering of Forest Products	Forest Nurseries and Gathering of Forest Products
113310	Agriculture, Forestry, Fishing and Hunting	Forestry and Logging	Logging	Logging	Logging
114111	Agriculture, Forestry, Fishing and Hunting	Fishing, Hunting and Trapping	Fishing	Fishing	Finfish Fishing
114112	Agriculture, Forestry, Fishing and Hunting	Fishing, Hunting and Trapping	Fishing	Fishing	Shellfish Fishing
114119	Agriculture, Forestry, Fishing and Hunting	Fishing, Hunting and Trapping	Fishing	Fishing	Other Marine Fishing
114210	Agriculture, Forestry, Fishing and Hunting	Fishing, Hunting and Trapping	Hunting and Trapping	Hunting and Trapping	Hunting and Trapping
115111	Agriculture, Forestry, Fishing and Hunting	Support Activities for Agriculture and Forestry	Support Activities for Crop Production	Support Activities for Crop Production	Cotton Ginning
115112	Agriculture, Forestry, Fishing and Hunting	Support Activities for Agriculture and Forestry	Support Activities for Crop Production	Support Activities for Crop Production	Soil Preparation, Planting, and Cultivating
115113	Agriculture, Forestry, Fishing and Hunting	Support Activities for Agriculture and Forestry	Support Activities for Crop Production	Support Activities for Crop Production	Crop Harvesting, Primarily by Machine
115114	Agriculture, Forestry, Fishing and Hunting	Support Activities for Agriculture and Forestry	Support Activities for Crop Production	Support Activities for Crop Production	Postharvest Crop Activities (except Cotton Ginning)
115115	Agriculture, Forestry, Fishing and Hunting	Support Activities for Agriculture and Forestry	Support Activities for Crop Production	Support Activities for Crop Production	Farm Labor Contractors and Crew Leaders
115116	Agriculture, Forestry, Fishing and Hunting	Support Activities for Agriculture and Forestry	Support Activities for Crop Production	Support Activities for Crop Production	Farm Management Services
115210	Agriculture, Forestry, Fishing and Hunting	Support Activities for Agriculture and Forestry	Support Activities for Animal Production	Support Activities for Animal Production	Support Activities for Animal Production

115310	Agriculture, Forestry, Fishing and Hunting	Support Activities for Agriculture and Forestry	Support Activities for Forestry	Support Activities for Forestry	Support Activities for Forestry
211111	Mining	Oil and Gas Extraction	Oil and Gas Extraction	Oil and Gas Extraction	Crude Petroleum and Natural Gas Extraction
211112	Mining	Oil and Gas Extraction	Oil and Gas Extraction	Oil and Gas Extraction	Natural Gas Liquid Extraction
212111	Mining	Mining (except Oil and Gas)	Coal Mining	Coal Mining	Bituminous Coal and Lignite Surface Mining
212112	Mining	Mining (except Oil and Gas)	Coal Mining	Coal Mining	Bituminous Coal Underground Mining
212113	Mining	Mining (except Oil and Gas)	Coal Mining	Coal Mining	Anthracite Mining
212210	Mining	Mining (except Oil and Gas)	Metal Ore Mining	Iron Ore Mining	Iron Ore Mining
212221	Mining	Mining (except Oil and Gas)	Metal Ore Mining	Gold Ore and Silver Ore Mining	Gold Ore Mining
212222	Mining	Mining (except Oil and Gas)	Metal Ore Mining	Gold Ore and Silver Ore Mining	Silver Ore Mining
212231	Mining	Mining (except Oil and Gas)	Metal Ore Mining	Copper, Nickel, Lead, and Zinc Mining	Lead Ore and Zinc Ore Mining
212234	Mining	Mining (except Oil and Gas)	Metal Ore Mining	Copper, Nickel, Lead, and Zinc Mining	Copper Ore and Nickel Ore Mining
212291	Mining	Mining (except Oil and Gas)	Metal Ore Mining	Other Metal Ore Mining	Uranium-Radium-Vanadium Ore Mining
212299	Mining	Mining (except Oil and Gas)	Metal Ore Mining	Other Metal Ore Mining	All Other Metal Ore Mining
212311	Mining	Mining (except Oil and Gas)	Nonmetallic Mineral Mining and Quarrying	Stone Mining and Quarrying	Dimension Stone Mining and Quarrying
212312	Mining	Mining (except Oil and Gas)	Nonmetallic Mineral Mining and Quarrying	Stone Mining and Quarrying	Crushed and Broken Limestone Mining and Quarrying
212313	Mining	Mining (except Oil and Gas)	Nonmetallic Mineral Mining and Quarrying	Stone Mining and Quarrying	Crushed and Broken Granite Mining and Quarrying
212319	Mining	Mining (except Oil and Gas)	Nonmetallic Mineral Mining and Quarrying	Stone Mining and Quarrying	Other Crushed and Broken Stone Mining and Quarrying
212321	Mining	Mining (except Oil and Gas)	Nonmetallic Mineral Mining and Quarrying	Sand, Gravel, Clay, and Ceramic and Refractory Minerals Mining and Quarrying	Construction Sand and Gravel Mining
212322	Mining	Mining (except Oil and Gas)	Nonmetallic Mineral Mining and Quarrying	Sand, Gravel, Clay, and Ceramic and Refractory Minerals Mining and Quarrying	Industrial Sand Mining

212324	Mining	Mining (except Oil and Gas)	Nonmetallic Mineral Mining and Quarrying	Sand, Gravel, Clay, and Ceramic and Refractory Minerals Mining and Quarrying	Kaolin and Ball Clay Mining
212325	Mining	Mining (except Oil and Gas)	Nonmetallic Mineral Mining and Quarrying	Sand, Gravel, Clay, and Ceramic and Refractory Minerals Mining and Quarrying	Clay and Ceramic and Refractory Minerals Mining
212391	Mining	Mining (except Oil and Gas)	Nonmetallic Mineral Mining and Quarrying	Other Nonmetallic Mineral Mining and Quarrying	Potash, Soda, and Borate Mineral Mining
212392	Mining	Mining (except Oil and Gas)	Nonmetallic Mineral Mining and Quarrying	Other Nonmetallic Mineral Mining and Quarrying	Phosphate Rock Mining
212393	Mining	Mining (except Oil and Gas)	Nonmetallic Mineral Mining and Quarrying	Other Nonmetallic Mineral Mining and Quarrying	Other Chemical and Fertilizer Mineral Mining
212399	Mining	Mining (except Oil and Gas)	Nonmetallic Mineral Mining and Quarrying	Other Nonmetallic Mineral Mining and Quarrying	All Other Nonmetallic Mineral Mining
213111	Mining	Support Activities for Mining	Support Activities for Mining	Support Activities for Mining	Drilling Oil and Gas Wells
213112	Mining	Support Activities for Mining	Support Activities for Mining	Support Activities for Mining	Support Activities for Oil and Gas Operations
213113	Mining	Support Activities for Mining	Support Activities for Mining	Support Activities for Mining	Support Activities for Coal Mining
213114	Mining	Support Activities for Mining	Support Activities for Mining	Support Activities for Mining	Support Activities for Metal Mining
213115	Mining	Support Activities for Mining	Support Activities for Mining	Support Activities for Mining	Support Activities for Nonmetallic Minerals (except Fuels)
221111	Utilities	Utilities	Electric Power Generation, Transmission and Distribution	Electric Power Generation	Hydroelectric Power Generation
221112	Utilities	Utilities	Electric Power Generation, Transmission and Distribution	Electric Power Generation	Fossil Fuel Electric Power Generation
221113	Utilities	Utilities	Electric Power Generation, Transmission and Distribution	Electric Power Generation	Nuclear Electric Power Generation
221119	Utilities	Utilities	Electric Power Generation, Transmission and Distribution	Electric Power Generation	Other Electric Power Generation
221121	Utilities	Utilities	Electric Power Generation, Transmission and Distribution	Electric Power Transmission, Control, and Distribution	Electric Bulk Power Transmission and Control
221122	Utilities	Utilities	Electric Power Generation, Transmission and Distribution	Electric Power Transmission, Control, and Distribution	Electric Power Distribution
221210	Utilities	Utilities	Natural Gas Distribution	Natural Gas Distribution	Natural Gas Distribution
221310	Utilities	Utilities	Water, Sewage and Other Systems	Water Supply and Irrigation Systems	Water Supply and Irrigation Systems

221320	Utilities	Utilities	Water, Sewage and Other Systems	Sewage Treatment Facilities	Sewage Treatment Facilities
221330	Utilities	Utilities	Water, Sewage and Other Systems	Steam and Air-Conditioning Supply	Steam and Air-Conditioning Supply
236115	Construction	Construction of Buildings	Residential Building Construction	Residential Building Construction	New Single-Family Housing Construction (except Operative Builders)
236116	Construction	Construction of Buildings	Residential Building Construction	Residential Building Construction	New Multifamily Housing Construction (except Operative Builders)
236117	Construction	Construction of Buildings	Residential Building Construction	Residential Building Construction	New Housing Operative Builders
236118	Construction	Construction of Buildings	Residential Building Construction	Residential Building Construction	Residential Remodelers
236210	Construction	Construction of Buildings	Nonresidential Building Construction	Industrial Building Construction	Industrial Building Construction
236220	Construction	Construction of Buildings	Nonresidential Building Construction	Commercial and Institutional Building Construction	Commercial and Institutional Building Construction
237110	Construction	Heavy and Civil Engineering Construction	Utility System Construction	Water and Sewer Line and Related Structures Construction	Water and Sewer Line and Related Structures Construction
237120	Construction	Heavy and Civil Engineering Construction	Utility System Construction	Oil and Gas Pipeline and Related Structures Construction	Oil and Gas Pipeline and Related Structures Construction
237130	Construction	Heavy and Civil Engineering Construction	Utility System Construction	Power and Communication Line and Related Structures Construction	Power and Communication Line and Related Structures Construction
237210	Construction	Heavy and Civil Engineering Construction	Land Subdivision	Land Subdivision	Land Subdivision
237310	Construction	Heavy and Civil Engineering Construction	Highway, Street, and Bridge Construction	Highway, Street, and Bridge Construction	Highway, Street, and Bridge Construction
237990	Construction	Heavy and Civil Engineering Construction	Other Heavy and Civil Engineering Construction	Other Heavy and Civil Engineering Construction	Other Heavy and Civil Engineering Construction
238110	Construction	Specialty Trade Contractors	Foundation, Structure, and Building Exterior Contractors	Poured Concrete Foundation and Structure Contractors	Poured Concrete Foundation and Structure Contractors
238120	Construction	Specialty Trade Contractors	Foundation, Structure, and Building Exterior Contractors	Structural Steel and Precast Concrete Contractors	Structural Steel and Precast Concrete Contractors

238130	Construction	Specialty Trade Contractors	Foundation, Structure, and Building Exterior Contractors	Framing Contractors	Framing Contractors
238140	Construction	Specialty Trade Contractors	Foundation, Structure, and Building Exterior Contractors	Masonry Contractors	Masonry Contractors
238150	Construction	Specialty Trade Contractors	Foundation, Structure, and Building Exterior Contractors	Glass and Glazing Contractors	Glass and Glazing Contractors
238160	Construction	Specialty Trade Contractors	Foundation, Structure, and Building Exterior Contractors	Roofing Contractors	Roofing Contractors
238170	Construction	Specialty Trade Contractors	Foundation, Structure, and Building Exterior Contractors	Siding Contractors	Siding Contractors
238190	Construction	Specialty Trade Contractors	Foundation, Structure, and Building Exterior Contractors	Other Foundation, Structure, and Building Exterior Contractors	Other Foundation, Structure, and Building Exterior Contractors
238210	Construction	Specialty Trade Contractors	Building Equipment Contractors	Electrical Contractors	Electrical Contractors
238220	Construction	Specialty Trade Contractors	Building Equipment Contractors	Plumbing, Heating, and Air-Conditioning Contractors	Plumbing, Heating, and Air-Conditioning Contractors
238290	Construction	Specialty Trade Contractors	Building Equipment Contractors	Other Building Equipment Contractors	Other Building Equipment Contractors
238310	Construction	Specialty Trade Contractors	Building Finishing Contractors	Drywall and Insulation Contractors	Drywall and Insulation Contractors
238320	Construction	Specialty Trade Contractors	Building Finishing Contractors	Painting and Wall Covering Contractors	Painting and Wall Covering Contractors
238330	Construction	Specialty Trade Contractors	Building Finishing Contractors	Flooring Contractors	Flooring Contractors
238340	Construction	Specialty Trade Contractors	Building Finishing Contractors	Tile and Terrazzo Contractors	Tile and Terrazzo Contractors
238350	Construction	Specialty Trade Contractors	Building Finishing Contractors	Finish Carpentry Contractors	Finish Carpentry Contractors
238390	Construction	Specialty Trade Contractors	Building Finishing Contractors	Other Building Finishing Contractors	Other Building Finishing Contractors
238910	Construction	Specialty Trade Contractors	Other Specialty Trade Contractors	Site Preparation Contractors	Site Preparation Contractors
238990	Construction	Specialty Trade Contractors	Other Specialty Trade Contractors	All Other Specialty Trade Contractors	All Other Specialty Trade Contractors
311111	Manufacturing	Food Manufacturing	Animal Food Manufacturing	Animal Food Manufacturing	Dog and Cat Food Manufacturing
311119	Manufacturing	Food Manufacturing	Animal Food Manufacturing	Animal Food Manufacturing	Other Animal Food Manufacturing
311211	Manufacturing	Food Manufacturing	Grain and Oilseed Milling	Flour Milling and Malt Manufacturing	Flour Milling

311212	Manufacturing	Food Manufacturing	Grain and Oilseed Milling	Flour Milling and Malt Manufacturing	Rice Milling
311213	Manufacturing	Food Manufacturing	Grain and Oilseed Milling	Flour Milling and Malt Manufacturing	Malt Manufacturing
311221	Manufacturing	Food Manufacturing	Grain and Oilseed Milling	Starch and Vegetable Fats and Oils Manufacturing	Wet Corn Milling
311222	Manufacturing	Food Manufacturing	Grain and Oilseed Milling	Starch and Vegetable Fats and Oils Manufacturing	Soybean Processing
311223	Manufacturing	Food Manufacturing	Grain and Oilseed Milling	Starch and Vegetable Fats and Oils Manufacturing	Other Oilseed Processing
311225	Manufacturing	Food Manufacturing	Grain and Oilseed Milling	Starch and Vegetable Fats and Oils Manufacturing	Fats and Oils Refining and Blending
311230	Manufacturing	Food Manufacturing	Grain and Oilseed Milling	Breakfast Cereal Manufacturing	Breakfast Cereal Manufacturing
311311	Manufacturing	Food Manufacturing	Sugar and Confectionery Product Manufacturing	Sugar Manufacturing	Sugarcane Mills
311312	Manufacturing	Food Manufacturing	Sugar and Confectionery Product Manufacturing	Sugar Manufacturing	Cane Sugar Refining
311313	Manufacturing	Food Manufacturing	Sugar and Confectionery Product Manufacturing	Sugar Manufacturing	Beet Sugar Manufacturing
311320	Manufacturing	Food Manufacturing	Sugar and Confectionery Product Manufacturing	Chocolate and Confectionery Manufacturing from Cacao Beans	Chocolate and Confectionery Manufacturing from Cacao Beans
311330	Manufacturing	Food Manufacturing	Sugar and Confectionery Product Manufacturing	Confectionery Manufacturing from Purchased Chocolate	Confectionery Manufacturing from Purchased Chocolate
311340	Manufacturing	Food Manufacturing	Sugar and Confectionery Product Manufacturing	Nonchocolate Confectionery Manufacturing	Nonchocolate Confectionery Manufacturing
311411	Manufacturing	Food Manufacturing	Fruit and Vegetable Preserving and Specialty Food Manufacturing	Frozen Food Manufacturing	Frozen Fruit, Juice, and Vegetable Manufacturing
311412	Manufacturing	Food Manufacturing	Fruit and Vegetable Preserving and Specialty Food Manufacturing	Frozen Food Manufacturing	Frozen Specialty Food Manufacturing
311421	Manufacturing	Food Manufacturing	Fruit and Vegetable Preserving and Specialty Food Manufacturing	Fruit and Vegetable Canning, Pickling, and Drying	Fruit and Vegetable Canning
311422	Manufacturing	Food Manufacturing	Fruit and Vegetable Preserving and Specialty Food Manufacturing	Fruit and Vegetable Canning, Pickling, and Drying	Specialty Canning

311423	Manufacturing	Food Manufacturing	Fruit and Vegetable Preserving and Specialty Food Manufacturing	Fruit and Vegetable Canning, Pickling, and Drying	Dried and Dehydrated Food Manufacturing
311511	Manufacturing	Food Manufacturing	Dairy Product Manufacturing	Dairy Product (except Frozen) Manufacturing	Fluid Milk Manufacturing
311512	Manufacturing	Food Manufacturing	Dairy Product Manufacturing	Dairy Product (except Frozen) Manufacturing	Creamery Butter Manufacturing
311513	Manufacturing	Food Manufacturing	Dairy Product Manufacturing	Dairy Product (except Frozen) Manufacturing	Cheese Manufacturing
311514	Manufacturing	Food Manufacturing	Dairy Product Manufacturing	Dairy Product (except Frozen) Manufacturing	Dry, Condensed, and Evaporated Dairy Product Manufacturing
311520	Manufacturing	Food Manufacturing	Dairy Product Manufacturing	Ice Cream and Frozen Dessert Manufacturing	Ice Cream and Frozen Dessert Manufacturing
311611	Manufacturing	Food Manufacturing	Animal Slaughtering and Processing	Animal Slaughtering and Processing	Animal (except Poultry) Slaughtering
311612	Manufacturing	Food Manufacturing	Animal Slaughtering and Processing	Animal Slaughtering and Processing	Meat Processed from Carcasses
311613	Manufacturing	Food Manufacturing	Animal Slaughtering and Processing	Animal Slaughtering and Processing	Rendering and Meat Byproduct Processing
311615	Manufacturing	Food Manufacturing	Animal Slaughtering and Processing	Animal Slaughtering and Processing	Poultry Processing
311711	Manufacturing	Food Manufacturing	Seafood Product Preparation and Packaging	Seafood Product Preparation and Packaging	Seafood Canning
311712	Manufacturing	Food Manufacturing	Seafood Product Preparation and Packaging	Seafood Product Preparation and Packaging	Fresh and Frozen Seafood Processing
311811	Manufacturing	Food Manufacturing	Bakeries and Tortilla Manufacturing	Bread and Bakery Product Manufacturing	Retail Bakeries
311812	Manufacturing	Food Manufacturing	Bakeries and Tortilla Manufacturing	Bread and Bakery Product Manufacturing	Commercial Bakeries
311813	Manufacturing	Food Manufacturing	Bakeries and Tortilla Manufacturing	Bread and Bakery Product Manufacturing	Frozen Cakes, Pies, and Other Pastries Manufacturing
311821	Manufacturing	Food Manufacturing	Bakeries and Tortilla Manufacturing	Cookie, Cracker, and Pasta Manufacturing	Cookie and Cracker Manufacturing
311822	Manufacturing	Food Manufacturing	Bakeries and Tortilla Manufacturing	Cookie, Cracker, and Pasta Manufacturing	Flour Mixes and Dough Manufacturing from Purchased Flour
311823	Manufacturing	Food Manufacturing	Bakeries and Tortilla Manufacturing	Cookie, Cracker, and Pasta Manufacturing	Dry Pasta Manufacturing
311830	Manufacturing	Food Manufacturing	Bakeries and Tortilla Manufacturing	Tortilla Manufacturing	Tortilla Manufacturing

311911	Manufacturing	Food Manufacturing	Other Food Manufacturing	Snack Food Manufacturing	Roasted Nuts and Peanut Butter Manufacturing
311919	Manufacturing	Food Manufacturing	Other Food Manufacturing	Snack Food Manufacturing	Other Snack Food Manufacturing
311920	Manufacturing	Food Manufacturing	Other Food Manufacturing	Coffee and Tea Manufacturing	Coffee and Tea Manufacturing
311930	Manufacturing	Food Manufacturing	Other Food Manufacturing	Flavoring Syrup and Concentrate Manufacturing	Flavoring Syrup and Concentrate Manufacturing
311941	Manufacturing	Food Manufacturing	Other Food Manufacturing	Seasoning and Dressing Manufacturing	Mayonnaise, Dressing, and Other Prepared Sauce Manufacturing
311942	Manufacturing	Food Manufacturing	Other Food Manufacturing	Seasoning and Dressing Manufacturing	Spice and Extract Manufacturing
311991	Manufacturing	Food Manufacturing	Other Food Manufacturing	All Other Food Manufacturing	Perishable Prepared Food Manufacturing
311999	Manufacturing	Food Manufacturing	Other Food Manufacturing	All Other Food Manufacturing	All Other Miscellaneous Food Manufacturing
312111	Manufacturing	Beverage and Tobacco Product Manufacturing	Beverage Manufacturing	Soft Drink and Ice Manufacturing	Soft Drink Manufacturing
312112	Manufacturing	Beverage and Tobacco Product Manufacturing	Beverage Manufacturing	Soft Drink and Ice Manufacturing	Bottled Water Manufacturing
312113	Manufacturing	Beverage and Tobacco Product Manufacturing	Beverage Manufacturing	Soft Drink and Ice Manufacturing	Ice Manufacturing
312120	Manufacturing	Beverage and Tobacco Product Manufacturing	Beverage Manufacturing	Breweries	Breweries
312130	Manufacturing	Beverage and Tobacco Product Manufacturing	Beverage Manufacturing	Wineries	Wineries
312140	Manufacturing	Beverage and Tobacco Product Manufacturing	Beverage Manufacturing	Distilleries	Distilleries
312210	Manufacturing	Beverage and Tobacco Product Manufacturing	Tobacco Manufacturing	Tobacco Stemming and Redrying	Tobacco Stemming and Redrying
312221	Manufacturing	Beverage and Tobacco Product Manufacturing	Tobacco Manufacturing	Tobacco Product Manufacturing	Cigarette Manufacturing
312229	Manufacturing	Beverage and Tobacco Product Manufacturing	Tobacco Manufacturing	Tobacco Product Manufacturing	Other Tobacco Product Manufacturing
313111	Manufacturing	Textile Mills	Fiber, Yarn, and Thread Mills	Fiber, Yarn, and Thread Mills	Yarn Spinning Mills
313112	Manufacturing	Textile Mills	Fiber, Yarn, and Thread Mills	Fiber, Yarn, and Thread Mills	Yarn Texturizing, Throwing, and Twisting Mills
313113	Manufacturing	Textile Mills	Fiber, Yarn, and Thread Mills	Fiber, Yarn, and Thread Mills	Thread Mills
313210	Manufacturing	Textile Mills	Fabric Mills	Broadwoven Fabric Mills	Broadwoven Fabric Mills

313221	Manufacturing	Textile Mills	Fabric Mills	Narrow Fabric Mills and Schiffli Machine Embroidery	Narrow Fabric Mills
313222	Manufacturing	Textile Mills	Fabric Mills	Narrow Fabric Mills and Schiffli Machine Embroidery	Schiffli Machine Embroidery
313230	Manufacturing	Textile Mills	Fabric Mills	Nonwoven Fabric Mills	Nonwoven Fabric Mills
313241	Manufacturing	Textile Mills	Fabric Mills	Knit Fabric Mills	Weft Knit Fabric Mills
313249	Manufacturing	Textile Mills	Fabric Mills	Knit Fabric Mills	Other Knit Fabric and Lace Mills
313311	Manufacturing	Textile Mills	Textile and Fabric Finishing and Fabric Coating Mills	Textile and Fabric Finishing Mills	Broadwoven Fabric Finishing Mills
313312	Manufacturing	Textile Mills	Textile and Fabric Finishing and Fabric Coating Mills	Textile and Fabric Finishing Mills	Textile and Fabric Finishing (except Broadwoven Fabric) Mills
313320	Manufacturing	Textile Mills	Textile and Fabric Finishing and Fabric Coating Mills	Fabric Coating Mills	Fabric Coating Mills
314110	Manufacturing	Textile Product Mills	Textile Furnishings Mills	Carpet and Rug Mills	Carpet and Rug Mills
314121	Manufacturing	Textile Product Mills	Textile Furnishings Mills	Curtain and Linen Mills	Curtain and Drapery Mills
314129	Manufacturing	Textile Product Mills	Textile Furnishings Mills	Curtain and Linen Mills	Other Household Textile Product Mills
314911	Manufacturing	Textile Product Mills	Other Textile Product Mills	Textile Bag and Canvas Mills	Textile Bag Mills
314912	Manufacturing	Textile Product Mills	Other Textile Product Mills	Textile Bag and Canvas Mills	Canvas and Related Product Mills
314991	Manufacturing	Textile Product Mills	Other Textile Product Mills	All Other Textile Product Mills	Rope, Cordage, and Twine Mills
314992	Manufacturing	Textile Product Mills	Other Textile Product Mills	All Other Textile Product Mills	Tire Cord and Tire Fabric Mills
314999	Manufacturing	Textile Product Mills	Other Textile Product Mills	All Other Textile Product Mills	All Other Miscellaneous Textile Product Mills
315111	Manufacturing	Apparel Manufacturing	Apparel Knitting Mills	Hosiery and Sock Mills	Sheer Hosiery Mills
315119	Manufacturing	Apparel Manufacturing	Apparel Knitting Mills	Hosiery and Sock Mills	Other Hosiery and Sock Mills
315191	Manufacturing	Apparel Manufacturing	Apparel Knitting Mills	Other Apparel Knitting Mills	Outerwear Knitting Mills
315192	Manufacturing	Apparel Manufacturing	Apparel Knitting Mills	Other Apparel Knitting Mills	Underwear and Nightwear Knitting Mills
315211	Manufacturing	Apparel Manufacturing	Cut and Sew Apparel Manufacturing	Cut and Sew Apparel Contractors	Men's and Boys' Cut and Sew Apparel Contractors
315212	Manufacturing	Apparel Manufacturing	Cut and Sew Apparel Manufacturing	Cut and Sew Apparel Contractors	Women's, Girls', and Infants' Cut and Sew Apparel Contractors

315221	Manufacturing	Apparel Manufacturing	Cut and Sew Apparel Manufacturing	Men's and Boys' Cut and Sew Apparel Manufacturing	Men's and Boys' Cut and Sew Underwear and Nightwear Manufacturing
315222	Manufacturing	Apparel Manufacturing	Cut and Sew Apparel Manufacturing	Men's and Boys' Cut and Sew Apparel Manufacturing	Men's and Boys' Cut and Sew Suit, Coat, and Overcoat Manufacturing
315223	Manufacturing	Apparel Manufacturing	Cut and Sew Apparel Manufacturing	Men's and Boys' Cut and Sew Apparel Manufacturing	Men's and Boys' Cut and Sew Shirt (except Work Shirt) Manufacturing
315224	Manufacturing	Apparel Manufacturing	Cut and Sew Apparel Manufacturing	Men's and Boys' Cut and Sew Apparel Manufacturing	Men's and Boys' Cut and Sew Trouser, Slack, and Jean Manufacturing
315225	Manufacturing	Apparel Manufacturing	Cut and Sew Apparel Manufacturing	Men's and Boys' Cut and Sew Apparel Manufacturing	Men's and Boys' Cut and Sew Work Clothing Manufacturing
315228	Manufacturing	Apparel Manufacturing	Cut and Sew Apparel Manufacturing	Men's and Boys' Cut and Sew Apparel Manufacturing	Men's and Boys' Cut and Sew Other Outerwear Manufacturing
315231	Manufacturing	Apparel Manufacturing	Cut and Sew Apparel Manufacturing	Women's and Girls' Cut and Sew Apparel Manufacturing	Women's and Girls' Cut and Sew Lingerie, Loungewear, and Nightwear Manufacturing
315232	Manufacturing	Apparel Manufacturing	Cut and Sew Apparel Manufacturing	Women's and Girls' Cut and Sew Apparel Manufacturing	Women's and Girls' Cut and Sew Blouse and Shirt Manufacturing
315233	Manufacturing	Apparel Manufacturing	Cut and Sew Apparel Manufacturing	Women's and Girls' Cut and Sew Apparel Manufacturing	Women's and Girls' Cut and Sew Dress Manufacturing
315234	Manufacturing	Apparel Manufacturing	Cut and Sew Apparel Manufacturing	Women's and Girls' Cut and Sew Apparel Manufacturing	Women's and Girls' Cut and Sew Suit, Coat, Tailored Jacket, and Skirt Manufacturing
315239	Manufacturing	Apparel Manufacturing	Cut and Sew Apparel Manufacturing	Women's and Girls' Cut and Sew Apparel Manufacturing	Women's and Girls' Cut and Sew Other Outerwear Manufacturing
315291	Manufacturing	Apparel Manufacturing	Cut and Sew Apparel Manufacturing	Other Cut and Sew Apparel Manufacturing	Infants' Cut and Sew Apparel Manufacturing
315292	Manufacturing	Apparel Manufacturing	Cut and Sew Apparel Manufacturing	Other Cut and Sew Apparel Manufacturing	Fur and Leather Apparel Manufacturing
315299	Manufacturing	Apparel Manufacturing	Cut and Sew Apparel Manufacturing	Other Cut and Sew Apparel Manufacturing	All Other Cut and Sew Apparel Manufacturing
315991	Manufacturing	Apparel Manufacturing	Apparel Accessories and Other Apparel Manufacturing	Apparel Accessories and Other Apparel Manufacturing	Hat, Cap, and Millinery Manufacturing

315992	Manufacturing	Apparel Manufacturing	Apparel Accessories and Other Apparel Manufacturing	Apparel Accessories and Other Apparel Manufacturing	Glove and Mitten Manufacturing
315993	Manufacturing	Apparel Manufacturing	Apparel Accessories and Other Apparel Manufacturing	Apparel Accessories and Other Apparel Manufacturing	Men's and Boys' Neckwear Manufacturing
315999	Manufacturing	Apparel Manufacturing	Apparel Accessories and Other Apparel Manufacturing	Apparel Accessories and Other Apparel Manufacturing	Other Apparel Accessories and Other Apparel Manufacturing
316110	Manufacturing	Leather and Allied Product Manufacturing	Leather and Hide Tanning and Finishing	Leather and Hide Tanning and Finishing	Leather and Hide Tanning and Finishing
316211	Manufacturing	Leather and Allied Product Manufacturing	Footwear Manufacturing	Footwear Manufacturing	Rubber and Plastics Footwear Manufacturing
316212	Manufacturing	Leather and Allied Product Manufacturing	Footwear Manufacturing	Footwear Manufacturing	House Slipper Manufacturing
316213	Manufacturing	Leather and Allied Product Manufacturing	Footwear Manufacturing	Footwear Manufacturing	Men's Footwear (except Athletic) Manufacturing
316214	Manufacturing	Leather and Allied Product Manufacturing	Footwear Manufacturing	Footwear Manufacturing	Women's Footwear (except Athletic) Manufacturing
316219	Manufacturing	Leather and Allied Product Manufacturing	Footwear Manufacturing	Footwear Manufacturing	Other Footwear Manufacturing
316991	Manufacturing	Leather and Allied Product Manufacturing	Other Leather and Allied Product Manufacturing	Other Leather and Allied Product Manufacturing	Luggage Manufacturing
316992	Manufacturing	Leather and Allied Product Manufacturing	Other Leather and Allied Product Manufacturing	Other Leather and Allied Product Manufacturing	Women's Handbag and Purse Manufacturing
316993	Manufacturing	Leather and Allied Product Manufacturing	Other Leather and Allied Product Manufacturing	Other Leather and Allied Product Manufacturing	Personal Leather Good (except Women's Handbag and Purse) Manufacturing
316999	Manufacturing	Leather and Allied Product Manufacturing	Other Leather and Allied Product Manufacturing	Other Leather and Allied Product Manufacturing	All Other Leather Good Manufacturing
321113	Manufacturing	Wood Product Manufacturing	Sawmills and Wood Preservation	Sawmills and Wood Preservation	Sawmills
321114	Manufacturing	Wood Product Manufacturing	Sawmills and Wood Preservation	Sawmills and Wood Preservation	Wood Preservation
321211	Manufacturing	Wood Product Manufacturing	Veneer, Plywood, and Engineered Wood Product Manufacturing	Veneer, Plywood, and Engineered Wood Product Manufacturing	Hardwood Veneer and Plywood Manufacturing
321212	Manufacturing	Wood Product Manufacturing	Veneer, Plywood, and Engineered Wood Product Manufacturing	Veneer, Plywood, and Engineered Wood Product Manufacturing	Softwood Veneer and Plywood Manufacturing
321213	Manufacturing	Wood Product Manufacturing	Veneer, Plywood, and Engineered Wood Product Manufacturing	Veneer, Plywood, and Engineered Wood Product Manufacturing	Engineered Wood Member (except Truss) Manufacturing

321214	Manufacturing	Wood Product Manufacturing	Veneer, Plywood, and Engineered Wood Product Manufacturing	Veneer, Plywood, and Engineered Wood Product Manufacturing	Truss Manufacturing
321219	Manufacturing	Wood Product Manufacturing	Veneer, Plywood, and Engineered Wood Product Manufacturing	Veneer, Plywood, and Engineered Wood Product Manufacturing	Reconstituted Wood Product Manufacturing
321911	Manufacturing	Wood Product Manufacturing	Other Wood Product Manufacturing	Millwork	Wood Window and Door Manufacturing
321912	Manufacturing	Wood Product Manufacturing	Other Wood Product Manufacturing	Millwork	Cut Stock, Resawing Lumber, and Planing
321918	Manufacturing	Wood Product Manufacturing	Other Wood Product Manufacturing	Millwork	Other Millwork (including Flooring)
321920	Manufacturing	Wood Product Manufacturing	Other Wood Product Manufacturing	Wood Container and Pallet Manufacturing	Wood Container and Pallet Manufacturing
321991	Manufacturing	Wood Product Manufacturing	Other Wood Product Manufacturing	All Other Wood Product Manufacturing	Manufactured Home (Mobile Home) Manufacturing
321992	Manufacturing	Wood Product Manufacturing	Other Wood Product Manufacturing	All Other Wood Product Manufacturing	Prefabricated Wood Building Manufacturing
321999	Manufacturing	Wood Product Manufacturing	Other Wood Product Manufacturing	All Other Wood Product Manufacturing	All Other Miscellaneous Wood Product Manufacturing
322110	Manufacturing	Paper Manufacturing	Pulp, Paper, and Paperboard Mills	Pulp Mills	Pulp Mills
322121	Manufacturing	Paper Manufacturing	Pulp, Paper, and Paperboard Mills	Paper Mills	Paper (except Newsprint) Mills
322122	Manufacturing	Paper Manufacturing	Pulp, Paper, and Paperboard Mills	Paper Mills	Newsprint Mills
322130	Manufacturing	Paper Manufacturing	Pulp, Paper, and Paperboard Mills	Paperboard Mills	Paperboard Mills
322211	Manufacturing	Paper Manufacturing	Converted Paper Product Manufacturing	Paperboard Container Manufacturing	Corrugated and Solid Fiber Box Manufacturing
322212	Manufacturing	Paper Manufacturing	Converted Paper Product Manufacturing	Paperboard Container Manufacturing	Folding Paperboard Box Manufacturing
322213	Manufacturing	Paper Manufacturing	Converted Paper Product Manufacturing	Paperboard Container Manufacturing	Setup Paperboard Box Manufacturing
322214	Manufacturing	Paper Manufacturing	Converted Paper Product Manufacturing	Paperboard Container Manufacturing	Fiber Can, Tube, Drum, and Similar Products Manufacturing
322215	Manufacturing	Paper Manufacturing	Converted Paper Product Manufacturing	Paperboard Container Manufacturing	Nonfolding Sanitary Food Container Manufacturing

322221	Manufacturing	Paper Manufacturing	Converted Paper Product Manufacturing	Paper Bag and Coated and Treated Paper Manufacturing	Coated and Laminated Packaging Paper and Plastics Film Manufacturing
322222	Manufacturing	Paper Manufacturing	Converted Paper Product Manufacturing	Paper Bag and Coated and Treated Paper Manufacturing	Coated and Laminated Paper Manufacturing
322223	Manufacturing	Paper Manufacturing	Converted Paper Product Manufacturing	Paper Bag and Coated and Treated Paper Manufacturing	Plastics, Foil, and Coated Paper Bag Manufacturing
322224	Manufacturing	Paper Manufacturing	Converted Paper Product Manufacturing	Paper Bag and Coated and Treated Paper Manufacturing	Uncoated Paper and Multiwall Bag Manufacturing
322225	Manufacturing	Paper Manufacturing	Converted Paper Product Manufacturing	Paper Bag and Coated and Treated Paper Manufacturing	Laminated Aluminum Foil Manufacturing for Flexible Packaging Uses
322226	Manufacturing	Paper Manufacturing	Converted Paper Product Manufacturing	Paper Bag and Coated and Treated Paper Manufacturing	Surface-Coated Paperboard Manufacturing
322231	Manufacturing	Paper Manufacturing	Converted Paper Product Manufacturing	Stationery Product Manufacturing	Die-Cut Paper and Paperboard Office Supplies Manufacturing
322232	Manufacturing	Paper Manufacturing	Converted Paper Product Manufacturing	Stationery Product Manufacturing	Envelope Manufacturing
322233	Manufacturing	Paper Manufacturing	Converted Paper Product Manufacturing	Stationery Product Manufacturing	Stationery, Tablet, and Related Product Manufacturing
322291	Manufacturing	Paper Manufacturing	Converted Paper Product Manufacturing	Other Converted Paper Product Manufacturing	Sanitary Paper Product Manufacturing
322299	Manufacturing	Paper Manufacturing	Converted Paper Product Manufacturing	Other Converted Paper Product Manufacturing	All Other Converted Paper Product Manufacturing
323110	Manufacturing	Printing and Related Support Activities	Printing and Related Support Activities	Printing	Commercial Lithographic Printing
323111	Manufacturing	Printing and Related Support Activities	Printing and Related Support Activities	Printing	Commercial Gravure Printing
323112	Manufacturing	Printing and Related Support Activities	Printing and Related Support Activities	Printing	Commercial Flexographic Printing
323113	Manufacturing	Printing and Related Support Activities	Printing and Related Support Activities	Printing	Commercial Screen Printing
323114	Manufacturing	Printing and Related Support Activities	Printing and Related Support Activities	Printing	Quick Printing
323115	Manufacturing	Printing and Related Support Activities	Printing and Related Support Activities	Printing	Digital Printing
323116	Manufacturing	Printing and Related Support Activities	Printing and Related Support Activities	Printing	Manifold Business Forms Printing
323117	Manufacturing	Printing and Related Support Activities	Printing and Related Support Activities	Printing	Books Printing

323118	Manufacturing	Printing and Related Support Activities	Printing and Related Support Activities	Printing	Blankbook, Looseleaf Binders, and Devices Manufacturing
323119	Manufacturing	Printing and Related Support Activities	Printing and Related Support Activities	Printing	Other Commercial Printing
323121	Manufacturing	Printing and Related Support Activities	Printing and Related Support Activities	Support Activities for Printing	Tradebinding and Related Work
323122	Manufacturing	Printing and Related Support Activities	Printing and Related Support Activities	Support Activities for Printing	Prepress Services
324110	Manufacturing	Petroleum and Coal Products Manufacturing	Petroleum and Coal Products Manufacturing	Petroleum Refineries	Petroleum Refineries
324121	Manufacturing	Petroleum and Coal Products Manufacturing	Petroleum and Coal Products Manufacturing	Asphalt Paving, Roofing, and Saturated Materials Manufacturing	Asphalt Paving Mixture and Block Manufacturing
324122	Manufacturing	Petroleum and Coal Products Manufacturing	Petroleum and Coal Products Manufacturing	Asphalt Paving, Roofing, and Saturated Materials Manufacturing	Asphalt Shingle and Coating Materials Manufacturing
324191	Manufacturing	Petroleum and Coal Products Manufacturing	Petroleum and Coal Products Manufacturing	Other Petroleum and Coal Products Manufacturing	Petroleum Lubricating Oil and Grease Manufacturing
324199	Manufacturing	Petroleum and Coal Products Manufacturing	Petroleum and Coal Products Manufacturing	Other Petroleum and Coal Products Manufacturing	All Other Petroleum and Coal Products Manufacturing
325110	Manufacturing	Chemical Manufacturing	Basic Chemical Manufacturing	Petrochemical Manufacturing	Petrochemical Manufacturing
325120	Manufacturing	Chemical Manufacturing	Basic Chemical Manufacturing	Industrial Gas Manufacturing	Industrial Gas Manufacturing
325131	Manufacturing	Chemical Manufacturing	Basic Chemical Manufacturing	Synthetic Dye and Pigment Manufacturing	Inorganic Dye and Pigment Manufacturing
325132	Manufacturing	Chemical Manufacturing	Basic Chemical Manufacturing	Synthetic Dye and Pigment Manufacturing	Synthetic Organic Dye and Pigment Manufacturing
325181	Manufacturing	Chemical Manufacturing	Basic Chemical Manufacturing	Other Basic Inorganic Chemical Manufacturing	Alkalies and Chlorine Manufacturing
325182	Manufacturing	Chemical Manufacturing	Basic Chemical Manufacturing	Other Basic Inorganic Chemical Manufacturing	Carbon Black Manufacturing
325188	Manufacturing	Chemical Manufacturing	Basic Chemical Manufacturing	Other Basic Inorganic Chemical Manufacturing	All Other Basic Inorganic Chemical Manufacturing
325191	Manufacturing	Chemical Manufacturing	Basic Chemical Manufacturing	Other Basic Organic Chemical Manufacturing	Gum and Wood Chemical Manufacturing
325192	Manufacturing	Chemical Manufacturing	Basic Chemical Manufacturing	Other Basic Organic Chemical Manufacturing	Cyclic Crude and Intermediate Manufacturing
325193	Manufacturing	Chemical Manufacturing	Basic Chemical Manufacturing	Other Basic Organic Chemical Manufacturing	Ethyl Alcohol Manufacturing

325199	Manufacturing	Chemical Manufacturing	Basic Chemical Manufacturing	Other Basic Organic Chemical Manufacturing	All Other Basic Organic Chemical Manufacturing
325211	Manufacturing	Chemical Manufacturing	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	Resin and Synthetic Rubber Manufacturing	Plastics Material and Resin Manufacturing
325212	Manufacturing	Chemical Manufacturing	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	Resin and Synthetic Rubber Manufacturing	Synthetic Rubber Manufacturing
325221	Manufacturing	Chemical Manufacturing	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	Artificial and Synthetic Fibers and Filaments Manufacturing	Cellulosic Organic Fiber Manufacturing
325222	Manufacturing	Chemical Manufacturing	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	Artificial and Synthetic Fibers and Filaments Manufacturing	Noncellulosic Organic Fiber Manufacturing
325311	Manufacturing	Chemical Manufacturing	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	Fertilizer Manufacturing	Nitrogenous Fertilizer Manufacturing
325312	Manufacturing	Chemical Manufacturing	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	Fertilizer Manufacturing	Phosphatic Fertilizer Manufacturing
325314	Manufacturing	Chemical Manufacturing	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	Fertilizer Manufacturing	Fertilizer (Mixing Only) Manufacturing
325320	Manufacturing	Chemical Manufacturing	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	Pesticide and Other Agricultural Chemical Manufacturing	Pesticide and Other Agricultural Chemical Manufacturing
325411	Manufacturing	Chemical Manufacturing	Pharmaceutical and Medicine Manufacturing	Pharmaceutical and Medicine Manufacturing	Medicinal and Botanical Manufacturing
325412	Manufacturing	Chemical Manufacturing	Pharmaceutical and Medicine Manufacturing	Pharmaceutical and Medicine Manufacturing	Pharmaceutical Preparation Manufacturing
325413	Manufacturing	Chemical Manufacturing	Pharmaceutical and Medicine Manufacturing	Pharmaceutical and Medicine Manufacturing	In-Vitro Diagnostic Substance Manufacturing
325414	Manufacturing	Chemical Manufacturing	Pharmaceutical and Medicine Manufacturing	Pharmaceutical and Medicine Manufacturing	Biological Product (except Diagnostic) Manufacturing
325510	Manufacturing	Chemical Manufacturing	Paint, Coating, and Adhesive Manufacturing	Paint and Coating Manufacturing	Paint and Coating Manufacturing
325520	Manufacturing	Chemical Manufacturing	Paint, Coating, and Adhesive Manufacturing	Adhesive Manufacturing	Adhesive Manufacturing
325611	Manufacturing	Chemical Manufacturing	Soap, Cleaning Compound, and Toilet Preparation Manufacturing	Soap and Cleaning Compound Manufacturing	Soap and Other Detergent Manufacturing

325612	Manufacturing	Chemical Manufacturing	Soap, Cleaning Compound, and Toilet Preparation Manufacturing	Soap and Cleaning Compound Manufacturing	Polish and Other Sanitation Good Manufacturing
325613	Manufacturing	Chemical Manufacturing	Soap, Cleaning Compound, and Toilet Preparation Manufacturing	Soap and Cleaning Compound Manufacturing	Surface Active Agent Manufacturing
325620	Manufacturing	Chemical Manufacturing	Soap, Cleaning Compound, and Toilet Preparation Manufacturing	Toilet Preparation Manufacturing	Toilet Preparation Manufacturing
325910	Manufacturing	Chemical Manufacturing	Other Chemical Product and Preparation Manufacturing	Printing Ink Manufacturing	Printing Ink Manufacturing
325920	Manufacturing	Chemical Manufacturing	Other Chemical Product and Preparation Manufacturing	Explosives Manufacturing	Explosives Manufacturing
325991	Manufacturing	Chemical Manufacturing	Other Chemical Product and Preparation Manufacturing	All Other Chemical Product and Preparation Manufacturing	Custom Compounding of Purchased Resins
325992	Manufacturing	Chemical Manufacturing	Other Chemical Product and Preparation Manufacturing	All Other Chemical Product and Preparation Manufacturing	Photographic Film, Paper, Plate, and Chemical Manufacturing
325998	Manufacturing	Chemical Manufacturing	Other Chemical Product and Preparation Manufacturing	All Other Chemical Product and Preparation Manufacturing	All Other Miscellaneous Chemical Product and Preparation Manufacturing
326111	Manufacturing	Plastics and Rubber Products Manufacturing	Plastics Product Manufacturing	Plastics Packaging Materials and Unlaminated Film and Sheet Manufacturing	Plastics Bag Manufacturing
326112	Manufacturing	Plastics and Rubber Products Manufacturing	Plastics Product Manufacturing	Plastics Packaging Materials and Unlaminated Film and Sheet Manufacturing	Plastics Packaging Film and Sheet (including Laminated) Manufacturing
326113	Manufacturing	Plastics and Rubber Products Manufacturing	Plastics Product Manufacturing	Plastics Packaging Materials and Unlaminated Film and Sheet Manufacturing	Unlaminated Plastics Film and Sheet (except Packaging) Manufacturing
326121	Manufacturing	Plastics and Rubber Products Manufacturing	Plastics Product Manufacturing	Plastics Pipe, Pipe Fitting, and Unlaminated Profile Shape Manufacturing	Unlaminated Plastics Profile Shape Manufacturing
326122	Manufacturing	Plastics and Rubber Products Manufacturing	Plastics Product Manufacturing	Plastics Pipe, Pipe Fitting, and Unlaminated Profile Shape Manufacturing	Plastics Pipe and Pipe Fitting Manufacturing
326130	Manufacturing	Plastics and Rubber Products Manufacturing	Plastics Product Manufacturing	Laminated Plastics Plate, Sheet (except Packaging), and Shape Manufacturing	Laminated Plastics Plate, Sheet (except Packaging), and Shape Manufacturing
326140	Manufacturing	Plastics and Rubber Products Manufacturing	Plastics Product Manufacturing	Polystyrene Foam Product Manufacturing	Polystyrene Foam Product Manufacturing

326150	Manufacturing	Plastics and Rubber Products Manufacturing	Plastics Product Manufacturing	Urethane and Other Foam Product (except Polystyrene) Manufacturing	Urethane and Other Foam Product (except Polystyrene) Manufacturing
326160	Manufacturing	Plastics and Rubber Products Manufacturing	Plastics Product Manufacturing	Plastics Bottle Manufacturing	Plastics Bottle Manufacturing
326191	Manufacturing	Plastics and Rubber Products Manufacturing	Plastics Product Manufacturing	Other Plastics Product Manufacturing	Plastics Plumbing Fixture Manufacturing
326192	Manufacturing	Plastics and Rubber Products Manufacturing	Plastics Product Manufacturing	Other Plastics Product Manufacturing	Resilient Floor Covering Manufacturing
326199	Manufacturing	Plastics and Rubber Products Manufacturing	Plastics Product Manufacturing	Other Plastics Product Manufacturing	All Other Plastics Product Manufacturing
326211	Manufacturing	Plastics and Rubber Products Manufacturing	Rubber Product Manufacturing	Tire Manufacturing	Tire Manufacturing (except Retreading)
326212	Manufacturing	Plastics and Rubber Products Manufacturing	Rubber Product Manufacturing	Tire Manufacturing	Tire Retreading
326220	Manufacturing	Plastics and Rubber Products Manufacturing	Rubber Product Manufacturing	Rubber and Plastics Hoses and Belting Manufacturing	Rubber and Plastics Hoses and Belting Manufacturing
326291	Manufacturing	Plastics and Rubber Products Manufacturing	Rubber Product Manufacturing	Other Rubber Product Manufacturing	Rubber Product Manufacturing for Mechanical Use
326299	Manufacturing	Plastics and Rubber Products Manufacturing	Rubber Product Manufacturing	Other Rubber Product Manufacturing	All Other Rubber Product Manufacturing
327111	Manufacturing	Nonmetallic Mineral Product Manufacturing	Clay Product and Refractory Manufacturing	Pottery, Ceramics, and Plumbing Fixture Manufacturing	Vitreous China Plumbing Fixture and China and Earthenware Bathroom Accessories Manufacturing
327112	Manufacturing	Nonmetallic Mineral Product Manufacturing	Clay Product and Refractory Manufacturing	Pottery, Ceramics, and Plumbing Fixture Manufacturing	Vitreous China, Fine Earthenware, and Other Pottery Product Manufacturing
327113	Manufacturing	Nonmetallic Mineral Product Manufacturing	Clay Product and Refractory Manufacturing	Pottery, Ceramics, and Plumbing Fixture Manufacturing	Porcelain Electrical Supply Manufacturing
327121	Manufacturing	Nonmetallic Mineral Product Manufacturing	Clay Product and Refractory Manufacturing	Clay Building Material and Refractories Manufacturing	Brick and Structural Clay Tile Manufacturing
327122	Manufacturing	Nonmetallic Mineral Product Manufacturing	Clay Product and Refractory Manufacturing	Clay Building Material and Refractories Manufacturing	Ceramic Wall and Floor Tile Manufacturing
327123	Manufacturing	Nonmetallic Mineral Product Manufacturing	Clay Product and Refractory Manufacturing	Clay Building Material and Refractories Manufacturing	Other Structural Clay Product Manufacturing
327124	Manufacturing	Nonmetallic Mineral Product Manufacturing	Clay Product and Refractory Manufacturing	Clay Building Material and Refractories Manufacturing	Clay Refractory Manufacturing
327125	Manufacturing	Nonmetallic Mineral Product Manufacturing	Clay Product and Refractory Manufacturing	Clay Building Material and Refractories Manufacturing	Nonclay Refractory Manufacturing

327211	Manufacturing	Nonmetallic Mineral Product Manufacturing	Glass and Glass Product Manufacturing	Glass and Glass Product Manufacturing	Flat Glass Manufacturing
327212	Manufacturing	Nonmetallic Mineral Product Manufacturing	Glass and Glass Product Manufacturing	Glass and Glass Product Manufacturing	Other Pressed and Blown Glass and Glassware Manufacturing
327213	Manufacturing	Nonmetallic Mineral Product Manufacturing	Glass and Glass Product Manufacturing	Glass and Glass Product Manufacturing	Glass Container Manufacturing
327215	Manufacturing	Nonmetallic Mineral Product Manufacturing	Glass and Glass Product Manufacturing	Glass and Glass Product Manufacturing	Glass Product Manufacturing Made of Purchased Glass
327310	Manufacturing	Nonmetallic Mineral Product Manufacturing	Cement and Concrete Product Manufacturing	Cement Manufacturing	Cement Manufacturing
327320	Manufacturing	Nonmetallic Mineral Product Manufacturing	Cement and Concrete Product Manufacturing	Ready-Mix Concrete Manufacturing	Ready-Mix Concrete Manufacturing
327331	Manufacturing	Nonmetallic Mineral Product Manufacturing	Cement and Concrete Product Manufacturing	Concrete Pipe, Brick, and Block Manufacturing	Concrete Block and Brick Manufacturing
327332	Manufacturing	Nonmetallic Mineral Product Manufacturing	Cement and Concrete Product Manufacturing	Concrete Pipe, Brick, and Block Manufacturing	Concrete Pipe Manufacturing
327390	Manufacturing	Nonmetallic Mineral Product Manufacturing	Cement and Concrete Product Manufacturing	Other Concrete Product Manufacturing	Other Concrete Product Manufacturing
327410	Manufacturing	Nonmetallic Mineral Product Manufacturing	Lime and Gypsum Product Manufacturing	Lime Manufacturing	Lime Manufacturing
327420	Manufacturing	Nonmetallic Mineral Product Manufacturing	Lime and Gypsum Product Manufacturing	Gypsum Product Manufacturing	Gypsum Product Manufacturing
327910	Manufacturing	Nonmetallic Mineral Product Manufacturing	Other Nonmetallic Mineral Product Manufacturing	Abrasive Product Manufacturing	Abrasive Product Manufacturing
327991	Manufacturing	Nonmetallic Mineral Product Manufacturing	Other Nonmetallic Mineral Product Manufacturing	All Other Nonmetallic Mineral Product Manufacturing	Cut Stone and Stone Product Manufacturing
327992	Manufacturing	Nonmetallic Mineral Product Manufacturing	Other Nonmetallic Mineral Product Manufacturing	All Other Nonmetallic Mineral Product Manufacturing	Ground or Treated Mineral and Earth Manufacturing
327993	Manufacturing	Nonmetallic Mineral Product Manufacturing	Other Nonmetallic Mineral Product Manufacturing	All Other Nonmetallic Mineral Product Manufacturing	Mineral Wool Manufacturing
327999	Manufacturing	Nonmetallic Mineral Product Manufacturing	Other Nonmetallic Mineral Product Manufacturing	All Other Nonmetallic Mineral Product Manufacturing	All Other Miscellaneous Nonmetallic Mineral Product Manufacturing
331111	Manufacturing	Primary Metal Manufacturing	Iron and Steel Mills and Ferroalloy Manufacturing	Iron and Steel Mills and Ferroalloy Manufacturing	Iron and Steel Mills
331112	Manufacturing	Primary Metal Manufacturing	Iron and Steel Mills and Ferroalloy Manufacturing	Iron and Steel Mills and Ferroalloy Manufacturing	Electrometallurgical Ferroalloy Product Manufacturing
331210	Manufacturing	Primary Metal Manufacturing	Steel Product Manufacturing from Purchased Steel	Iron and Steel Pipe and Tube Manufacturing from Purchased Steel	Iron and Steel Pipe and Tube Manufacturing from Purchased Steel

331221	Manufacturing	Primary Metal Manufacturing	Steel Product Manufacturing from Purchased Steel	Rolling and Drawing of Purchased Steel	Rolled Steel Shape Manufacturing
331222	Manufacturing	Primary Metal Manufacturing	Steel Product Manufacturing from Purchased Steel	Rolling and Drawing of Purchased Steel	Steel Wire Drawing
331311	Manufacturing	Primary Metal Manufacturing	Alumina and Aluminum Production and Processing	Alumina and Aluminum Production and Processing	Alumina Refining
331312	Manufacturing	Primary Metal Manufacturing	Alumina and Aluminum Production and Processing	Alumina and Aluminum Production and Processing	Primary Aluminum Production
331314	Manufacturing	Primary Metal Manufacturing	Alumina and Aluminum Production and Processing	Alumina and Aluminum Production and Processing	Secondary Smelting and Alloying of Aluminum
331315	Manufacturing	Primary Metal Manufacturing	Alumina and Aluminum Production and Processing	Alumina and Aluminum Production and Processing	Aluminum Sheet, Plate, and Foil Manufacturing
331316	Manufacturing	Primary Metal Manufacturing	Alumina and Aluminum Production and Processing	Alumina and Aluminum Production and Processing	Aluminum Extruded Product Manufacturing
331319	Manufacturing	Primary Metal Manufacturing	Alumina and Aluminum Production and Processing	Alumina and Aluminum Production and Processing	Other Aluminum Rolling and Drawing
331411	Manufacturing	Primary Metal Manufacturing	Nonferrous Metal (except Aluminum) Production and Processing	Nonferrous Metal (except Aluminum) Smelting and Refining	Primary Smelting and Refining of Copper
331419	Manufacturing	Primary Metal Manufacturing	Nonferrous Metal (except Aluminum) Production and Processing	Nonferrous Metal (except Aluminum) Smelting and Refining	Primary Smelting and Refining of Nonferrous Metal (except Copper and Aluminum)
331421	Manufacturing	Primary Metal Manufacturing	Nonferrous Metal (except Aluminum) Production and Processing	Copper Rolling, Drawing, Extruding, and Alloying	Copper Rolling, Drawing, and Extruding
331422	Manufacturing	Primary Metal Manufacturing	Nonferrous Metal (except Aluminum) Production and Processing	Copper Rolling, Drawing, Extruding, and Alloying	Copper Wire (except Mechanical) Drawing
331423	Manufacturing	Primary Metal Manufacturing	Nonferrous Metal (except Aluminum) Production and Processing	Copper Rolling, Drawing, Extruding, and Alloying	Secondary Smelting, Refining, and Alloying of Copper
331491	Manufacturing	Primary Metal Manufacturing	Nonferrous Metal (except Aluminum) Production and Processing	Nonferrous Metal (except Copper and Aluminum) Rolling, Drawing, Extruding, and Alloying	Nonferrous Metal (except Copper and Aluminum) Rolling, Drawing, and Extruding
331492	Manufacturing	Primary Metal Manufacturing	Nonferrous Metal (except Aluminum) Production and Processing	Nonferrous Metal (except Copper and Aluminum) Rolling, Drawing, Extruding, and Alloying	Secondary Smelting, Refining, and Alloying of Nonferrous Metal (except Copper and Aluminum)
331511	Manufacturing	Primary Metal Manufacturing	Foundries	Ferrous Metal Foundries	Iron Foundries

331512	Manufacturing	Primary Metal Manufacturing	Foundries	Ferrous Metal Foundries	Steel Investment Foundries
331513	Manufacturing	Primary Metal Manufacturing	Foundries	Ferrous Metal Foundries	Steel Foundries (except Investment)
331521	Manufacturing	Primary Metal Manufacturing	Foundries	Nonferrous Metal Foundries	Aluminum Die-Casting Foundries
331522	Manufacturing	Primary Metal Manufacturing	Foundries	Nonferrous Metal Foundries	Nonferrous (except Aluminum) Die-Casting Foundries
331524	Manufacturing	Primary Metal Manufacturing	Foundries	Nonferrous Metal Foundries	Aluminum Foundries (except Die-Casting)
331525	Manufacturing	Primary Metal Manufacturing	Foundries	Nonferrous Metal Foundries	Copper Foundries (except Die-Casting)
331528	Manufacturing	Primary Metal Manufacturing	Foundries	Nonferrous Metal Foundries	Other Nonferrous Foundries (except Die-Casting)
332111	Manufacturing	Fabricated Metal Product Manufacturing	Forging and Stamping	Forging and Stamping	Iron and Steel Forging
332112	Manufacturing	Fabricated Metal Product Manufacturing	Forging and Stamping	Forging and Stamping	Nonferrous Forging
332114	Manufacturing	Fabricated Metal Product Manufacturing	Forging and Stamping	Forging and Stamping	Custom Roll Forming
332115	Manufacturing	Fabricated Metal Product Manufacturing	Forging and Stamping	Forging and Stamping	Crown and Closure Manufacturing
332116	Manufacturing	Fabricated Metal Product Manufacturing	Forging and Stamping	Forging and Stamping	Metal Stamping
332117	Manufacturing	Fabricated Metal Product Manufacturing	Forging and Stamping	Forging and Stamping	Powder Metallurgy Part Manufacturing
332211	Manufacturing	Fabricated Metal Product Manufacturing	Cutlery and Handtool Manufacturing	Cutlery and Handtool Manufacturing	Cutlery and Flatware (except Precious) Manufacturing
332212	Manufacturing	Fabricated Metal Product Manufacturing	Cutlery and Handtool Manufacturing	Cutlery and Handtool Manufacturing	Hand and Edge Tool Manufacturing
332213	Manufacturing	Fabricated Metal Product Manufacturing	Cutlery and Handtool Manufacturing	Cutlery and Handtool Manufacturing	Saw Blade and Handsaw Manufacturing
332214	Manufacturing	Fabricated Metal Product Manufacturing	Cutlery and Handtool Manufacturing	Cutlery and Handtool Manufacturing	Kitchen Utensil, Pot, and Pan Manufacturing
332311	Manufacturing	Fabricated Metal Product Manufacturing	Architectural and Structural Metals Manufacturing	Plate Work and Fabricated Structural Product Manufacturing	Prefabricated Metal Building and Component Manufacturing
332312	Manufacturing	Fabricated Metal Product Manufacturing	Architectural and Structural Metals Manufacturing	Plate Work and Fabricated Structural Product Manufacturing	Fabricated Structural Metal Manufacturing

332313	Manufacturing	Fabricated Metal Product Manufacturing	Architectural and Structural Metals Manufacturing	Plate Work and Fabricated Structural Product Manufacturing	Plate Work Manufacturing
332321	Manufacturing	Fabricated Metal Product Manufacturing	Architectural and Structural Metals Manufacturing	Ornamental and Architectural Metal Products Manufacturing	Metal Window and Door Manufacturing
332322	Manufacturing	Fabricated Metal Product Manufacturing	Architectural and Structural Metals Manufacturing	Ornamental and Architectural Metal Products Manufacturing	Sheet Metal Work Manufacturing
332323	Manufacturing	Fabricated Metal Product Manufacturing	Architectural and Structural Metals Manufacturing	Ornamental and Architectural Metal Products Manufacturing	Ornamental and Architectural Metal Work Manufacturing
332410	Manufacturing	Fabricated Metal Product Manufacturing	Boiler, Tank, and Shipping Container Manufacturing	Power Boiler and Heat Exchanger Manufacturing	Power Boiler and Heat Exchanger Manufacturing
332420	Manufacturing	Fabricated Metal Product Manufacturing	Boiler, Tank, and Shipping Container Manufacturing	Metal Tank (Heavy Gauge) Manufacturing	Metal Tank (Heavy Gauge) Manufacturing
332431	Manufacturing	Fabricated Metal Product Manufacturing	Boiler, Tank, and Shipping Container Manufacturing	Metal Can, Box, and Other Metal Container (Light Gauge) Manufacturing	Metal Can Manufacturing
332439	Manufacturing	Fabricated Metal Product Manufacturing	Boiler, Tank, and Shipping Container Manufacturing	Metal Can, Box, and Other Metal Container (Light Gauge) Manufacturing	Other Metal Container Manufacturing
332510	Manufacturing	Fabricated Metal Product Manufacturing	Hardware Manufacturing	Hardware Manufacturing	Hardware Manufacturing
332611	Manufacturing	Fabricated Metal Product Manufacturing	Spring and Wire Product Manufacturing	Spring and Wire Product Manufacturing	Spring (Heavy Gauge) Manufacturing
332612	Manufacturing	Fabricated Metal Product Manufacturing	Spring and Wire Product Manufacturing	Spring and Wire Product Manufacturing	Spring (Light Gauge) Manufacturing
332618	Manufacturing	Fabricated Metal Product Manufacturing	Spring and Wire Product Manufacturing	Spring and Wire Product Manufacturing	Other Fabricated Wire Product Manufacturing
332710	Manufacturing	Fabricated Metal Product Manufacturing	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	Machine Shops	Machine Shops
332721	Manufacturing	Fabricated Metal Product Manufacturing	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	Turned Product and Screw, Nut, and Bolt Manufacturing	Precision Turned Product Manufacturing
332722	Manufacturing	Fabricated Metal Product Manufacturing	Machine Shops; Turned Product; and Screw, Nut, and Bolt Manufacturing	Turned Product and Screw, Nut, and Bolt Manufacturing	Bolt, Nut, Screw, Rivet, and Washer Manufacturing
332811	Manufacturing	Fabricated Metal Product Manufacturing	Coating, Engraving, Heat Treating, and Allied Activities	Coating, Engraving, Heat Treating, and Allied Activities	Metal Heat Treating
332812	Manufacturing	Fabricated Metal Product Manufacturing	Coating, Engraving, Heat Treating, and Allied Activities	Coating, Engraving, Heat Treating, and Allied Activities	Metal Coating, Engraving (except Jewelry and

					Silverware), and Allied Services to Manufacturers
332813	Manufacturing	Fabricated Metal Product Manufacturing	Coating, Engraving, Heat Treating, and Allied Activities	Coating, Engraving, Heat Treating, and Allied Activities	Electroplating, Plating, Polishing, Anodizing, and Coloring
332911	Manufacturing	Fabricated Metal Product Manufacturing	Other Fabricated Metal Product Manufacturing	Metal Valve Manufacturing	Industrial Valve Manufacturing
332912	Manufacturing	Fabricated Metal Product Manufacturing	Other Fabricated Metal Product Manufacturing	Metal Valve Manufacturing	Fluid Power Valve and Hose Fitting Manufacturing
332913	Manufacturing	Fabricated Metal Product Manufacturing	Other Fabricated Metal Product Manufacturing	Metal Valve Manufacturing	Plumbing Fixture Fitting and Trim Manufacturing
332919	Manufacturing	Fabricated Metal Product Manufacturing	Other Fabricated Metal Product Manufacturing	Metal Valve Manufacturing	Other Metal Valve and Pipe Fitting Manufacturing
332991	Manufacturing	Fabricated Metal Product Manufacturing	Other Fabricated Metal Product Manufacturing	All Other Fabricated Metal Product Manufacturing	Ball and Roller Bearing Manufacturing
332992	Manufacturing	Fabricated Metal Product Manufacturing	Other Fabricated Metal Product Manufacturing	All Other Fabricated Metal Product Manufacturing	Small Arms Ammunition Manufacturing
332993	Manufacturing	Fabricated Metal Product Manufacturing	Other Fabricated Metal Product Manufacturing	All Other Fabricated Metal Product Manufacturing	Ammunition (except Small Arms) Manufacturing
332994	Manufacturing	Fabricated Metal Product Manufacturing	Other Fabricated Metal Product Manufacturing	All Other Fabricated Metal Product Manufacturing	Small Arms Manufacturing
332995	Manufacturing	Fabricated Metal Product Manufacturing	Other Fabricated Metal Product Manufacturing	All Other Fabricated Metal Product Manufacturing	Other Ordnance and Accessories Manufacturing
332996	Manufacturing	Fabricated Metal Product Manufacturing	Other Fabricated Metal Product Manufacturing	All Other Fabricated Metal Product Manufacturing	Fabricated Pipe and Pipe Fitting Manufacturing
332997	Manufacturing	Fabricated Metal Product Manufacturing	Other Fabricated Metal Product Manufacturing	All Other Fabricated Metal Product Manufacturing	Industrial Pattern Manufacturing
332998	Manufacturing	Fabricated Metal Product Manufacturing	Other Fabricated Metal Product Manufacturing	All Other Fabricated Metal Product Manufacturing	Enameled Iron and Metal Sanitary Ware Manufacturing
332999	Manufacturing	Fabricated Metal Product Manufacturing	Other Fabricated Metal Product Manufacturing	All Other Fabricated Metal Product Manufacturing	All Other Miscellaneous Fabricated Metal Product Manufacturing
333111	Manufacturing	Machinery Manufacturing	Agriculture, Construction, and Mining Machinery Manufacturing	Agricultural Implement Manufacturing	Farm Machinery and Equipment Manufacturing
333112	Manufacturing	Machinery Manufacturing	Agriculture, Construction, and Mining Machinery Manufacturing	Agricultural Implement Manufacturing	Lawn and Garden Tractor and Home Lawn and Garden Equipment Manufacturing
333120	Manufacturing	Machinery Manufacturing	Agriculture, Construction, and Mining Machinery Manufacturing	Construction Machinery Manufacturing	Construction Machinery Manufacturing

333131	Manufacturing	Machinery Manufacturing	Agriculture, Construction, and Mining Machinery Manufacturing	Mining and Oil and Gas Field Machinery Manufacturing	Mining Machinery and Equipment Manufacturing
333132	Manufacturing	Machinery Manufacturing	Agriculture, Construction, and Mining Machinery Manufacturing	Mining and Oil and Gas Field Machinery Manufacturing	Oil and Gas Field Machinery and Equipment Manufacturing
333210	Manufacturing	Machinery Manufacturing	Industrial Machinery Manufacturing	Sawmill and Woodworking Machinery Manufacturing	Sawmill and Woodworking Machinery Manufacturing
333220	Manufacturing	Machinery Manufacturing	Industrial Machinery Manufacturing	Plastics and Rubber Industry Machinery Manufacturing	Plastics and Rubber Industry Machinery Manufacturing
333291	Manufacturing	Machinery Manufacturing	Industrial Machinery Manufacturing	Other Industrial Machinery Manufacturing	Paper Industry Machinery Manufacturing
333292	Manufacturing	Machinery Manufacturing	Industrial Machinery Manufacturing	Other Industrial Machinery Manufacturing	Textile Machinery Manufacturing
333293	Manufacturing	Machinery Manufacturing	Industrial Machinery Manufacturing	Other Industrial Machinery Manufacturing	Printing Machinery and Equipment Manufacturing
333294	Manufacturing	Machinery Manufacturing	Industrial Machinery Manufacturing	Other Industrial Machinery Manufacturing	Food Product Machinery Manufacturing
333295	Manufacturing	Machinery Manufacturing	Industrial Machinery Manufacturing	Other Industrial Machinery Manufacturing	Semiconductor Machinery Manufacturing
333298	Manufacturing	Machinery Manufacturing	Industrial Machinery Manufacturing	Other Industrial Machinery Manufacturing	All Other Industrial Machinery Manufacturing
333311	Manufacturing	Machinery Manufacturing	Commercial and Service Industry Machinery Manufacturing	Commercial and Service Industry Machinery Manufacturing	Automatic Vending Machine Manufacturing
333312	Manufacturing	Machinery Manufacturing	Commercial and Service Industry Machinery Manufacturing	Commercial and Service Industry Machinery Manufacturing	Commercial Laundry, Drycleaning, and Pressing Machine Manufacturing
333313	Manufacturing	Machinery Manufacturing	Commercial and Service Industry Machinery Manufacturing	Commercial and Service Industry Machinery Manufacturing	Office Machinery Manufacturing
333314	Manufacturing	Machinery Manufacturing	Commercial and Service Industry Machinery Manufacturing	Commercial and Service Industry Machinery Manufacturing	Optical Instrument and Lens Manufacturing
333315	Manufacturing	Machinery Manufacturing	Commercial and Service Industry Machinery Manufacturing	Commercial and Service Industry Machinery Manufacturing	Photographic and Photocopying Equipment Manufacturing
333319	Manufacturing	Machinery Manufacturing	Commercial and Service Industry Machinery Manufacturing	Commercial and Service Industry Machinery Manufacturing	Other Commercial and Service Industry Machinery Manufacturing

333411	Manufacturing	Machinery Manufacturing	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	Air Purification Equipment Manufacturing
333412	Manufacturing	Machinery Manufacturing	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	Industrial and Commercial Fan and Blower Manufacturing
333414	Manufacturing	Machinery Manufacturing	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	Heating Equipment (except Warm Air Furnaces) Manufacturing
333415	Manufacturing	Machinery Manufacturing	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing
333511	Manufacturing	Machinery Manufacturing	Metalworking Machinery Manufacturing	Metalworking Machinery Manufacturing	Industrial Mold Manufacturing
333512	Manufacturing	Machinery Manufacturing	Metalworking Machinery Manufacturing	Metalworking Machinery Manufacturing	Machine Tool (Metal Cutting Types) Manufacturing
333513	Manufacturing	Machinery Manufacturing	Metalworking Machinery Manufacturing	Metalworking Machinery Manufacturing	Machine Tool (Metal Forming Types) Manufacturing
333514	Manufacturing	Machinery Manufacturing	Metalworking Machinery Manufacturing	Metalworking Machinery Manufacturing	Special Die and Tool, Die Set, Jig, and Fixture Manufacturing
333515	Manufacturing	Machinery Manufacturing	Metalworking Machinery Manufacturing	Metalworking Machinery Manufacturing	Cutting Tool and Machine Tool Accessory Manufacturing
333516	Manufacturing	Machinery Manufacturing	Metalworking Machinery Manufacturing	Metalworking Machinery Manufacturing	Rolling Mill Machinery and Equipment Manufacturing
333518	Manufacturing	Machinery Manufacturing	Metalworking Machinery Manufacturing	Metalworking Machinery Manufacturing	Other Metalworking Machinery Manufacturing
333611	Manufacturing	Machinery Manufacturing	Engine, Turbine, and Power Transmission Equipment Manufacturing	Engine, Turbine, and Power Transmission Equipment Manufacturing	Turbine and Turbine Generator Set Units Manufacturing
333612	Manufacturing	Machinery Manufacturing	Engine, Turbine, and Power Transmission Equipment Manufacturing	Engine, Turbine, and Power Transmission Equipment Manufacturing	Speed Changer, Industrial High-Speed Drive, and Gear Manufacturing
333613	Manufacturing	Machinery Manufacturing	Engine, Turbine, and Power Transmission Equipment Manufacturing	Engine, Turbine, and Power Transmission Equipment Manufacturing	Mechanical Power Transmission Equipment Manufacturing

333618	Manufacturing	Machinery Manufacturing	Engine, Turbine, and Power Transmission Equipment Manufacturing	Engine, Turbine, and Power Transmission Equipment Manufacturing	Other Engine Equipment Manufacturing
333911	Manufacturing	Machinery Manufacturing	Other General Purpose Machinery Manufacturing	Pump and Compressor Manufacturing	Pump and Pumping Equipment Manufacturing
333912	Manufacturing	Machinery Manufacturing	Other General Purpose Machinery Manufacturing	Pump and Compressor Manufacturing	Air and Gas Compressor Manufacturing
333913	Manufacturing	Machinery Manufacturing	Other General Purpose Machinery Manufacturing	Pump and Compressor Manufacturing	Measuring and Dispensing Pump Manufacturing
333921	Manufacturing	Machinery Manufacturing	Other General Purpose Machinery Manufacturing	Material Handling Equipment Manufacturing	Elevator and Moving Stairway Manufacturing
333922	Manufacturing	Machinery Manufacturing	Other General Purpose Machinery Manufacturing	Material Handling Equipment Manufacturing	Conveyor and Conveying Equipment Manufacturing
333923	Manufacturing	Machinery Manufacturing	Other General Purpose Machinery Manufacturing	Material Handling Equipment Manufacturing	Overhead Traveling Crane, Hoist, and Monorail System Manufacturing
333924	Manufacturing	Machinery Manufacturing	Other General Purpose Machinery Manufacturing	Material Handling Equipment Manufacturing	Industrial Truck, Tractor, Trailer, and Stacker Machinery Manufacturing
333991	Manufacturing	Machinery Manufacturing	Other General Purpose Machinery Manufacturing	All Other General Purpose Machinery Manufacturing	Power-Driven Handtool Manufacturing
333992	Manufacturing	Machinery Manufacturing	Other General Purpose Machinery Manufacturing	All Other General Purpose Machinery Manufacturing	Welding and Soldering Equipment Manufacturing
333993	Manufacturing	Machinery Manufacturing	Other General Purpose Machinery Manufacturing	All Other General Purpose Machinery Manufacturing	Packaging Machinery Manufacturing
333994	Manufacturing	Machinery Manufacturing	Other General Purpose Machinery Manufacturing	All Other General Purpose Machinery Manufacturing	Industrial Process Furnace and Oven Manufacturing
333995	Manufacturing	Machinery Manufacturing	Other General Purpose Machinery Manufacturing	All Other General Purpose Machinery Manufacturing	Fluid Power Cylinder and Actuator Manufacturing
333996	Manufacturing	Machinery Manufacturing	Other General Purpose Machinery Manufacturing	All Other General Purpose Machinery Manufacturing	Fluid Power Pump and Motor Manufacturing
333997	Manufacturing	Machinery Manufacturing	Other General Purpose Machinery Manufacturing	All Other General Purpose Machinery Manufacturing	Scale and Balance (except Laboratory) Manufacturing
333999	Manufacturing	Machinery Manufacturing	Other General Purpose Machinery Manufacturing	All Other General Purpose Machinery Manufacturing	All Other Miscellaneous General Purpose Machinery Manufacturing
334111	Manufacturing	Computer and Electronic Product Manufacturing	Computer and Peripheral Equipment Manufacturing	Computer and Peripheral Equipment Manufacturing	Electronic Computer Manufacturing

334112	Manufacturing	Computer and Electronic Product Manufacturing	Computer and Peripheral Equipment Manufacturing	Computer and Peripheral Equipment Manufacturing	Computer Storage Device Manufacturing
334113	Manufacturing	Computer and Electronic Product Manufacturing	Computer and Peripheral Equipment Manufacturing	Computer and Peripheral Equipment Manufacturing	Computer Terminal Manufacturing
334119	Manufacturing	Computer and Electronic Product Manufacturing	Computer and Peripheral Equipment Manufacturing	Computer and Peripheral Equipment Manufacturing	Other Computer Peripheral Equipment Manufacturing
334210	Manufacturing	Computer and Electronic Product Manufacturing	Communications Equipment Manufacturing	Telephone Apparatus Manufacturing	Telephone Apparatus Manufacturing
334220	Manufacturing	Computer and Electronic Product Manufacturing	Communications Equipment Manufacturing	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing	Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing
334290	Manufacturing	Computer and Electronic Product Manufacturing	Communications Equipment Manufacturing	Other Communications Equipment Manufacturing	Other Communications Equipment Manufacturing
334310	Manufacturing	Computer and Electronic Product Manufacturing	Audio and Video Equipment Manufacturing	Audio and Video Equipment Manufacturing	Audio and Video Equipment Manufacturing
334411	Manufacturing	Computer and Electronic Product Manufacturing	Semiconductor and Other Electronic Component Manufacturing	Semiconductor and Other Electronic Component Manufacturing	Electron Tube Manufacturing
334412	Manufacturing	Computer and Electronic Product Manufacturing	Semiconductor and Other Electronic Component Manufacturing	Semiconductor and Other Electronic Component Manufacturing	Bare Printed Circuit Board Manufacturing
334413	Manufacturing	Computer and Electronic Product Manufacturing	Semiconductor and Other Electronic Component Manufacturing	Semiconductor and Other Electronic Component Manufacturing	Semiconductor and Related Device Manufacturing
334414	Manufacturing	Computer and Electronic Product Manufacturing	Semiconductor and Other Electronic Component Manufacturing	Semiconductor and Other Electronic Component Manufacturing	Electronic Capacitor Manufacturing
334415	Manufacturing	Computer and Electronic Product Manufacturing	Semiconductor and Other Electronic Component Manufacturing	Semiconductor and Other Electronic Component Manufacturing	Electronic Resistor Manufacturing
334416	Manufacturing	Computer and Electronic Product Manufacturing	Semiconductor and Other Electronic Component Manufacturing	Semiconductor and Other Electronic Component Manufacturing	Electronic Coil, Transformer, and Other Inductor Manufacturing

334417	Manufacturing	Computer and Electronic Product Manufacturing	Semiconductor and Other Electronic Component Manufacturing	Semiconductor and Other Electronic Component Manufacturing	Electronic Connector Manufacturing
334418	Manufacturing	Computer and Electronic Product Manufacturing	Semiconductor and Other Electronic Component Manufacturing	Semiconductor and Other Electronic Component Manufacturing	Printed Circuit Assembly (Electronic Assembly) Manufacturing
334419	Manufacturing	Computer and Electronic Product Manufacturing	Semiconductor and Other Electronic Component Manufacturing	Semiconductor and Other Electronic Component Manufacturing	Other Electronic Component Manufacturing
334510	Manufacturing	Computer and Electronic Product Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Electromedical and Electrotherapeutic Apparatus Manufacturing
334511	Manufacturing	Computer and Electronic Product Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Search, Detection, Navigation, Guidance, Aeronautical, and Nautical System and Instrument Manufacturing
334512	Manufacturing	Computer and Electronic Product Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use
334513	Manufacturing	Computer and Electronic Product Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Instruments and Related Products Manufacturing for Measuring, Displaying, and Controlling Industrial Process Variables
334514	Manufacturing	Computer and Electronic Product Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Totalizing Fluid Meter and Counting Device Manufacturing
334515	Manufacturing	Computer and Electronic Product Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals
334516	Manufacturing	Computer and Electronic Product Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Analytical Laboratory Instrument Manufacturing
334517	Manufacturing	Computer and Electronic Product Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Irradiation Apparatus Manufacturing
334518	Manufacturing	Computer and Electronic Product Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Watch, Clock, and Part Manufacturing

334519	Manufacturing	Computer and Electronic Product Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	Other Measuring and Controlling Device Manufacturing
334611	Manufacturing	Computer and Electronic Product Manufacturing	Manufacturing and Reproducing Magnetic and Optical Media	Manufacturing and Reproducing Magnetic and Optical Media	Software Reproducing
334612	Manufacturing	Computer and Electronic Product Manufacturing	Manufacturing and Reproducing Magnetic and Optical Media	Manufacturing and Reproducing Magnetic and Optical Media	Prerecorded Compact Disc (except Software), Tape, and Record Reproducing
334613	Manufacturing	Computer and Electronic Product Manufacturing	Manufacturing and Reproducing Magnetic and Optical Media	Manufacturing and Reproducing Magnetic and Optical Media	Magnetic and Optical Recording Media Manufacturing
335110	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Electric Lighting Equipment Manufacturing	Electric Lamp Bulb and Part Manufacturing	Electric Lamp Bulb and Part Manufacturing
335121	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Electric Lighting Equipment Manufacturing	Lighting Fixture Manufacturing	Residential Electric Lighting Fixture Manufacturing
335122	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Electric Lighting Equipment Manufacturing	Lighting Fixture Manufacturing	Commercial, Industrial, and Institutional Electric Lighting Fixture Manufacturing
335129	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Electric Lighting Equipment Manufacturing	Lighting Fixture Manufacturing	Other Lighting Equipment Manufacturing
335211	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Household Appliance Manufacturing	Small Electrical Appliance Manufacturing	Electric Housewares and Household Fan Manufacturing
335212	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Household Appliance Manufacturing	Small Electrical Appliance Manufacturing	Household Vacuum Cleaner Manufacturing
335221	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Household Appliance Manufacturing	Major Appliance Manufacturing	Household Cooking Appliance Manufacturing

335222	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Household Appliance Manufacturing	Major Appliance Manufacturing	Household Refrigerator and Home Freezer Manufacturing
335224	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Household Appliance Manufacturing	Major Appliance Manufacturing	Household Laundry Equipment Manufacturing
335228	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Household Appliance Manufacturing	Major Appliance Manufacturing	Other Major Household Appliance Manufacturing
335311	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Electrical Equipment Manufacturing	Electrical Equipment Manufacturing	Power, Distribution, and Specialty Transformer Manufacturing
335312	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Electrical Equipment Manufacturing	Electrical Equipment Manufacturing	Motor and Generator Manufacturing
335313	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Electrical Equipment Manufacturing	Electrical Equipment Manufacturing	Switchgear and Switchboard Apparatus Manufacturing
335314	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Electrical Equipment Manufacturing	Electrical Equipment Manufacturing	Relay and Industrial Control Manufacturing
335911	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Other Electrical Equipment and Component Manufacturing	Battery Manufacturing	Storage Battery Manufacturing
335912	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Other Electrical Equipment and Component Manufacturing	Battery Manufacturing	Primary Battery Manufacturing
335921	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Other Electrical Equipment and Component Manufacturing	Communication and Energy Wire and Cable Manufacturing	Fiber Optic Cable Manufacturing

335929	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Other Electrical Equipment and Component Manufacturing	Communication and Energy Wire and Cable Manufacturing	Other Communication and Energy Wire Manufacturing
335931	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Other Electrical Equipment and Component Manufacturing	Wiring Device Manufacturing	Current-Carrying Wiring Device Manufacturing
335932	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Other Electrical Equipment and Component Manufacturing	Wiring Device Manufacturing	Noncurrent-Carrying Wiring Device Manufacturing
335991	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Other Electrical Equipment and Component Manufacturing	All Other Electrical Equipment and Component Manufacturing	Carbon and Graphite Product Manufacturing
335999	Manufacturing	Electrical Equipment, Appliance, and Component Manufacturing	Other Electrical Equipment and Component Manufacturing	All Other Electrical Equipment and Component Manufacturing	All Other Miscellaneous Electrical Equipment and Component Manufacturing
336111	Manufacturing	Transportation Equipment Manufacturing	Motor Vehicle Manufacturing	Automobile and Light Duty Motor Vehicle Manufacturing	Automobile Manufacturing
336112	Manufacturing	Transportation Equipment Manufacturing	Motor Vehicle Manufacturing	Automobile and Light Duty Motor Vehicle Manufacturing	Light Truck and Utility Vehicle Manufacturing
336120	Manufacturing	Transportation Equipment Manufacturing	Motor Vehicle Manufacturing	Heavy Duty Truck Manufacturing	Heavy Duty Truck Manufacturing
336211	Manufacturing	Transportation Equipment Manufacturing	Motor Vehicle Body and Trailer Manufacturing	Motor Vehicle Body and Trailer Manufacturing	Motor Vehicle Body Manufacturing
336212	Manufacturing	Transportation Equipment Manufacturing	Motor Vehicle Body and Trailer Manufacturing	Motor Vehicle Body and Trailer Manufacturing	Truck Trailer Manufacturing
336213	Manufacturing	Transportation Equipment Manufacturing	Motor Vehicle Body and Trailer Manufacturing	Motor Vehicle Body and Trailer Manufacturing	Motor Home Manufacturing
336214	Manufacturing	Transportation Equipment Manufacturing	Motor Vehicle Body and Trailer Manufacturing	Motor Vehicle Body and Trailer Manufacturing	Travel Trailer and Camper Manufacturing

336311	Manufacturing	Transportation Equipment Manufacturing	Motor Vehicle Parts Manufacturing	Motor Vehicle Gasoline Engine and Engine Parts Manufacturing	Carburetor, Piston, Piston Ring, and Valve Manufacturing
336312	Manufacturing	Transportation Equipment Manufacturing	Motor Vehicle Parts Manufacturing	Motor Vehicle Gasoline Engine and Engine Parts Manufacturing	Gasoline Engine and Engine Parts Manufacturing
336321	Manufacturing	Transportation Equipment Manufacturing	Motor Vehicle Parts Manufacturing	Motor Vehicle Electrical and Electronic Equipment Manufacturing	Vehicular Lighting Equipment Manufacturing
336322	Manufacturing	Transportation Equipment Manufacturing	Motor Vehicle Parts Manufacturing	Motor Vehicle Electrical and Electronic Equipment Manufacturing	Other Motor Vehicle Electrical and Electronic Equipment Manufacturing
336330	Manufacturing	Transportation Equipment Manufacturing	Motor Vehicle Parts Manufacturing	Motor Vehicle Steering and Suspension Components (except Spring) Manufacturing	Motor Vehicle Steering and Suspension Components (except Spring) Manufacturing
336340	Manufacturing	Transportation Equipment Manufacturing	Motor Vehicle Parts Manufacturing	Motor Vehicle Brake System Manufacturing	Motor Vehicle Brake System Manufacturing
336350	Manufacturing	Transportation Equipment Manufacturing	Motor Vehicle Parts Manufacturing	Motor Vehicle Transmission and Power Train Parts Manufacturing	Motor Vehicle Transmission and Power Train Parts Manufacturing
336360	Manufacturing	Transportation Equipment Manufacturing	Motor Vehicle Parts Manufacturing	Motor Vehicle Seating and Interior Trim Manufacturing	Motor Vehicle Seating and Interior Trim Manufacturing
336370	Manufacturing	Transportation Equipment Manufacturing	Motor Vehicle Parts Manufacturing	Motor Vehicle Metal Stamping	Motor Vehicle Metal Stamping
336391	Manufacturing	Transportation Equipment Manufacturing	Motor Vehicle Parts Manufacturing	Other Motor Vehicle Parts Manufacturing	Motor Vehicle Air-Conditioning Manufacturing
336399	Manufacturing	Transportation Equipment Manufacturing	Motor Vehicle Parts Manufacturing	Other Motor Vehicle Parts Manufacturing	All Other Motor Vehicle Parts Manufacturing
336411	Manufacturing	Transportation Equipment Manufacturing	Aerospace Product and Parts Manufacturing	Aerospace Product and Parts Manufacturing	Aircraft Manufacturing
336412	Manufacturing	Transportation Equipment Manufacturing	Aerospace Product and Parts Manufacturing	Aerospace Product and Parts Manufacturing	Aircraft Engine and Engine Parts Manufacturing

336413	Manufacturing	Transportation Equipment Manufacturing	Aerospace Product and Parts Manufacturing	Aerospace Product and Parts Manufacturing	Other Aircraft Parts and Auxiliary Equipment Manufacturing
336414	Manufacturing	Transportation Equipment Manufacturing	Aerospace Product and Parts Manufacturing	Aerospace Product and Parts Manufacturing	Guided Missile and Space Vehicle Manufacturing
336415	Manufacturing	Transportation Equipment Manufacturing	Aerospace Product and Parts Manufacturing	Aerospace Product and Parts Manufacturing	Guided Missile and Space Vehicle Propulsion Unit and Propulsion Unit Parts Manufacturing
336419	Manufacturing	Transportation Equipment Manufacturing	Aerospace Product and Parts Manufacturing	Aerospace Product and Parts Manufacturing	Other Guided Missile and Space Vehicle Parts and Auxiliary Equipment Manufacturing
336510	Manufacturing	Transportation Equipment Manufacturing	Railroad Rolling Stock Manufacturing	Railroad Rolling Stock Manufacturing	Railroad Rolling Stock Manufacturing
336611	Manufacturing	Transportation Equipment Manufacturing	Ship and Boat Building	Ship and Boat Building	Ship Building and Repairing
336612	Manufacturing	Transportation Equipment Manufacturing	Ship and Boat Building	Ship and Boat Building	Boat Building
336991	Manufacturing	Transportation Equipment Manufacturing	Other Transportation Equipment Manufacturing	Other Transportation Equipment Manufacturing	Motorcycle, Bicycle, and Parts Manufacturing
336992	Manufacturing	Transportation Equipment Manufacturing	Other Transportation Equipment Manufacturing	Other Transportation Equipment Manufacturing	Military Armored Vehicle, Tank, and Tank Component Manufacturing
336999	Manufacturing	Transportation Equipment Manufacturing	Other Transportation Equipment Manufacturing	Other Transportation Equipment Manufacturing	All Other Transportation Equipment Manufacturing
337110	Manufacturing	Furniture and Related Product Manufacturing	Household and Institutional Furniture and Kitchen Cabinet Manufacturing	Wood Kitchen Cabinet and Countertop Manufacturing	Wood Kitchen Cabinet and Countertop Manufacturing
337121	Manufacturing	Furniture and Related Product Manufacturing	Household and Institutional Furniture and Kitchen Cabinet Manufacturing	Household and Institutional Furniture Manufacturing	Upholstered Household Furniture Manufacturing
337122	Manufacturing	Furniture and Related Product Manufacturing	Household and Institutional Furniture and Kitchen Cabinet Manufacturing	Household and Institutional Furniture Manufacturing	Nonupholstered Wood Household Furniture Manufacturing

337124	Manufacturing	Furniture and Related Product Manufacturing	Household and Institutional Furniture and Kitchen Cabinet Manufacturing	Household and Institutional Furniture Manufacturing	Metal Household Furniture Manufacturing
337125	Manufacturing	Furniture and Related Product Manufacturing	Household and Institutional Furniture and Kitchen Cabinet Manufacturing	Household and Institutional Furniture Manufacturing	Household Furniture (except Wood and Metal) Manufacturing
337127	Manufacturing	Furniture and Related Product Manufacturing	Household and Institutional Furniture and Kitchen Cabinet Manufacturing	Household and Institutional Furniture Manufacturing	Institutional Furniture Manufacturing
337129	Manufacturing	Furniture and Related Product Manufacturing	Household and Institutional Furniture and Kitchen Cabinet Manufacturing	Household and Institutional Furniture Manufacturing	Wood Television, Radio, and Sewing Machine Cabinet Manufacturing
337211	Manufacturing	Furniture and Related Product Manufacturing	Office Furniture (including Fixtures) Manufacturing	Office Furniture (including Fixtures) Manufacturing	Wood Office Furniture Manufacturing
337212	Manufacturing	Furniture and Related Product Manufacturing	Office Furniture (including Fixtures) Manufacturing	Office Furniture (including Fixtures) Manufacturing	Custom Architectural Woodwork and Millwork Manufacturing
337214	Manufacturing	Furniture and Related Product Manufacturing	Office Furniture (including Fixtures) Manufacturing	Office Furniture (including Fixtures) Manufacturing	Office Furniture (except Wood) Manufacturing
337215	Manufacturing	Furniture and Related Product Manufacturing	Office Furniture (including Fixtures) Manufacturing	Office Furniture (including Fixtures) Manufacturing	Showcase, Partition, Shelving, and Locker Manufacturing
337910	Manufacturing	Furniture and Related Product Manufacturing	Other Furniture Related Product Manufacturing	Mattress Manufacturing	Mattress Manufacturing
337920	Manufacturing	Furniture and Related Product Manufacturing	Other Furniture Related Product Manufacturing	Blind and Shade Manufacturing	Blind and Shade Manufacturing
339111	Manufacturing	Miscellaneous Manufacturing	Medical Equipment and Supplies Manufacturing	Medical Equipment and Supplies Manufacturing	Laboratory Apparatus and Furniture Manufacturing
339112	Manufacturing	Miscellaneous Manufacturing	Medical Equipment and Supplies Manufacturing	Medical Equipment and Supplies Manufacturing	Surgical and Medical Instrument Manufacturing
339113	Manufacturing	Miscellaneous Manufacturing	Medical Equipment and Supplies Manufacturing	Medical Equipment and Supplies Manufacturing	Surgical Appliance and Supplies Manufacturing
339114	Manufacturing	Miscellaneous Manufacturing	Medical Equipment and Supplies Manufacturing	Medical Equipment and Supplies Manufacturing	Dental Equipment and Supplies Manufacturing
339115	Manufacturing	Miscellaneous Manufacturing	Medical Equipment and Supplies Manufacturing	Medical Equipment and Supplies Manufacturing	Ophthalmic Goods Manufacturing
339116	Manufacturing	Miscellaneous Manufacturing	Medical Equipment and Supplies Manufacturing	Medical Equipment and Supplies Manufacturing	Dental Laboratories
339911	Manufacturing	Miscellaneous Manufacturing	Other Miscellaneous Manufacturing	Jewelry and Silverware Manufacturing	Jewelry (except Costume) Manufacturing
339912	Manufacturing	Miscellaneous Manufacturing	Other Miscellaneous Manufacturing	Jewelry and Silverware Manufacturing	Silverware and Hollowware Manufacturing

339913	Manufacturing	Miscellaneous Manufacturing	Other Miscellaneous Manufacturing	Jewelry and Silverware Manufacturing	Jewelers' Material and Lapidary Work Manufacturing
339914	Manufacturing	Miscellaneous Manufacturing	Other Miscellaneous Manufacturing	Jewelry and Silverware Manufacturing	Costume Jewelry and Novelty Manufacturing
339920	Manufacturing	Miscellaneous Manufacturing	Other Miscellaneous Manufacturing	Sporting and Athletic Goods Manufacturing	Sporting and Athletic Goods Manufacturing
339931	Manufacturing	Miscellaneous Manufacturing	Other Miscellaneous Manufacturing	Doll, Toy, and Game Manufacturing	Doll and Stuffed Toy Manufacturing
339932	Manufacturing	Miscellaneous Manufacturing	Other Miscellaneous Manufacturing	Doll, Toy, and Game Manufacturing	Game, Toy, and Children's Vehicle Manufacturing
339941	Manufacturing	Miscellaneous Manufacturing	Other Miscellaneous Manufacturing	Office Supplies (except Paper) Manufacturing	Pen and Mechanical Pencil Manufacturing
339942	Manufacturing	Miscellaneous Manufacturing	Other Miscellaneous Manufacturing	Office Supplies (except Paper) Manufacturing	Lead Pencil and Art Good Manufacturing
339943	Manufacturing	Miscellaneous Manufacturing	Other Miscellaneous Manufacturing	Office Supplies (except Paper) Manufacturing	Marking Device Manufacturing
339944	Manufacturing	Miscellaneous Manufacturing	Other Miscellaneous Manufacturing	Office Supplies (except Paper) Manufacturing	Carbon Paper and Inked Ribbon Manufacturing
339950	Manufacturing	Miscellaneous Manufacturing	Other Miscellaneous Manufacturing	Sign Manufacturing	Sign Manufacturing
339991	Manufacturing	Miscellaneous Manufacturing	Other Miscellaneous Manufacturing	All Other Miscellaneous Manufacturing	Gasket, Packing, and Sealing Device Manufacturing
339992	Manufacturing	Miscellaneous Manufacturing	Other Miscellaneous Manufacturing	All Other Miscellaneous Manufacturing	Musical Instrument Manufacturing
339993	Manufacturing	Miscellaneous Manufacturing	Other Miscellaneous Manufacturing	All Other Miscellaneous Manufacturing	Fastener, Button, Needle, and Pin Manufacturing
339994	Manufacturing	Miscellaneous Manufacturing	Other Miscellaneous Manufacturing	All Other Miscellaneous Manufacturing	Broom, Brush, and Mop Manufacturing
339995	Manufacturing	Miscellaneous Manufacturing	Other Miscellaneous Manufacturing	All Other Miscellaneous Manufacturing	Burial Casket Manufacturing
339999	Manufacturing	Miscellaneous Manufacturing	Other Miscellaneous Manufacturing	All Other Miscellaneous Manufacturing	All Other Miscellaneous Manufacturing
423110	Wholesale Trade	Merchant Wholesalers, Durable Goods	Motor Vehicle and Motor Vehicle Parts and Supplies Merchant Wholesalers	Automobile and Other Motor Vehicle Merchant Wholesalers	Automobile and Other Motor Vehicle Merchant Wholesalers
423120	Wholesale Trade	Merchant Wholesalers, Durable Goods	Motor Vehicle and Motor Vehicle Parts and Supplies Merchant Wholesalers	Motor Vehicle Supplies and New Parts Merchant Wholesalers	Motor Vehicle Supplies and New Parts Merchant Wholesalers
423130	Wholesale Trade	Merchant Wholesalers, Durable Goods	Motor Vehicle and Motor Vehicle Parts and Supplies Merchant Wholesalers	Tire and Tube Merchant Wholesalers	Tire and Tube Merchant Wholesalers

423140	Wholesale Trade	Merchant Wholesalers, Durable Goods	Motor Vehicle and Motor Vehicle Parts and Supplies Merchant Wholesalers	Motor Vehicle Parts (Used) Merchant Wholesalers	Motor Vehicle Parts (Used) Merchant Wholesalers
423210	Wholesale Trade	Merchant Wholesalers, Durable Goods	Furniture and Home Furnishing Merchant Wholesalers	Furniture Merchant Wholesalers	Furniture Merchant Wholesalers
423220	Wholesale Trade	Merchant Wholesalers, Durable Goods	Furniture and Home Furnishing Merchant Wholesalers	Home Furnishing Merchant Wholesalers	Home Furnishing Merchant Wholesalers
423310	Wholesale Trade	Merchant Wholesalers, Durable Goods	Lumber and Other Construction Materials Merchant Wholesalers	Lumber, Plywood, Millwork, and Wood Panel Merchant Wholesalers	Lumber, Plywood, Millwork, and Wood Panel Merchant Wholesalers
423320	Wholesale Trade	Merchant Wholesalers, Durable Goods	Lumber and Other Construction Materials Merchant Wholesalers	Brick, Stone, and Related Construction Material Merchant Wholesalers	Brick, Stone, and Related Construction Material Merchant Wholesalers
423330	Wholesale Trade	Merchant Wholesalers, Durable Goods	Lumber and Other Construction Materials Merchant Wholesalers	Roofing, Siding, and Insulation Material Merchant Wholesalers	Roofing, Siding, and Insulation Material Merchant Wholesalers
423390	Wholesale Trade	Merchant Wholesalers, Durable Goods	Lumber and Other Construction Materials Merchant Wholesalers	Other Construction Material Merchant Wholesalers	Other Construction Material Merchant Wholesalers
423410	Wholesale Trade	Merchant Wholesalers, Durable Goods	Professional and Commercial Equipment and Supplies Merchant Wholesalers	Photographic Equipment and Supplies Merchant Wholesalers	Photographic Equipment and Supplies Merchant Wholesalers
423420	Wholesale Trade	Merchant Wholesalers, Durable Goods	Professional and Commercial Equipment and Supplies Merchant Wholesalers	Office Equipment Merchant Wholesalers	Office Equipment Merchant Wholesalers
423430	Wholesale Trade	Merchant Wholesalers, Durable Goods	Professional and Commercial Equipment and Supplies Merchant Wholesalers	Computer and Computer Peripheral Equipment and Software Merchant Wholesalers	Computer and Computer Peripheral Equipment and Software Merchant Wholesalers
423440	Wholesale Trade	Merchant Wholesalers, Durable Goods	Professional and Commercial Equipment and Supplies Merchant Wholesalers	Other Commercial Equipment Merchant Wholesalers	Other Commercial Equipment Merchant Wholesalers
423450	Wholesale Trade	Merchant Wholesalers, Durable Goods	Professional and Commercial Equipment and Supplies Merchant Wholesalers	Medical, Dental, and Hospital Equipment and Supplies Merchant Wholesalers	Medical, Dental, and Hospital Equipment and Supplies Merchant Wholesalers
423460	Wholesale Trade	Merchant Wholesalers, Durable Goods	Professional and Commercial Equipment and Supplies Merchant Wholesalers	Ophthalmic Goods Merchant Wholesalers	Ophthalmic Goods Merchant Wholesalers

423490	Wholesale Trade	Merchant Wholesalers, Durable Goods	Professional and Commercial Equipment and Supplies Merchant Wholesalers	Other Professional Equipment and Supplies Merchant Wholesalers	Other Professional Equipment and Supplies Merchant Wholesalers
423510	Wholesale Trade	Merchant Wholesalers, Durable Goods	Metal and Mineral (except Petroleum) Merchant Wholesalers	Metal Service Centers and Other Metal Merchant Wholesalers	Metal Service Centers and Other Metal Merchant Wholesalers
423520	Wholesale Trade	Merchant Wholesalers, Durable Goods	Metal and Mineral (except Petroleum) Merchant Wholesalers	Coal and Other Mineral and Ore Merchant Wholesalers	Coal and Other Mineral and Ore Merchant Wholesalers
423610	Wholesale Trade	Merchant Wholesalers, Durable Goods	Electrical and Electronic Goods Merchant Wholesalers	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers
423620	Wholesale Trade	Merchant Wholesalers, Durable Goods	Electrical and Electronic Goods Merchant Wholesalers	Electrical and Electronic Appliance, Television, and Radio Set Merchant Wholesalers	Electrical and Electronic Appliance, Television, and Radio Set Merchant Wholesalers
423690	Wholesale Trade	Merchant Wholesalers, Durable Goods	Electrical and Electronic Goods Merchant Wholesalers	Other Electronic Parts and Equipment Merchant Wholesalers	Other Electronic Parts and Equipment Merchant Wholesalers
423710	Wholesale Trade	Merchant Wholesalers, Durable Goods	Hardware, and Plumbing and Heating Equipment and Supplies Merchant Wholesalers	Hardware Merchant Wholesalers	Hardware Merchant Wholesalers
423720	Wholesale Trade	Merchant Wholesalers, Durable Goods	Hardware, and Plumbing and Heating Equipment and Supplies Merchant Wholesalers	Plumbing and Heating Equipment and Supplies (Hydronics) Merchant Wholesalers	Plumbing and Heating Equipment and Supplies (Hydronics) Merchant Wholesalers
423730	Wholesale Trade	Merchant Wholesalers, Durable Goods	Hardware, and Plumbing and Heating Equipment and Supplies Merchant Wholesalers	Warm Air Heating and Air-Conditioning Equipment and Supplies Merchant Wholesalers	Warm Air Heating and Air-Conditioning Equipment and Supplies Merchant Wholesalers
423740	Wholesale Trade	Merchant Wholesalers, Durable Goods	Hardware, and Plumbing and Heating Equipment and Supplies Merchant Wholesalers	Refrigeration Equipment and Supplies Merchant Wholesalers	Refrigeration Equipment and Supplies Merchant Wholesalers
423810	Wholesale Trade	Merchant Wholesalers, Durable Goods	Machinery, Equipment, and Supplies Merchant Wholesalers	Construction and Mining (except Oil Well) Machinery and Equipment Merchant Wholesalers	Construction and Mining (except Oil Well) Machinery and Equipment Merchant Wholesalers

423820	Wholesale Trade	Merchant Wholesalers, Durable Goods	Machinery, Equipment, and Supplies Merchant Wholesalers	Farm and Garden Machinery and Equipment Merchant Wholesalers	Farm and Garden Machinery and Equipment Merchant Wholesalers
423830	Wholesale Trade	Merchant Wholesalers, Durable Goods	Machinery, Equipment, and Supplies Merchant Wholesalers	Industrial Machinery and Equipment Merchant Wholesalers	Industrial Machinery and Equipment Merchant Wholesalers
423840	Wholesale Trade	Merchant Wholesalers, Durable Goods	Machinery, Equipment, and Supplies Merchant Wholesalers	Industrial Supplies Merchant Wholesalers	Industrial Supplies Merchant Wholesalers
423850	Wholesale Trade	Merchant Wholesalers, Durable Goods	Machinery, Equipment, and Supplies Merchant Wholesalers	Service Establishment Equipment and Supplies Merchant Wholesalers	Service Establishment Equipment and Supplies Merchant Wholesalers
423860	Wholesale Trade	Merchant Wholesalers, Durable Goods	Machinery, Equipment, and Supplies Merchant Wholesalers	Transportation Equipment and Supplies (except Motor Vehicle) Merchant Wholesalers	Transportation Equipment and Supplies (except Motor Vehicle) Merchant Wholesalers
423910	Wholesale Trade	Merchant Wholesalers, Durable Goods	Miscellaneous Durable Goods Merchant Wholesalers	Sporting and Recreational Goods and Supplies Merchant Wholesalers	Sporting and Recreational Goods and Supplies Merchant Wholesalers
423920	Wholesale Trade	Merchant Wholesalers, Durable Goods	Miscellaneous Durable Goods Merchant Wholesalers	Toy and Hobby Goods and Supplies Merchant Wholesalers	Toy and Hobby Goods and Supplies Merchant Wholesalers
423930	Wholesale Trade	Merchant Wholesalers, Durable Goods	Miscellaneous Durable Goods Merchant Wholesalers	Recyclable Material Merchant Wholesalers	Recyclable Material Merchant Wholesalers
423940	Wholesale Trade	Merchant Wholesalers, Durable Goods	Miscellaneous Durable Goods Merchant Wholesalers	Jewelry, Watch, Precious Stone, and Precious Metal Merchant Wholesalers	Jewelry, Watch, Precious Stone, and Precious Metal Merchant Wholesalers
423990	Wholesale Trade	Merchant Wholesalers, Durable Goods	Miscellaneous Durable Goods Merchant Wholesalers	Other Miscellaneous Durable Goods Merchant Wholesalers	Other Miscellaneous Durable Goods Merchant Wholesalers
424110	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Paper and Paper Product Merchant Wholesalers	Printing and Writing Paper Merchant Wholesalers	Printing and Writing Paper Merchant Wholesalers
424120	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Paper and Paper Product Merchant Wholesalers	Stationery and Office Supplies Merchant Wholesalers	Stationery and Office Supplies Merchant Wholesalers
424130	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Paper and Paper Product Merchant Wholesalers	Industrial and Personal Service Paper Merchant Wholesalers	Industrial and Personal Service Paper Merchant Wholesalers
424210	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Drugs and Druggists' Sundries Merchant Wholesalers	Drugs and Druggists' Sundries Merchant Wholesalers	Drugs and Druggists' Sundries Merchant Wholesalers
424310	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Apparel, Piece Goods, and Notions Merchant Wholesalers	Piece Goods, Notions, and Other Dry Goods Merchant Wholesalers	Piece Goods, Notions, and Other Dry Goods Merchant Wholesalers

424320	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Apparel, Piece Goods, and Notions Merchant Wholesalers	Men's and Boys' Clothing and Furnishings Merchant Wholesalers	Men's and Boys' Clothing and Furnishings Merchant Wholesalers
424330	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Apparel, Piece Goods, and Notions Merchant Wholesalers	Women's, Children's, and Infants' Clothing and Accessories Merchant Wholesalers	Women's, Children's, and Infants' Clothing and Accessories Merchant Wholesalers
424340	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Apparel, Piece Goods, and Notions Merchant Wholesalers	Footwear Merchant Wholesalers	Footwear Merchant Wholesalers
424410	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Grocery and Related Product Wholesalers	General Line Grocery Merchant Wholesalers	General Line Grocery Merchant Wholesalers
424420	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Grocery and Related Product Wholesalers	Packaged Frozen Food Merchant Wholesalers	Packaged Frozen Food Merchant Wholesalers
424430	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Grocery and Related Product Wholesalers	Dairy Product (except Dried or Canned) Merchant Wholesalers	Dairy Product (except Dried or Canned) Merchant Wholesalers
424440	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Grocery and Related Product Wholesalers	Poultry and Poultry Product Merchant Wholesalers	Poultry and Poultry Product Merchant Wholesalers
424450	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Grocery and Related Product Wholesalers	Confectionery Merchant Wholesalers	Confectionery Merchant Wholesalers
424460	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Grocery and Related Product Wholesalers	Fish and Seafood Merchant Wholesalers	Fish and Seafood Merchant Wholesalers
424470	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Grocery and Related Product Wholesalers	Meat and Meat Product Merchant Wholesalers	Meat and Meat Product Merchant Wholesalers
424480	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Grocery and Related Product Wholesalers	Fresh Fruit and Vegetable Merchant Wholesalers	Fresh Fruit and Vegetable Merchant Wholesalers
424490	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Grocery and Related Product Wholesalers	Other Grocery and Related Products Merchant Wholesalers	Other Grocery and Related Products Merchant Wholesalers
424510	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Farm Product Raw Material Merchant Wholesalers	Grain and Field Bean Merchant Wholesalers	Grain and Field Bean Merchant Wholesalers
424520	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Farm Product Raw Material Merchant Wholesalers	Livestock Merchant Wholesalers	Livestock Merchant Wholesalers
424590	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Farm Product Raw Material Merchant Wholesalers	Other Farm Product Raw Material Merchant Wholesalers	Other Farm Product Raw Material Merchant Wholesalers
424610	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Chemical and Allied Products Merchant Wholesalers	Plastics Materials and Basic Forms and Shapes Merchant Wholesalers	Plastics Materials and Basic Forms and Shapes Merchant Wholesalers
424690	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Chemical and Allied Products Merchant Wholesalers	Other Chemical and Allied Products Merchant Wholesalers	Other Chemical and Allied Products Merchant Wholesalers

424710	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Petroleum and Petroleum Products Merchant Wholesalers	Petroleum Bulk Stations and Terminals	Petroleum Bulk Stations and Terminals
424720	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Petroleum and Petroleum Products Merchant Wholesalers	Petroleum and Petroleum Products Merchant Wholesalers (except Bulk Stations and Terminals)	Petroleum and Petroleum Products Merchant Wholesalers (except Bulk Stations and Terminals)
424810	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Beer, Wine, and Distilled Alcoholic Beverage Merchant Wholesalers	Beer and Ale Merchant Wholesalers	Beer and Ale Merchant Wholesalers
424820	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Beer, Wine, and Distilled Alcoholic Beverage Merchant Wholesalers	Wine and Distilled Alcoholic Beverage Merchant Wholesalers	Wine and Distilled Alcoholic Beverage Merchant Wholesalers
424910	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Miscellaneous Nondurable Goods Merchant Wholesalers	Farm Supplies Merchant Wholesalers	Farm Supplies Merchant Wholesalers
424920	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Miscellaneous Nondurable Goods Merchant Wholesalers	Book, Periodical, and Newspaper Merchant Wholesalers	Book, Periodical, and Newspaper Merchant Wholesalers
424930	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Miscellaneous Nondurable Goods Merchant Wholesalers	Flower, Nursery Stock, and Florists' Supplies Merchant Wholesalers	Flower, Nursery Stock, and Florists' Supplies Merchant Wholesalers
424940	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Miscellaneous Nondurable Goods Merchant Wholesalers	Tobacco and Tobacco Product Merchant Wholesalers	Tobacco and Tobacco Product Merchant Wholesalers
424950	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Miscellaneous Nondurable Goods Merchant Wholesalers	Paint, Varnish, and Supplies Merchant Wholesalers	Paint, Varnish, and Supplies Merchant Wholesalers
424990	Wholesale Trade	Merchant Wholesalers, Nondurable Goods	Miscellaneous Nondurable Goods Merchant Wholesalers	Other Miscellaneous Nondurable Goods Merchant Wholesalers	Other Miscellaneous Nondurable Goods Merchant Wholesalers
425110	Wholesale Trade	Wholesale Electronic Markets and Agents and Brokers	Wholesale Electronic Markets and Agents and Brokers	Business to Business Electronic Markets	Business to Business Electronic Markets
425120	Wholesale Trade	Wholesale Electronic Markets and Agents and Brokers	Wholesale Electronic Markets and Agents and Brokers	Wholesale Trade Agents and Brokers	Wholesale Trade Agents and Brokers
441110	Retail Trade	Motor Vehicle and Parts Dealers	Automobile Dealers	New Car Dealers	New Car Dealers
441120	Retail Trade	Motor Vehicle and Parts Dealers	Automobile Dealers	Used Car Dealers	Used Car Dealers
441210	Retail Trade	Motor Vehicle and Parts Dealers	Other Motor Vehicle Dealers	Recreational Vehicle Dealers	Recreational Vehicle Dealers

441221	Retail Trade	Motor Vehicle and Parts Dealers	Other Motor Vehicle Dealers	Motorcycle, Boat, and Other Motor Vehicle Dealers	Motorcycle Dealers
441222	Retail Trade	Motor Vehicle and Parts Dealers	Other Motor Vehicle Dealers	Motorcycle, Boat, and Other Motor Vehicle Dealers	Boat Dealers
441229	Retail Trade	Motor Vehicle and Parts Dealers	Other Motor Vehicle Dealers	Motorcycle, Boat, and Other Motor Vehicle Dealers	All Other Motor Vehicle Dealers
441310	Retail Trade	Motor Vehicle and Parts Dealers	Automotive Parts, Accessories, and Tire Stores	Automotive Parts and Accessories Stores	Automotive Parts and Accessories Stores
441320	Retail Trade	Motor Vehicle and Parts Dealers	Automotive Parts, Accessories, and Tire Stores	Tire Dealers	Tire Dealers
442110	Retail Trade	Furniture and Home Furnishings Stores	Furniture Stores	Furniture Stores	Furniture Stores
442210	Retail Trade	Furniture and Home Furnishings Stores	Home Furnishings Stores	Floor Covering Stores	Floor Covering Stores
442291	Retail Trade	Furniture and Home Furnishings Stores	Home Furnishings Stores	Other Home Furnishings Stores	Window Treatment Stores
442299	Retail Trade	Furniture and Home Furnishings Stores	Home Furnishings Stores	Other Home Furnishings Stores	All Other Home Furnishings Stores
443111	Retail Trade	Electronics and Appliance Stores	Electronics and Appliance Stores	Appliance, Television, and Other Electronics Stores	Household Appliance Stores
443112	Retail Trade	Electronics and Appliance Stores	Electronics and Appliance Stores	Appliance, Television, and Other Electronics Stores	Radio, Television, and Other Electronics Stores
443120	Retail Trade	Electronics and Appliance Stores	Electronics and Appliance Stores	Computer and Software Stores	Computer and Software Stores
443130	Retail Trade	Electronics and Appliance Stores	Electronics and Appliance Stores	Camera and Photographic Supplies Stores	Camera and Photographic Supplies Stores
444110	Retail Trade	Building Material and Garden Equipment and Supplies Dealers	Building Material and Supplies Dealers	Home Centers	Home Centers
444120	Retail Trade	Building Material and Garden Equipment and Supplies Dealers	Building Material and Supplies Dealers	Paint and Wallpaper Stores	Paint and Wallpaper Stores
444130	Retail Trade	Building Material and Garden Equipment and Supplies Dealers	Building Material and Supplies Dealers	Hardware Stores	Hardware Stores
444190	Retail Trade	Building Material and Garden Equipment and Supplies Dealers	Building Material and Supplies Dealers	Other Building Material Dealers	Other Building Material Dealers
444210	Retail Trade	Building Material and Garden Equipment and Supplies Dealers	Lawn and Garden Equipment and Supplies Stores	Outdoor Power Equipment Stores	Outdoor Power Equipment Stores

444220	Retail Trade	Building Material and Garden Equipment and Supplies Dealers	Lawn and Garden Equipment and Supplies Stores	Nursery, Garden Center, and Farm Supply Stores	Nursery, Garden Center, and Farm Supply Stores
445110	Retail Trade	Food and Beverage Stores	Grocery Stores	Supermarkets and Other Grocery (except Convenience) Stores	Supermarkets and Other Grocery (except Convenience) Stores
445120	Retail Trade	Food and Beverage Stores	Grocery Stores	Convenience Stores	Convenience Stores
445210	Retail Trade	Food and Beverage Stores	Specialty Food Stores	Meat Markets	Meat Markets
445220	Retail Trade	Food and Beverage Stores	Specialty Food Stores	Fish and Seafood Markets	Fish and Seafood Markets
445230	Retail Trade	Food and Beverage Stores	Specialty Food Stores	Fruit and Vegetable Markets	Fruit and Vegetable Markets
445291	Retail Trade	Food and Beverage Stores	Specialty Food Stores	Other Specialty Food Stores	Baked Goods Stores
445292	Retail Trade	Food and Beverage Stores	Specialty Food Stores	Other Specialty Food Stores	Confectionery and Nut Stores
445299	Retail Trade	Food and Beverage Stores	Specialty Food Stores	Other Specialty Food Stores	All Other Specialty Food Stores
445310	Retail Trade	Food and Beverage Stores	Beer, Wine, and Liquor Stores	Beer, Wine, and Liquor Stores	Beer, Wine, and Liquor Stores
446110	Retail Trade	Health and Personal Care Stores	Health and Personal Care Stores	Pharmacies and Drug Stores	Pharmacies and Drug Stores
446120	Retail Trade	Health and Personal Care Stores	Health and Personal Care Stores	Cosmetics, Beauty Supplies, and Perfume Stores	Cosmetics, Beauty Supplies, and Perfume Stores
446130	Retail Trade	Health and Personal Care Stores	Health and Personal Care Stores	Optical Goods Stores	Optical Goods Stores
446191	Retail Trade	Health and Personal Care Stores	Health and Personal Care Stores	Other Health and Personal Care Stores	Food (Health) Supplement Stores
446199	Retail Trade	Health and Personal Care Stores	Health and Personal Care Stores	Other Health and Personal Care Stores	All Other Health and Personal Care Stores
447110	Retail Trade	Gasoline Stations	Gasoline Stations	Gasoline Stations with Convenience Stores	Gasoline Stations with Convenience Stores
447190	Retail Trade	Gasoline Stations	Gasoline Stations	Other Gasoline Stations	Other Gasoline Stations
448110	Retail Trade	Clothing and Clothing Accessories Stores	Clothing Stores	Men's Clothing Stores	Men's Clothing Stores
448120	Retail Trade	Clothing and Clothing Accessories Stores	Clothing Stores	Women's Clothing Stores	Women's Clothing Stores
448130	Retail Trade	Clothing and Clothing Accessories Stores	Clothing Stores	Children's and Infants' Clothing Stores	Children's and Infants' Clothing Stores

448140	Retail Trade	Clothing and Clothing Accessories Stores	Clothing Stores	Family Clothing Stores	Family Clothing Stores
448150	Retail Trade	Clothing and Clothing Accessories Stores	Clothing Stores	Clothing Accessories Stores	Clothing Accessories Stores
448190	Retail Trade	Clothing and Clothing Accessories Stores	Clothing Stores	Other Clothing Stores	Other Clothing Stores
448210	Retail Trade	Clothing and Clothing Accessories Stores	Shoe Stores	Shoe Stores	Shoe Stores
448310	Retail Trade	Clothing and Clothing Accessories Stores	Jewelry, Luggage, and Leather Goods Stores	Jewelry Stores	Jewelry Stores
448320	Retail Trade	Clothing and Clothing Accessories Stores	Jewelry, Luggage, and Leather Goods Stores	Luggage and Leather Goods Stores	Luggage and Leather Goods Stores
451110	Retail Trade	Sporting Goods, Hobby, Book, and Music Stores	Sporting Goods, Hobby, and Musical Instrument Stores	Sporting Goods Stores	Sporting Goods Stores
451120	Retail Trade	Sporting Goods, Hobby, Book, and Music Stores	Sporting Goods, Hobby, and Musical Instrument Stores	Hobby, Toy, and Game Stores	Hobby, Toy, and Game Stores
451130	Retail Trade	Sporting Goods, Hobby, Book, and Music Stores	Sporting Goods, Hobby, and Musical Instrument Stores	Sewing, Needlework, and Piece Goods Stores	Sewing, Needlework, and Piece Goods Stores
451140	Retail Trade	Sporting Goods, Hobby, Book, and Music Stores	Sporting Goods, Hobby, and Musical Instrument Stores	Musical Instrument and Supplies Stores	Musical Instrument and Supplies Stores
451211	Retail Trade	Sporting Goods, Hobby, Book, and Music Stores	Book, Periodical, and Music Stores	Book Stores and News Dealers	Book Stores
451212	Retail Trade	Sporting Goods, Hobby, Book, and Music Stores	Book, Periodical, and Music Stores	Book Stores and News Dealers	News Dealers and Newsstands
451220	Retail Trade	Sporting Goods, Hobby, Book, and Music Stores	Book, Periodical, and Music Stores	Prerecorded Tape, Compact Disc, and Record Stores	Prerecorded Tape, Compact Disc, and Record Stores
452110	Retail Trade	General Merchandise Stores	Department Stores	Department Stores	Department Stores
452111	Retail Trade	General Merchandise Stores	Department Stores	Department Stores	Department Stores (except Discount Department Stores)
452112	Retail Trade	General Merchandise Stores	Department Stores	Department Stores	Discount Department Stores
452910	Retail Trade	General Merchandise Stores	Other General Merchandise Stores	Warehouse Clubs and Supercenters	Warehouse Clubs and Supercenters

452990	Retail Trade	General Merchandise Stores	Other General Merchandise Stores	All Other General Merchandise Stores	All Other General Merchandise Stores
453110	Retail Trade	Miscellaneous Store Retailers	Florists	Florists	Florists
453210	Retail Trade	Miscellaneous Store Retailers	Office Supplies, Stationery, and Gift Stores	Office Supplies and Stationery Stores	Office Supplies and Stationery Stores
453220	Retail Trade	Miscellaneous Store Retailers	Office Supplies, Stationery, and Gift Stores	Gift, Novelty, and Souvenir Stores	Gift, Novelty, and Souvenir Stores
453310	Retail Trade	Miscellaneous Store Retailers	Used Merchandise Stores	Used Merchandise Stores	Used Merchandise Stores
453910	Retail Trade	Miscellaneous Store Retailers	Other Miscellaneous Store Retailers	Pet and Pet Supplies Stores	Pet and Pet Supplies Stores
453920	Retail Trade	Miscellaneous Store Retailers	Other Miscellaneous Store Retailers	Art Dealers	Art Dealers
453930	Retail Trade	Miscellaneous Store Retailers	Other Miscellaneous Store Retailers	Manufactured (Mobile) Home Dealers	Manufactured (Mobile) Home Dealers
453991	Retail Trade	Miscellaneous Store Retailers	Other Miscellaneous Store Retailers	All Other Miscellaneous Store Retailers	Tobacco Stores
453998	Retail Trade	Miscellaneous Store Retailers	Other Miscellaneous Store Retailers	All Other Miscellaneous Store Retailers	All Other Miscellaneous Store Retailers (except Tobacco Stores)
454110	Retail Trade	Nonstore Retailers	Electronic Shopping and Mail-Order Houses	Electronic Shopping and Mail-Order Houses	Electronic Shopping and Mail-Order Houses
454111	Retail Trade	Nonstore Retailers	Electronic Shopping and Mail-Order Houses	Electronic Shopping and Mail-Order Houses	Electronic Shopping
454112	Retail Trade	Nonstore Retailers	Electronic Shopping and Mail-Order Houses	Electronic Shopping and Mail-Order Houses	Electronic Auctions
454113	Retail Trade	Nonstore Retailers	Electronic Shopping and Mail-Order Houses	Electronic Shopping and Mail-Order Houses	Mail-Order Houses
454210	Retail Trade	Nonstore Retailers	Vending Machine Operators	Vending Machine Operators	Vending Machine Operators
454311	Retail Trade	Nonstore Retailers	Direct Selling Establishments	Fuel Dealers	Heating Oil Dealers
454312	Retail Trade	Nonstore Retailers	Direct Selling Establishments	Fuel Dealers	Liquefied Petroleum Gas (Bottled Gas) Dealers
454319	Retail Trade	Nonstore Retailers	Direct Selling Establishments	Fuel Dealers	Other Fuel Dealers
454390	Retail Trade	Nonstore Retailers	Direct Selling Establishments	Other Direct Selling Establishments	Other Direct Selling Establishments
481111	Transportation and Warehousing	Air Transportation	Scheduled Air Transportation	Scheduled Air Transportation	Scheduled Passenger Air Transportation
481112	Transportation and Warehousing	Air Transportation	Scheduled Air Transportation	Scheduled Air Transportation	Scheduled Freight Air Transportation

481211	Transportation and Warehousing	Air Transportation	Nonscheduled Air Transportation	Nonscheduled Air Transportation	Nonscheduled Chartered Passenger Air Transportation
481212	Transportation and Warehousing	Air Transportation	Nonscheduled Air Transportation	Nonscheduled Air Transportation	Nonscheduled Chartered Freight Air Transportation
481219	Transportation and Warehousing	Air Transportation	Nonscheduled Air Transportation	Nonscheduled Air Transportation	Other Nonscheduled Air Transportation
482111	Transportation and Warehousing	Rail Transportation	Rail Transportation	Rail Transportation	Line-Haul Railroads
482112	Transportation and Warehousing	Rail Transportation	Rail Transportation	Rail Transportation	Short Line Railroads
483111	Transportation and Warehousing	Water Transportation	Deep Sea, Coastal, and Great Lakes Water Transportation	Deep Sea, Coastal, and Great Lakes Water Transportation	Deep Sea Freight Transportation
483112	Transportation and Warehousing	Water Transportation	Deep Sea, Coastal, and Great Lakes Water Transportation	Deep Sea, Coastal, and Great Lakes Water Transportation	Deep Sea Passenger Transportation
483113	Transportation and Warehousing	Water Transportation	Deep Sea, Coastal, and Great Lakes Water Transportation	Deep Sea, Coastal, and Great Lakes Water Transportation	Coastal and Great Lakes Freight Transportation
483114	Transportation and Warehousing	Water Transportation	Deep Sea, Coastal, and Great Lakes Water Transportation	Deep Sea, Coastal, and Great Lakes Water Transportation	Coastal and Great Lakes Passenger Transportation
483211	Transportation and Warehousing	Water Transportation	Inland Water Transportation	Inland Water Transportation	Inland Water Freight Transportation
483212	Transportation and Warehousing	Water Transportation	Inland Water Transportation	Inland Water Transportation	Inland Water Passenger Transportation
484110	Transportation and Warehousing	Truck Transportation	General Freight Trucking	General Freight Trucking, Local	General Freight Trucking, Local
484121	Transportation and Warehousing	Truck Transportation	General Freight Trucking	General Freight Trucking, Long-Distance	General Freight Trucking, Long-Distance, Truckload
484122	Transportation and Warehousing	Truck Transportation	General Freight Trucking	General Freight Trucking, Long-Distance	General Freight Trucking, Long-Distance, Less Than Truckload
484210	Transportation and Warehousing	Truck Transportation	Specialized Freight Trucking	Used Household and Office Goods Moving	Used Household and Office Goods Moving
484220	Transportation and Warehousing	Truck Transportation	Specialized Freight Trucking	Specialized Freight (except Used Goods) Trucking, Local	Specialized Freight (except Used Goods) Trucking, Local
484230	Transportation and Warehousing	Truck Transportation	Specialized Freight Trucking	Specialized Freight (except Used Goods) Trucking, Long-Distance	Specialized Freight (except Used Goods) Trucking, Long-Distance
485111	Transportation and Warehousing	Transit and Ground Passenger Transportation	Urban Transit Systems	Urban Transit Systems	Mixed Mode Transit Systems

485112	Transportation and Warehousing	Transit and Ground Passenger Transportation	Urban Transit Systems	Urban Transit Systems	Commuter Rail Systems
485113	Transportation and Warehousing	Transit and Ground Passenger Transportation	Urban Transit Systems	Urban Transit Systems	Bus and Other Motor Vehicle Transit Systems
485119	Transportation and Warehousing	Transit and Ground Passenger Transportation	Urban Transit Systems	Urban Transit Systems	Other Urban Transit Systems
485210	Transportation and Warehousing	Transit and Ground Passenger Transportation	Interurban and Rural Bus Transportation	Interurban and Rural Bus Transportation	Interurban and Rural Bus Transportation
485310	Transportation and Warehousing	Transit and Ground Passenger Transportation	Taxi and Limousine Service	Taxi Service	Taxi Service
485320	Transportation and Warehousing	Transit and Ground Passenger Transportation	Taxi and Limousine Service	Limousine Service	Limousine Service
485410	Transportation and Warehousing	Transit and Ground Passenger Transportation	School and Employee Bus Transportation	School and Employee Bus Transportation	School and Employee Bus Transportation
485510	Transportation and Warehousing	Transit and Ground Passenger Transportation	Charter Bus Industry	Charter Bus Industry	Charter Bus Industry
485991	Transportation and Warehousing	Transit and Ground Passenger Transportation	Other Transit and Ground Passenger Transportation	Other Transit and Ground Passenger Transportation	Special Needs Transportation
485999	Transportation and Warehousing	Transit and Ground Passenger Transportation	Other Transit and Ground Passenger Transportation	Other Transit and Ground Passenger Transportation	All Other Transit and Ground Passenger Transportation
486110	Transportation and Warehousing	Pipeline Transportation	Pipeline Transportation of Crude Oil	Pipeline Transportation of Crude Oil	Pipeline Transportation of Crude Oil
486210	Transportation and Warehousing	Pipeline Transportation	Pipeline Transportation of Natural Gas	Pipeline Transportation of Natural Gas	Pipeline Transportation of Natural Gas
486910	Transportation and Warehousing	Pipeline Transportation	Other Pipeline Transportation	Pipeline Transportation of Refined Petroleum Products	Pipeline Transportation of Refined Petroleum Products
486990	Transportation and Warehousing	Pipeline Transportation	Other Pipeline Transportation	All Other Pipeline Transportation	All Other Pipeline Transportation
487110	Transportation and Warehousing	Scenic and Sightseeing Transportation	Scenic and Sightseeing Transportation, Land	Scenic and Sightseeing Transportation, Land	Scenic and Sightseeing Transportation, Land

487210	Transportation and Warehousing	Scenic and Sightseeing Transportation	Scenic and Sightseeing Transportation, Water	Scenic and Sightseeing Transportation, Water	Scenic and Sightseeing Transportation, Water
487990	Transportation and Warehousing	Scenic and Sightseeing Transportation	Scenic and Sightseeing Transportation, Other	Scenic and Sightseeing Transportation, Other	Scenic and Sightseeing Transportation, Other
488111	Transportation and Warehousing	Support Activities for Transportation	Support Activities for Air Transportation	Airport Operations	Air Traffic Control
488119	Transportation and Warehousing	Support Activities for Transportation	Support Activities for Air Transportation	Airport Operations	Other Airport Operations
488190	Transportation and Warehousing	Support Activities for Transportation	Support Activities for Air Transportation	Other Support Activities for Air Transportation	Other Support Activities for Air Transportation
488210	Transportation and Warehousing	Support Activities for Transportation	Support Activities for Rail Transportation	Support Activities for Rail Transportation	Support Activities for Rail Transportation
488310	Transportation and Warehousing	Support Activities for Transportation	Support Activities for Water Transportation	Port and Harbor Operations	Port and Harbor Operations
488320	Transportation and Warehousing	Support Activities for Transportation	Support Activities for Water Transportation	Marine Cargo Handling	Marine Cargo Handling
488330	Transportation and Warehousing	Support Activities for Transportation	Support Activities for Water Transportation	Navigational Services to Shipping	Navigational Services to Shipping
488390	Transportation and Warehousing	Support Activities for Transportation	Support Activities for Water Transportation	Other Support Activities for Water Transportation	Other Support Activities for Water Transportation
488410	Transportation and Warehousing	Support Activities for Transportation	Support Activities for Road Transportation	Motor Vehicle Towing	Motor Vehicle Towing
488490	Transportation and Warehousing	Support Activities for Transportation	Support Activities for Road Transportation	Other Support Activities for Road Transportation	Other Support Activities for Road Transportation
488510	Transportation and Warehousing	Support Activities for Transportation	Freight Transportation Arrangement	Freight Transportation Arrangement	Freight Transportation Arrangement
488991	Transportation and Warehousing	Support Activities for Transportation	Other Support Activities for Transportation	Other Support Activities for Transportation	Packing and Crating
488999	Transportation and Warehousing	Support Activities for Transportation	Other Support Activities for Transportation	Other Support Activities for Transportation	All Other Support Activities for Transportation
491110	Transportation and Warehousing	Postal Service	Postal Service	Postal Service	Postal Service
492110	Transportation and Warehousing	Couriers and Messengers	Couriers	Couriers	Couriers
492210	Transportation and Warehousing	Couriers and Messengers	Local Messengers and Local Delivery	Local Messengers and Local Delivery	Local Messengers and Local Delivery
493110	Transportation and Warehousing	Warehousing and Storage	Warehousing and Storage	General Warehousing and Storage	General Warehousing and Storage
493120	Transportation and Warehousing	Warehousing and Storage	Warehousing and Storage	Refrigerated Warehousing and Storage	Refrigerated Warehousing and Storage

493130	Transportation and Warehousing	Warehousing and Storage	Warehousing and Storage	Farm Product Warehousing and Storage	Farm Product Warehousing and Storage
493190	Transportation and Warehousing	Warehousing and Storage	Warehousing and Storage	Other Warehousing and Storage	Other Warehousing and Storage
511110	Information	Publishing Industries (except Internet)	Newspaper, Periodical, Book, and Directory Publishers	Newspaper Publishers	Newspaper Publishers
511120	Information	Publishing Industries (except Internet)	Newspaper, Periodical, Book, and Directory Publishers	Periodical Publishers	Periodical Publishers
511130	Information	Publishing Industries (except Internet)	Newspaper, Periodical, Book, and Directory Publishers	Book Publishers	Book Publishers
511140	Information	Publishing Industries (except Internet)	Newspaper, Periodical, Book, and Directory Publishers	Directory and Mailing List Publishers	Directory and Mailing List Publishers
511191	Information	Publishing Industries (except Internet)	Newspaper, Periodical, Book, and Directory Publishers	Other Publishers	Greeting Card Publishers
511199	Information	Publishing Industries (except Internet)	Newspaper, Periodical, Book, and Directory Publishers	Other Publishers	All Other Publishers
511210	Information	Publishing Industries (except Internet)	Software Publishers	Software Publishers	Software Publishers
512110	Information	Motion Picture and Sound Recording Industries	Motion Picture and Video Industries	Motion Picture and Video Production	Motion Picture and Video Production
512120	Information	Motion Picture and Sound Recording Industries	Motion Picture and Video Industries	Motion Picture and Video Distribution	Motion Picture and Video Distribution
512131	Information	Motion Picture and Sound Recording Industries	Motion Picture and Video Industries	Motion Picture and Video Exhibition	Motion Picture Theaters (except Drive-Ins)
512132	Information	Motion Picture and Sound Recording Industries	Motion Picture and Video Industries	Motion Picture and Video Exhibition	Drive-In Motion Picture Theaters
512191	Information	Motion Picture and Sound Recording Industries	Motion Picture and Video Industries	Postproduction Services and Other Motion Picture and Video Industries	Teleproduction and Other Postproduction Services
512199	Information	Motion Picture and Sound Recording Industries	Motion Picture and Video Industries	Postproduction Services and Other Motion Picture and Video Industries	Other Motion Picture and Video Industries
512210	Information	Motion Picture and Sound Recording Industries	Sound Recording Industries	Record Production	Record Production

512220	Information	Motion Picture and Sound Recording Industries	Sound Recording Industries	Integrated Record Production/Distribution	Integrated Record Production/Distribution
512230	Information	Motion Picture and Sound Recording Industries	Sound Recording Industries	Music Publishers	Music Publishers
512240	Information	Motion Picture and Sound Recording Industries	Sound Recording Industries	Sound Recording Studios	Sound Recording Studios
512290	Information	Motion Picture and Sound Recording Industries	Sound Recording Industries	Other Sound Recording Industries	Other Sound Recording Industries
515111	Information	Broadcasting (except Internet)	Radio and Television Broadcasting	Radio Broadcasting	Radio Networks
515112	Information	Broadcasting (except Internet)	Radio and Television Broadcasting	Radio Broadcasting	Radio Stations
515120	Information	Broadcasting (except Internet)	Radio and Television Broadcasting	Television Broadcasting	Television Broadcasting
515210	Information	Broadcasting (except Internet)	Cable and Other Subscription Programming	Cable and Other Subscription Programming	Cable and Other Subscription Programming
516110	Information	Internet Publishing and Broadcasting	Internet Publishing and Broadcasting	Internet Publishing and Broadcasting	Internet Publishing and Broadcasting
517110	Information	Telecommunications	Wired Telecommunications Carriers	Wired Telecommunications Carriers	Wired Telecommunications Carriers
517211	Information	Telecommunications	Wireless Telecommunications Carriers (except Satellite)	Wireless Telecommunications Carriers (except Satellite)	Paging
517212	Information	Telecommunications	Wireless Telecommunications Carriers (except Satellite)	Wireless Telecommunications Carriers (except Satellite)	Cellular and Other Wireless Telecommunications
517310	Information	Telecommunications	Telecommunications Resellers	Telecommunications Resellers	Telecommunications Resellers
517410	Information	Telecommunications	Satellite Telecommunications	Satellite Telecommunications	Satellite Telecommunications
517510	Information	Telecommunications	Cable and Other Program Distribution	Cable and Other Program Distribution	Cable and Other Program Distribution
517910	Information	Telecommunications	Other Telecommunications	Other Telecommunications	Other Telecommunications
518111	Information	Internet Service Providers, Web Search Portals, and Data Processing Services	Internet Service Providers and Web Search Portals	Internet Service Providers and Web Search Portals	Internet Service Providers
518112	Information	Internet Service Providers, Web Search	Internet Service Providers and Web Search Portals	Internet Service Providers and Web Search Portals	Web Search Portals

		Portals, and Data Processing Services			
518210	Information	Internet Service Providers, Web Search Portals, and Data Processing Services	Data Processing, Hosting, and Related Services	Data Processing, Hosting, and Related Services	Data Processing, Hosting, and Related Services
519110	Information	Other Information Services	Other Information Services	News Syndicates	News Syndicates
519120	Information	Other Information Services	Other Information Services	Libraries and Archives	Libraries and Archives
519190	Information	Other Information Services	Other Information Services	All Other Information Services	All Other Information Services
521110	Finance and Insurance	Monetary Authorities - Central Bank	Monetary Authorities - Central Bank	Monetary Authorities - Central Bank	Monetary Authorities - Central Bank
522110	Finance and Insurance	Credit Intermediation and Related Activities	Depository Credit Intermediation	Commercial Banking	Commercial Banking
522120	Finance and Insurance	Credit Intermediation and Related Activities	Depository Credit Intermediation	Savings Institutions	Savings Institutions
522130	Finance and Insurance	Credit Intermediation and Related Activities	Depository Credit Intermediation	Credit Unions	Credit Unions
522190	Finance and Insurance	Credit Intermediation and Related Activities	Depository Credit Intermediation	Other Depository Credit Intermediation	Other Depository Credit Intermediation
522210	Finance and Insurance	Credit Intermediation and Related Activities	Nondepository Credit Intermediation	Credit Card Issuing	Credit Card Issuing
522220	Finance and Insurance	Credit Intermediation and Related Activities	Nondepository Credit Intermediation	Sales Financing	Sales Financing
522291	Finance and Insurance	Credit Intermediation and Related Activities	Nondepository Credit Intermediation	Other Nondepository Credit Intermediation	Consumer Lending
522292	Finance and Insurance	Credit Intermediation and Related Activities	Nondepository Credit Intermediation	Other Nondepository Credit Intermediation	Real Estate Credit
522293	Finance and Insurance	Credit Intermediation and Related Activities	Nondepository Credit Intermediation	Other Nondepository Credit Intermediation	International Trade Financing
522294	Finance and Insurance	Credit Intermediation and Related Activities	Nondepository Credit Intermediation	Other Nondepository Credit Intermediation	Secondary Market Financing
522298	Finance and Insurance	Credit Intermediation and Related Activities	Nondepository Credit Intermediation	Other Nondepository Credit Intermediation	All Other Nondepository Credit Intermediation
522310	Finance and Insurance	Credit Intermediation and Related Activities	Activities Related to Credit Intermediation	Mortgage and Nonmortgage Loan Brokers	Mortgage and Nonmortgage Loan Brokers
522320	Finance and Insurance	Credit Intermediation and Related Activities	Activities Related to Credit Intermediation	Financial Transactions Processing, Reserve, and Clearinghouse Activities	Financial Transactions Processing, Reserve, and Clearinghouse Activities

522390	Finance and Insurance	Credit Intermediation and Related Activities	Activities Related to Credit Intermediation	Other Activities Related to Credit Intermediation	Other Activities Related to Credit Intermediation
523110	Finance and Insurance	Securities, Commodity Contracts, and Other Financial Investments and Related Activities	Securities and Commodity Contracts Intermediation and Brokerage	Investment Banking and Securities Dealing	Investment Banking and Securities Dealing
523120	Finance and Insurance	Securities, Commodity Contracts, and Other Financial Investments and Related Activities	Securities and Commodity Contracts Intermediation and Brokerage	Securities Brokerage	Securities Brokerage
523130	Finance and Insurance	Securities, Commodity Contracts, and Other Financial Investments and Related Activities	Securities and Commodity Contracts Intermediation and Brokerage	Commodity Contracts Dealing	Commodity Contracts Dealing
523140	Finance and Insurance	Securities, Commodity Contracts, and Other Financial Investments and Related Activities	Securities and Commodity Contracts Intermediation and Brokerage	Commodity Contracts Brokerage	Commodity Contracts Brokerage
523210	Finance and Insurance	Securities, Commodity Contracts, and Other Financial Investments and Related Activities	Securities and Commodity Exchanges	Securities and Commodity Exchanges	Securities and Commodity Exchanges
523910	Finance and Insurance	Securities, Commodity Contracts, and Other Financial Investments and Related Activities	Other Financial Investment Activities	Miscellaneous Intermediation	Miscellaneous Intermediation
523920	Finance and Insurance	Securities, Commodity Contracts, and Other Financial Investments and Related Activities	Other Financial Investment Activities	Portfolio Management	Portfolio Management
523930	Finance and Insurance	Securities, Commodity Contracts, and Other Financial Investments and Related Activities	Other Financial Investment Activities	Investment Advice	Investment Advice
523991	Finance and Insurance	Securities, Commodity Contracts, and Other Financial Investments and Related Activities	Other Financial Investment Activities	All Other Financial Investment Activities	Trust, Fiduciary, and Custody Activities
523999	Finance and Insurance	Securities, Commodity Contracts, and Other	Other Financial Investment Activities	All Other Financial Investment Activities	Miscellaneous Financial Investment Activities

		Financial Investments and Related Activities			
524113	Finance and Insurance	Insurance Carriers and Related Activities	Insurance Carriers	Direct Life, Health, and Medical Insurance Carriers	Direct Life Insurance Carriers
524114	Finance and Insurance	Insurance Carriers and Related Activities	Insurance Carriers	Direct Life, Health, and Medical Insurance Carriers	Direct Health and Medical Insurance Carriers
524126	Finance and Insurance	Insurance Carriers and Related Activities	Insurance Carriers	Direct Insurance (except Life, Health, and Medical) Carriers	Direct Property and Casualty Insurance Carriers
524127	Finance and Insurance	Insurance Carriers and Related Activities	Insurance Carriers	Direct Insurance (except Life, Health, and Medical) Carriers	Direct Title Insurance Carriers
524128	Finance and Insurance	Insurance Carriers and Related Activities	Insurance Carriers	Direct Insurance (except Life, Health, and Medical) Carriers	Other Direct Insurance (except Life, Health, and Medical) Carriers
524130	Finance and Insurance	Insurance Carriers and Related Activities	Insurance Carriers	Reinsurance Carriers	Reinsurance Carriers
524210	Finance and Insurance	Insurance Carriers and Related Activities	Agencies, Brokerages, and Other Insurance Related Activities	Insurance Agencies and Brokerages	Insurance Agencies and Brokerages
524291	Finance and Insurance	Insurance Carriers and Related Activities	Agencies, Brokerages, and Other Insurance Related Activities	Other Insurance Related Activities	Claims Adjusting
524292	Finance and Insurance	Insurance Carriers and Related Activities	Agencies, Brokerages, and Other Insurance Related Activities	Other Insurance Related Activities	Third Party Administration of Insurance and Pension Funds
524298	Finance and Insurance	Insurance Carriers and Related Activities	Agencies, Brokerages, and Other Insurance Related Activities	Other Insurance Related Activities	All Other Insurance Related Activities
525110	Finance and Insurance	Funds, Trusts, and Other Financial Vehicles	Insurance and Employee Benefit Funds	Pension Funds	Pension Funds
525120	Finance and Insurance	Funds, Trusts, and Other Financial Vehicles	Insurance and Employee Benefit Funds	Health and Welfare Funds	Health and Welfare Funds
525190	Finance and Insurance	Funds, Trusts, and Other Financial Vehicles	Insurance and Employee Benefit Funds	Other Insurance Funds	Other Insurance Funds
525910	Finance and Insurance	Funds, Trusts, and Other Financial Vehicles	Other Investment Pools and Funds	Open-End Investment Funds	Open-End Investment Funds

525920	Finance and Insurance	Funds, Trusts, and Other Financial Vehicles	Other Investment Pools and Funds	Trusts, Estates, and Agency Accounts	Trusts, Estates, and Agency Accounts
525930	Finance and Insurance	Funds, Trusts, and Other Financial Vehicles	Other Investment Pools and Funds	Real Estate Investment Trusts	Real Estate Investment Trusts
525990	Finance and Insurance	Funds, Trusts, and Other Financial Vehicles	Other Investment Pools and Funds	Other Financial Vehicles	Other Financial Vehicles
531110	Real Estate and Rental and Leasing	Real Estate	Lessors of Real Estate	Lessors of Residential Buildings and Dwellings	Lessors of Residential Buildings and Dwellings
531120	Real Estate and Rental and Leasing	Real Estate	Lessors of Real Estate	Lessors of Nonresidential Buildings (except Miniwarehouses)	Lessors of Nonresidential Buildings (except Miniwarehouses)
531130	Real Estate and Rental and Leasing	Real Estate	Lessors of Real Estate	Lessors of Miniwarehouses and Self-Storage Units	Lessors of Miniwarehouses and Self-Storage Units
531190	Real Estate and Rental and Leasing	Real Estate	Lessors of Real Estate	Lessors of Other Real Estate Property	Lessors of Other Real Estate Property
531210	Real Estate and Rental and Leasing	Real Estate	Offices of Real Estate Agents and Brokers	Offices of Real Estate Agents and Brokers	Offices of Real Estate Agents and Brokers
531311	Real Estate and Rental and Leasing	Real Estate	Activities Related to Real Estate	Real Estate Property Managers	Residential Property Managers
531312	Real Estate and Rental and Leasing	Real Estate	Activities Related to Real Estate	Real Estate Property Managers	Nonresidential Property Managers
531320	Real Estate and Rental and Leasing	Real Estate	Activities Related to Real Estate	Offices of Real Estate Appraisers	Offices of Real Estate Appraisers
531390	Real Estate and Rental and Leasing	Real Estate	Activities Related to Real Estate	Other Activities Related to Real Estate	Other Activities Related to Real Estate
532111	Real Estate and Rental and Leasing	Rental and Leasing Services	Automotive Equipment Rental and Leasing	Passenger Car Rental and Leasing	Passenger Car Rental

532112	Real Estate and Rental and Leasing	Rental and Leasing Services	Automotive Equipment Rental and Leasing	Passenger Car Rental and Leasing	Passenger Car Leasing
532120	Real Estate and Rental and Leasing	Rental and Leasing Services	Automotive Equipment Rental and Leasing	Truck, Utility Trailer, and RV (Recreational Vehicle) Rental and Leasing	Truck, Utility Trailer, and RV (Recreational Vehicle) Rental and Leasing
532210	Real Estate and Rental and Leasing	Rental and Leasing Services	Consumer Goods Rental	Consumer Electronics and Appliances Rental	Consumer Electronics and Appliances Rental
532220	Real Estate and Rental and Leasing	Rental and Leasing Services	Consumer Goods Rental	Formal Wear and Costume Rental	Formal Wear and Costume Rental
532230	Real Estate and Rental and Leasing	Rental and Leasing Services	Consumer Goods Rental	Video Tape and Disc Rental	Video Tape and Disc Rental
532291	Real Estate and Rental and Leasing	Rental and Leasing Services	Consumer Goods Rental	Other Consumer Goods Rental	Home Health Equipment Rental
532292	Real Estate and Rental and Leasing	Rental and Leasing Services	Consumer Goods Rental	Other Consumer Goods Rental	Recreational Goods Rental
532299	Real Estate and Rental and Leasing	Rental and Leasing Services	Consumer Goods Rental	Other Consumer Goods Rental	All Other Consumer Goods Rental
532310	Real Estate and Rental and Leasing	Rental and Leasing Services	General Rental Centers	General Rental Centers	General Rental Centers
532411	Real Estate and Rental and Leasing	Rental and Leasing Services	Commercial and Industrial Machinery and Equipment Rental and Leasing	Construction, Transportation, Mining, and Forestry Machinery and Equipment Rental and Leasing	Commercial Air, Rail, and Water Transportation Equipment Rental and Leasing
532412	Real Estate and Rental and Leasing	Rental and Leasing Services	Commercial and Industrial Machinery and Equipment Rental and Leasing	Construction, Transportation, Mining, and Forestry Machinery and Equipment Rental and Leasing	Construction, Mining, and Forestry Machinery and Equipment Rental and Leasing
532420	Real Estate and Rental and Leasing	Rental and Leasing Services	Commercial and Industrial Machinery and Equipment Rental and Leasing	Office Machinery and Equipment Rental and Leasing	Office Machinery and Equipment Rental and Leasing
532490	Real Estate and Rental and Leasing	Rental and Leasing Services	Commercial and Industrial Machinery and Equipment Rental and Leasing	Other Commercial and Industrial Machinery and Equipment Rental and Leasing	Other Commercial and Industrial Machinery and Equipment Rental and Leasing

533110	Real Estate and Rental and Leasing	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)
541110	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Legal Services	Offices of Lawyers	Offices of Lawyers
541120	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Legal Services	Offices of Notaries	Offices of Notaries
541191	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Legal Services	Other Legal Services	Title Abstract and Settlement Offices
541199	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Legal Services	Other Legal Services	All Other Legal Services
541211	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	Offices of Certified Public Accountants
541213	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	Tax Preparation Services
541214	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	Payroll Services
541219	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	Accounting, Tax Preparation, Bookkeeping, and Payroll Services	Other Accounting Services
541310	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Architectural, Engineering, and Related Services	Architectural Services	Architectural Services
541320	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Architectural, Engineering, and Related Services	Landscape Architectural Services	Landscape Architectural Services
541330	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Architectural, Engineering, and Related Services	Engineering Services	Engineering Services
541340	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Architectural, Engineering, and Related Services	Drafting Services	Drafting Services

541350	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Architectural, Engineering, and Related Services	Building Inspection Services	Building Inspection Services
541360	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Architectural, Engineering, and Related Services	Geophysical Surveying and Mapping Services	Geophysical Surveying and Mapping Services
541370	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Architectural, Engineering, and Related Services	Surveying and Mapping (except Geophysical) Services	Surveying and Mapping (except Geophysical) Services
541380	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Architectural, Engineering, and Related Services	Testing Laboratories	Testing Laboratories
541410	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Specialized Design Services	Interior Design Services	Interior Design Services
541420	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Specialized Design Services	Industrial Design Services	Industrial Design Services
541430	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Specialized Design Services	Graphic Design Services	Graphic Design Services
541490	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Specialized Design Services	Other Specialized Design Services	Other Specialized Design Services
541511	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Computer Systems Design and Related Services	Computer Systems Design and Related Services	Custom Computer Programming Services
541512	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Computer Systems Design and Related Services	Computer Systems Design and Related Services	Computer Systems Design Services
541513	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Computer Systems Design and Related Services	Computer Systems Design and Related Services	Computer Facilities Management Services
541519	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Computer Systems Design and Related Services	Computer Systems Design and Related Services	Other Computer Related Services
541611	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Management, Scientific, and Technical Consulting Services	Management Consulting Services	Administrative Management and General Management Consulting Services

541612	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Management, Scientific, and Technical Consulting Services	Management Consulting Services	Human Resources and Executive Search Consulting Services
541613	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Management, Scientific, and Technical Consulting Services	Management Consulting Services	Marketing Consulting Services
541614	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Management, Scientific, and Technical Consulting Services	Management Consulting Services	Process, Physical Distribution, and Logistics Consulting Services
541618	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Management, Scientific, and Technical Consulting Services	Management Consulting Services	Other Management Consulting Services
541620	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Management, Scientific, and Technical Consulting Services	Environmental Consulting Services	Environmental Consulting Services
541690	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Management, Scientific, and Technical Consulting Services	Other Scientific and Technical Consulting Services	Other Scientific and Technical Consulting Services
541710	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Scientific Research and Development Services	Research and Development in the Physical, Engineering, and Life Sciences	Research and Development in the Physical, Engineering, and Life Sciences
541720	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Scientific Research and Development Services	Research and Development in the Social Sciences and Humanities	Research and Development in the Social Sciences and Humanities
541810	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Advertising and Related Services	Advertising Agencies	Advertising Agencies
541820	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Advertising and Related Services	Public Relations Agencies	Public Relations Agencies
541830	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Advertising and Related Services	Media Buying Agencies	Media Buying Agencies
541840	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Advertising and Related Services	Media Representatives	Media Representatives
541850	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Advertising and Related Services	Display Advertising	Display Advertising

541860	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Advertising and Related Services	Direct Mail Advertising	Direct Mail Advertising
541870	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Advertising and Related Services	Advertising Material Distribution Services	Advertising Material Distribution Services
541890	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Advertising and Related Services	Other Services Related to Advertising	Other Services Related to Advertising
541910	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Other Professional, Scientific, and Technical Services	Marketing Research and Public Opinion Polling	Marketing Research and Public Opinion Polling
541921	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Other Professional, Scientific, and Technical Services	Photographic Services	Photography Studios, Portrait
541922	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Other Professional, Scientific, and Technical Services	Photographic Services	Commercial Photography
541930	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Other Professional, Scientific, and Technical Services	Translation and Interpretation Services	Translation and Interpretation Services
541940	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Other Professional, Scientific, and Technical Services	Veterinary Services	Veterinary Services
541990	Professional, Scientific, and Technical Services	Professional, Scientific, and Technical Services	Other Professional, Scientific, and Technical Services	All Other Professional, Scientific, and Technical Services	All Other Professional, Scientific, and Technical Services
551111	Management of Companies and Enterprises	Management of Companies and Enterprises	Management of Companies and Enterprises	Management of Companies and Enterprises	Offices of Bank Holding Companies
551112	Management of Companies and Enterprises	Management of Companies and Enterprises	Management of Companies and Enterprises	Management of Companies and Enterprises	Offices of Other Holding Companies
551114	Management of Companies and Enterprises	Management of Companies and Enterprises	Management of Companies and Enterprises	Management of Companies and Enterprises	Corporate, Subsidiary, and Regional Managing Offices
561110	Administrative and Support and Waste Management and	Administrative and Support Services	Office Administrative Services	Office Administrative Services	Office Administrative Services

	Remediation Services				
561210	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Facilities Support Services	Facilities Support Services	Facilities Support Services
561310	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Employment Services	Employment Placement Agencies	Employment Placement Agencies
561320	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Employment Services	Temporary Help Services	Temporary Help Services
561330	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Employment Services	Professional Employer Organizations	Professional Employer Organizations
561410	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Business Support Services	Document Preparation Services	Document Preparation Services
561421	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Business Support Services	Telephone Call Centers	Telephone Answering Services
561422	Administrative and Support and Waste	Administrative and Support Services	Business Support Services	Telephone Call Centers	Telemarketing Bureaus

	Management and Remediation Services				
561431	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Business Support Services	Business Service Centers	Private Mail Centers
561439	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Business Support Services	Business Service Centers	Other Business Service Centers (including Copy Shops)
561440	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Business Support Services	Collection Agencies	Collection Agencies
561450	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Business Support Services	Credit Bureaus	Credit Bureaus
561491	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Business Support Services	Other Business Support Services	Repossession Services
561492	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Business Support Services	Other Business Support Services	Court Reporting and Stenotype Services
561499	Administrative and Support and	Administrative and Support Services	Business Support Services	Other Business Support Services	All Other Business Support Services

	Waste Management and Remediation Services				
561510	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Travel Arrangement and Reservation Services	Travel Agencies	Travel Agencies
561520	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Travel Arrangement and Reservation Services	Tour Operators	Tour Operators
561591	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Travel Arrangement and Reservation Services	Other Travel Arrangement and Reservation Services	Convention and Visitors Bureaus
561599	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Travel Arrangement and Reservation Services	Other Travel Arrangement and Reservation Services	All Other Travel Arrangement and Reservation Services
561611	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Investigation and Security Services	Investigation, Guard, and Armored Car Services	Investigation Services
561612	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Investigation and Security Services	Investigation, Guard, and Armored Car Services	Security Guards and Patrol Services

561613	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Investigation and Security Services	Investigation, Guard, and Armored Car Services	Armored Car Services
561621	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Investigation and Security Services	Security Systems Services	Security Systems Services (except Locksmiths)
561622	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Investigation and Security Services	Security Systems Services	Locksmiths
561710	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Services to Buildings and Dwellings	Exterminating and Pest Control Services	Exterminating and Pest Control Services
561720	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Services to Buildings and Dwellings	Janitorial Services	Janitorial Services
561730	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Services to Buildings and Dwellings	Landscaping Services	Landscaping Services
561740	Administrative and Support and Waste Management and	Administrative and Support Services	Services to Buildings and Dwellings	Carpet and Upholstery Cleaning Services	Carpet and Upholstery Cleaning Services

	Remediation Services				
561790	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Services to Buildings and Dwellings	Other Services to Buildings and Dwellings	Other Services to Buildings and Dwellings
561910	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Other Support Services	Packaging and Labeling Services	Packaging and Labeling Services
561920	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Other Support Services	Convention and Trade Show Organizers	Convention and Trade Show Organizers
561990	Administrative and Support and Waste Management and Remediation Services	Administrative and Support Services	Other Support Services	All Other Support Services	All Other Support Services
562111	Administrative and Support and Waste Management and Remediation Services	Waste Management and Remediation Services	Waste Collection	Waste Collection	Solid Waste Collection
562112	Administrative and Support and Waste Management and Remediation Services	Waste Management and Remediation Services	Waste Collection	Waste Collection	Hazardous Waste Collection
562119	Administrative and Support and Waste	Waste Management and Remediation Services	Waste Collection	Waste Collection	Other Waste Collection

	Management and Remediation Services				
562211	Administrative and Support and Waste Management and Remediation Services	Waste Management and Remediation Services	Waste Treatment and Disposal	Waste Treatment and Disposal	Hazardous Waste Treatment and Disposal
562212	Administrative and Support and Waste Management and Remediation Services	Waste Management and Remediation Services	Waste Treatment and Disposal	Waste Treatment and Disposal	Solid Waste Landfill
562213	Administrative and Support and Waste Management and Remediation Services	Waste Management and Remediation Services	Waste Treatment and Disposal	Waste Treatment and Disposal	Solid Waste Combustors and Incinerators
562219	Administrative and Support and Waste Management and Remediation Services	Waste Management and Remediation Services	Waste Treatment and Disposal	Waste Treatment and Disposal	Other Nonhazardous Waste Treatment and Disposal
562910	Administrative and Support and Waste Management and Remediation Services	Waste Management and Remediation Services	Remediation and Other Waste Management Services	Remediation Services	Remediation Services
562920	Administrative and Support and Waste Management and Remediation Services	Waste Management and Remediation Services	Remediation and Other Waste Management Services	Materials Recovery Facilities	Materials Recovery Facilities

562991	Administrative and Support and Waste Management and Remediation Services	Waste Management and Remediation Services	Remediation and Other Waste Management Services	All Other Waste Management Services	Septic Tank and Related Services
562998	Administrative and Support and Waste Management and Remediation Services	Waste Management and Remediation Services	Remediation and Other Waste Management Services	All Other Waste Management Services	All Other Miscellaneous Waste Management Services
611110	Educational Services	Educational Services	Elementary and Secondary Schools	Elementary and Secondary Schools	Elementary and Secondary Schools
611210	Educational Services	Educational Services	Junior Colleges	Junior Colleges	Junior Colleges
611310	Educational Services	Educational Services	Colleges, Universities, and Professional Schools	Colleges, Universities, and Professional Schools	Colleges, Universities, and Professional Schools
611410	Educational Services	Educational Services	Business Schools and Computer and Management Training	Business and Secretarial Schools	Business and Secretarial Schools
611420	Educational Services	Educational Services	Business Schools and Computer and Management Training	Computer Training	Computer Training
611430	Educational Services	Educational Services	Business Schools and Computer and Management Training	Professional and Management Development Training	Professional and Management Development Training
611511	Educational Services	Educational Services	Technical and Trade Schools	Technical and Trade Schools	Cosmetology and Barber Schools
611512	Educational Services	Educational Services	Technical and Trade Schools	Technical and Trade Schools	Flight Training
611513	Educational Services	Educational Services	Technical and Trade Schools	Technical and Trade Schools	Apprenticeship Training
611519	Educational Services	Educational Services	Technical and Trade Schools	Technical and Trade Schools	Other Technical and Trade Schools
611610	Educational Services	Educational Services	Other Schools and Instruction	Fine Arts Schools	Fine Arts Schools
611620	Educational Services	Educational Services	Other Schools and Instruction	Sports and Recreation Instruction	Sports and Recreation Instruction
611630	Educational Services	Educational Services	Other Schools and Instruction	Language Schools	Language Schools

611691	Educational Services	Educational Services	Other Schools and Instruction	All Other Schools and Instruction	Exam Preparation and Tutoring
611692	Educational Services	Educational Services	Other Schools and Instruction	All Other Schools and Instruction	Automobile Driving Schools
611699	Educational Services	Educational Services	Other Schools and Instruction	All Other Schools and Instruction	All Other Miscellaneous Schools and Instruction
611710	Educational Services	Educational Services	Educational Support Services	Educational Support Services	Educational Support Services
621111	Health Care and Social Assistance	Ambulatory Health Care Services	Offices of Physicians	Offices of Physicians	Offices of Physicians (except Mental Health Specialists)
621112	Health Care and Social Assistance	Ambulatory Health Care Services	Offices of Physicians	Offices of Physicians	Offices of Physicians, Mental Health Specialists
621210	Health Care and Social Assistance	Ambulatory Health Care Services	Offices of Dentists	Offices of Dentists	Offices of Dentists
621310	Health Care and Social Assistance	Ambulatory Health Care Services	Offices of Other Health Practitioners	Offices of Chiropractors	Offices of Chiropractors
621320	Health Care and Social Assistance	Ambulatory Health Care Services	Offices of Other Health Practitioners	Offices of Optometrists	Offices of Optometrists
621330	Health Care and Social Assistance	Ambulatory Health Care Services	Offices of Other Health Practitioners	Offices of Mental Health Practitioners (except Physicians)	Offices of Mental Health Practitioners (except Physicians)
621340	Health Care and Social Assistance	Ambulatory Health Care Services	Offices of Other Health Practitioners	Offices of Physical, Occupational and Speech Therapists, and Audiologists	Offices of Physical, Occupational and Speech Therapists, and Audiologists
621391	Health Care and Social Assistance	Ambulatory Health Care Services	Offices of Other Health Practitioners	Offices of All Other Health Practitioners	Offices of Podiatrists
621399	Health Care and Social Assistance	Ambulatory Health Care Services	Offices of Other Health Practitioners	Offices of All Other Health Practitioners	Offices of All Other Miscellaneous Health Practitioners
621410	Health Care and Social Assistance	Ambulatory Health Care Services	Outpatient Care Centers	Family Planning Centers	Family Planning Centers
621420	Health Care and Social Assistance	Ambulatory Health Care Services	Outpatient Care Centers	Outpatient Mental Health and Substance Abuse Centers	Outpatient Mental Health and Substance Abuse Centers
621491	Health Care and Social Assistance	Ambulatory Health Care Services	Outpatient Care Centers	Other Outpatient Care Centers	HMO Medical Centers
621492	Health Care and Social Assistance	Ambulatory Health Care Services	Outpatient Care Centers	Other Outpatient Care Centers	Kidney Dialysis Centers
621493	Health Care and Social Assistance	Ambulatory Health Care Services	Outpatient Care Centers	Other Outpatient Care Centers	Freestanding Ambulatory Surgical and Emergency Centers

621498	Health Care and Social Assistance	Ambulatory Health Care Services	Outpatient Care Centers	Other Outpatient Care Centers	All Other Outpatient Care Centers
621511	Health Care and Social Assistance	Ambulatory Health Care Services	Medical and Diagnostic Laboratories	Medical and Diagnostic Laboratories	Medical Laboratories
621512	Health Care and Social Assistance	Ambulatory Health Care Services	Medical and Diagnostic Laboratories	Medical and Diagnostic Laboratories	Diagnostic Imaging Centers
621610	Health Care and Social Assistance	Ambulatory Health Care Services	Home Health Care Services	Home Health Care Services	Home Health Care Services
621910	Health Care and Social Assistance	Ambulatory Health Care Services	Other Ambulatory Health Care Services	Ambulance Services	Ambulance Services
621991	Health Care and Social Assistance	Ambulatory Health Care Services	Other Ambulatory Health Care Services	All Other Ambulatory Health Care Services	Blood and Organ Banks
621999	Health Care and Social Assistance	Ambulatory Health Care Services	Other Ambulatory Health Care Services	All Other Ambulatory Health Care Services	All Other Miscellaneous Ambulatory Health Care Services
622110	Health Care and Social Assistance	Hospitals	General Medical and Surgical Hospitals	General Medical and Surgical Hospitals	General Medical and Surgical Hospitals
622210	Health Care and Social Assistance	Hospitals	Psychiatric and Substance Abuse Hospitals	Psychiatric and Substance Abuse Hospitals	Psychiatric and Substance Abuse Hospitals
622310	Health Care and Social Assistance	Hospitals	Specialty (except Psychiatric and Substance Abuse) Hospitals	Specialty (except Psychiatric and Substance Abuse) Hospitals	Specialty (except Psychiatric and Substance Abuse) Hospitals
623110	Health Care and Social Assistance	Nursing and Residential Care Facilities	Nursing Care Facilities	Nursing Care Facilities	Nursing Care Facilities
623210	Health Care and Social Assistance	Nursing and Residential Care Facilities	Residential Mental Retardation, Mental Health and Substance Abuse Facilities	Residential Mental Retardation Facilities	Residential Mental Retardation Facilities
623220	Health Care and Social Assistance	Nursing and Residential Care Facilities	Residential Mental Retardation, Mental Health and Substance Abuse Facilities	Residential Mental Health and Substance Abuse Facilities	Residential Mental Health and Substance Abuse Facilities
623311	Health Care and Social Assistance	Nursing and Residential Care Facilities	Community Care Facilities for the Elderly	Community Care Facilities for the Elderly	Continuing Care Retirement Communities
623312	Health Care and Social Assistance	Nursing and Residential Care Facilities	Community Care Facilities for the Elderly	Community Care Facilities for the Elderly	Homes for the Elderly

623990	Health Care and Social Assistance	Nursing and Residential Care Facilities	Other Residential Care Facilities	Other Residential Care Facilities	Other Residential Care Facilities
624110	Health Care and Social Assistance	Social Assistance	Individual and Family Services	Child and Youth Services	Child and Youth Services
624120	Health Care and Social Assistance	Social Assistance	Individual and Family Services	Services for the Elderly and Persons with Disabilities	Services for the Elderly and Persons with Disabilities
624190	Health Care and Social Assistance	Social Assistance	Individual and Family Services	Other Individual and Family Services	Other Individual and Family Services
624210	Health Care and Social Assistance	Social Assistance	Community Food and Housing, and Emergency and Other Relief Services	Community Food Services	Community Food Services
624221	Health Care and Social Assistance	Social Assistance	Community Food and Housing, and Emergency and Other Relief Services	Community Housing Services	Temporary Shelters
624229	Health Care and Social Assistance	Social Assistance	Community Food and Housing, and Emergency and Other Relief Services	Community Housing Services	Other Community Housing Services
624230	Health Care and Social Assistance	Social Assistance	Community Food and Housing, and Emergency and Other Relief Services	Emergency and Other Relief Services	Emergency and Other Relief Services
624310	Health Care and Social Assistance	Social Assistance	Vocational Rehabilitation Services	Vocational Rehabilitation Services	Vocational Rehabilitation Services
624410	Health Care and Social Assistance	Social Assistance	Child Day Care Services	Child Day Care Services	Child Day Care Services
711110	Arts, Entertainment, and Recreation	Performing Arts, Spectator Sports, and Related Industries	Performing Arts Companies	Theater Companies and Dinner Theaters	Theater Companies and Dinner Theaters
711120	Arts, Entertainment, and Recreation	Performing Arts, Spectator Sports, and Related Industries	Performing Arts Companies	Dance Companies	Dance Companies
711130	Arts, Entertainment, and Recreation	Performing Arts, Spectator Sports, and Related Industries	Performing Arts Companies	Musical Groups and Artists	Musical Groups and Artists
711190	Arts, Entertainment, and Recreation	Performing Arts, Spectator Sports, and Related Industries	Performing Arts Companies	Other Performing Arts Companies	Other Performing Arts Companies
711211	Arts, Entertainment, and Recreation	Performing Arts, Spectator Sports, and Related Industries	Spectator Sports	Spectator Sports	Sports Teams and Clubs

711212	Arts, Entertainment, and Recreation	Performing Arts, Spectator Sports, and Related Industries	Spectator Sports	Spectator Sports	Racetracks
711219	Arts, Entertainment, and Recreation	Performing Arts, Spectator Sports, and Related Industries	Spectator Sports	Spectator Sports	Other Spectator Sports
711310	Arts, Entertainment, and Recreation	Performing Arts, Spectator Sports, and Related Industries	Promoters of Performing Arts, Sports, and Similar Events	Promoters of Performing Arts, Sports, and Similar Events with Facilities	Promoters of Performing Arts, Sports, and Similar Events with Facilities
711320	Arts, Entertainment, and Recreation	Performing Arts, Spectator Sports, and Related Industries	Promoters of Performing Arts, Sports, and Similar Events	Promoters of Performing Arts, Sports, and Similar Events without Facilities	Promoters of Performing Arts, Sports, and Similar Events without Facilities
711410	Arts, Entertainment, and Recreation	Performing Arts, Spectator Sports, and Related Industries	Agents and Managers for Artists, Athletes, Entertainers, and Other Public Figures	Agents and Managers for Artists, Athletes, Entertainers, and Other Public Figures	Agents and Managers for Artists, Athletes, Entertainers, and Other Public Figures
711510	Arts, Entertainment, and Recreation	Performing Arts, Spectator Sports, and Related Industries	Independent Artists, Writers, and Performers	Independent Artists, Writers, and Performers	Independent Artists, Writers, and Performers
712110	Arts, Entertainment, and Recreation	Museums, Historical Sites, and Similar Institutions	Museums, Historical Sites, and Similar Institutions	Museums	Museums
712120	Arts, Entertainment, and Recreation	Museums, Historical Sites, and Similar Institutions	Museums, Historical Sites, and Similar Institutions	Historical Sites	Historical Sites
712130	Arts, Entertainment, and Recreation	Museums, Historical Sites, and Similar Institutions	Museums, Historical Sites, and Similar Institutions	Zoos and Botanical Gardens	Zoos and Botanical Gardens
712190	Arts, Entertainment, and Recreation	Museums, Historical Sites, and Similar Institutions	Museums, Historical Sites, and Similar Institutions	Nature Parks and Other Similar Institutions	Nature Parks and Other Similar Institutions
713110	Arts, Entertainment, and Recreation	Amusement, Gambling, and Recreation Industries	Amusement Parks and Arcades	Amusement and Theme Parks	Amusement and Theme Parks
713120	Arts, Entertainment, and Recreation	Amusement, Gambling, and Recreation Industries	Amusement Parks and Arcades	Amusement Arcades	Amusement Arcades
713210	Arts, Entertainment, and Recreation	Amusement, Gambling, and Recreation Industries	Gambling Industries	Casinos (except Casino Hotels)	Casinos (except Casino Hotels)

713290	Arts, Entertainment, and Recreation	Amusement, Gambling, and Recreation Industries	Gambling Industries	Other Gambling Industries	Other Gambling Industries
713910	Arts, Entertainment, and Recreation	Amusement, Gambling, and Recreation Industries	Other Amusement and Recreation Industries	Golf Courses and Country Clubs	Golf Courses and Country Clubs
713920	Arts, Entertainment, and Recreation	Amusement, Gambling, and Recreation Industries	Other Amusement and Recreation Industries	Skiing Facilities	Skiing Facilities
713930	Arts, Entertainment, and Recreation	Amusement, Gambling, and Recreation Industries	Other Amusement and Recreation Industries	Marinas	Marinas
713940	Arts, Entertainment, and Recreation	Amusement, Gambling, and Recreation Industries	Other Amusement and Recreation Industries	Fitness and Recreational Sports Centers	Fitness and Recreational Sports Centers
713950	Arts, Entertainment, and Recreation	Amusement, Gambling, and Recreation Industries	Other Amusement and Recreation Industries	Bowling Centers	Bowling Centers
713990	Arts, Entertainment, and Recreation	Amusement, Gambling, and Recreation Industries	Other Amusement and Recreation Industries	All Other Amusement and Recreation Industries	All Other Amusement and Recreation Industries
721110	Accommodation and Food Services	Accommodation	Traveler Accommodation	Hotels (except Casino Hotels) and Motels	Hotels (except Casino Hotels) and Motels
721120	Accommodation and Food Services	Accommodation	Traveler Accommodation	Casino Hotels	Casino Hotels
721191	Accommodation and Food Services	Accommodation	Traveler Accommodation	Other Traveler Accommodation	Bed-and-Breakfast Inns
721199	Accommodation and Food Services	Accommodation	Traveler Accommodation	Other Traveler Accommodation	All Other Traveler Accommodation
721211	Accommodation and Food Services	Accommodation	RV (Recreational Vehicle) Parks and Recreational Camps	RV (Recreational Vehicle) Parks and Recreational Camps	RV (Recreational Vehicle) Parks and Campgrounds
721214	Accommodation and Food Services	Accommodation	RV (Recreational Vehicle) Parks and Recreational Camps	RV (Recreational Vehicle) Parks and Recreational Camps	Recreational and Vacation Camps (except Campgrounds)
721310	Accommodation and Food Services	Accommodation	Rooming and Boarding Houses	Rooming and Boarding Houses	Rooming and Boarding Houses
722110	Accommodation and Food Services	Food Services and Drinking Places	Full-Service Restaurants	Full-Service Restaurants	Full-Service Restaurants
722211	Accommodation and Food Services	Food Services and Drinking Places	Limited-Service Eating Places	Limited-Service Eating Places	Limited-Service Restaurants

722212	Accommodation and Food Services	Food Services and Drinking Places	Limited-Service Eating Places	Limited-Service Eating Places	Cafeterias
722213	Accommodation and Food Services	Food Services and Drinking Places	Limited-Service Eating Places	Limited-Service Eating Places	Snack and Nonalcoholic Beverage Bars
722310	Accommodation and Food Services	Food Services and Drinking Places	Special Food Services	Food Service Contractors	Food Service Contractors
722320	Accommodation and Food Services	Food Services and Drinking Places	Special Food Services	Caterers	Caterers
722330	Accommodation and Food Services	Food Services and Drinking Places	Special Food Services	Mobile Food Services	Mobile Food Services
722410	Accommodation and Food Services	Food Services and Drinking Places	Drinking Places (Alcoholic Beverages)	Drinking Places (Alcoholic Beverages)	Drinking Places (Alcoholic Beverages)
811111	Other Services (except Public Administration)	Repair and Maintenance	Automotive Repair and Maintenance	Automotive Mechanical and Electrical Repair and Maintenance	General Automotive Repair
811112	Other Services (except Public Administration)	Repair and Maintenance	Automotive Repair and Maintenance	Automotive Mechanical and Electrical Repair and Maintenance	Automotive Exhaust System Repair
811113	Other Services (except Public Administration)	Repair and Maintenance	Automotive Repair and Maintenance	Automotive Mechanical and Electrical Repair and Maintenance	Automotive Transmission Repair
811118	Other Services (except Public Administration)	Repair and Maintenance	Automotive Repair and Maintenance	Automotive Mechanical and Electrical Repair and Maintenance	Other Automotive Mechanical and Electrical Repair and Maintenance
811121	Other Services (except Public Administration)	Repair and Maintenance	Automotive Repair and Maintenance	Automotive Body, Paint, Interior, and Glass Repair	Automotive Body, Paint, and Interior Repair and Maintenance
811122	Other Services (except Public Administration)	Repair and Maintenance	Automotive Repair and Maintenance	Automotive Body, Paint, Interior, and Glass Repair	Automotive Glass Replacement Shops
811191	Other Services (except Public Administration)	Repair and Maintenance	Automotive Repair and Maintenance	Other Automotive Repair and Maintenance	Automotive Oil Change and Lubrication Shops
811192	Other Services (except Public Administration)	Repair and Maintenance	Automotive Repair and Maintenance	Other Automotive Repair and Maintenance	Car Washes
811198	Other Services (except Public Administration)	Repair and Maintenance	Automotive Repair and Maintenance	Other Automotive Repair and Maintenance	All Other Automotive Repair and Maintenance

811211	Other Services (except Public Administration)	Repair and Maintenance	Electronic and Precision Equipment Repair and Maintenance	Electronic and Precision Equipment Repair and Maintenance	Consumer Electronics Repair and Maintenance
811212	Other Services (except Public Administration)	Repair and Maintenance	Electronic and Precision Equipment Repair and Maintenance	Electronic and Precision Equipment Repair and Maintenance	Computer and Office Machine Repair and Maintenance
811213	Other Services (except Public Administration)	Repair and Maintenance	Electronic and Precision Equipment Repair and Maintenance	Electronic and Precision Equipment Repair and Maintenance	Communication Equipment Repair and Maintenance
811219	Other Services (except Public Administration)	Repair and Maintenance	Electronic and Precision Equipment Repair and Maintenance	Electronic and Precision Equipment Repair and Maintenance	Other Electronic and Precision Equipment Repair and Maintenance
811310	Other Services (except Public Administration)	Repair and Maintenance	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance
811411	Other Services (except Public Administration)	Repair and Maintenance	Personal and Household Goods Repair and Maintenance	Home and Garden Equipment and Appliance Repair and Maintenance	Home and Garden Equipment Repair and Maintenance
811412	Other Services (except Public Administration)	Repair and Maintenance	Personal and Household Goods Repair and Maintenance	Home and Garden Equipment and Appliance Repair and Maintenance	Appliance Repair and Maintenance
811420	Other Services (except Public Administration)	Repair and Maintenance	Personal and Household Goods Repair and Maintenance	Reupholstery and Furniture Repair	Reupholstery and Furniture Repair
811430	Other Services (except Public Administration)	Repair and Maintenance	Personal and Household Goods Repair and Maintenance	Footwear and Leather Goods Repair	Footwear and Leather Goods Repair
811490	Other Services (except Public Administration)	Repair and Maintenance	Personal and Household Goods Repair and Maintenance	Other Personal and Household Goods Repair and Maintenance	Other Personal and Household Goods Repair and Maintenance
812111	Other Services (except Public Administration)	Personal and Laundry Services	Personal Care Services	Hair, Nail, and Skin Care Services	Barber Shops
812112	Other Services (except Public Administration)	Personal and Laundry Services	Personal Care Services	Hair, Nail, and Skin Care Services	Beauty Salons
812113	Other Services (except Public Administration)	Personal and Laundry Services	Personal Care Services	Hair, Nail, and Skin Care Services	Nail Salons

812191	Other Services (except Public Administration)	Personal and Laundry Services	Personal Care Services	Other Personal Care Services	Diet and Weight Reducing Centers
812199	Other Services (except Public Administration)	Personal and Laundry Services	Personal Care Services	Other Personal Care Services	Other Personal Care Services
812210	Other Services (except Public Administration)	Personal and Laundry Services	Death Care Services	Funeral Homes and Funeral Services	Funeral Homes and Funeral Services
812220	Other Services (except Public Administration)	Personal and Laundry Services	Death Care Services	Cemeteries and Crematories	Cemeteries and Crematories
812310	Other Services (except Public Administration)	Personal and Laundry Services	Drycleaning and Laundry Services	Coin-Operated Laundries and Drycleaners	Coin-Operated Laundries and Drycleaners
812320	Other Services (except Public Administration)	Personal and Laundry Services	Drycleaning and Laundry Services	Drycleaning and Laundry Services (except Coin-Operated)	Drycleaning and Laundry Services (except Coin-Operated)
812331	Other Services (except Public Administration)	Personal and Laundry Services	Drycleaning and Laundry Services	Linen and Uniform Supply	Linen Supply
812332	Other Services (except Public Administration)	Personal and Laundry Services	Drycleaning and Laundry Services	Linen and Uniform Supply	Industrial Launderers
812910	Other Services (except Public Administration)	Personal and Laundry Services	Other Personal Services	Pet Care (except Veterinary) Services	Pet Care (except Veterinary) Services
812921	Other Services (except Public Administration)	Personal and Laundry Services	Other Personal Services	Photofinishing	Photofinishing Laboratories (except One-Hour)
812922	Other Services (except Public Administration)	Personal and Laundry Services	Other Personal Services	Photofinishing	One-Hour Photofinishing
812930	Other Services (except Public Administration)	Personal and Laundry Services	Other Personal Services	Parking Lots and Garages	Parking Lots and Garages
812990	Other Services (except Public Administration)	Personal and Laundry Services	Other Personal Services	All Other Personal Services	All Other Personal Services

813110	Other Services (except Public Administration)	Religious, Grantmaking, Civic, Professional, and Similar Organizations	Religious Organizations	Religious Organizations	Religious Organizations
813211	Other Services (except Public Administration)	Religious, Grantmaking, Civic, Professional, and Similar Organizations	Grantmaking and Giving Services	Grantmaking and Giving Services	Grantmaking Foundations
813212	Other Services (except Public Administration)	Religious, Grantmaking, Civic, Professional, and Similar Organizations	Grantmaking and Giving Services	Grantmaking and Giving Services	Voluntary Health Organizations
813219	Other Services (except Public Administration)	Religious, Grantmaking, Civic, Professional, and Similar Organizations	Grantmaking and Giving Services	Grantmaking and Giving Services	Other Grantmaking and Giving Services
813311	Other Services (except Public Administration)	Religious, Grantmaking, Civic, Professional, and Similar Organizations	Social Advocacy Organizations	Social Advocacy Organizations	Human Rights Organizations
813312	Other Services (except Public Administration)	Religious, Grantmaking, Civic, Professional, and Similar Organizations	Social Advocacy Organizations	Social Advocacy Organizations	Environment, Conservation and Wildlife Organizations
813319	Other Services (except Public Administration)	Religious, Grantmaking, Civic, Professional, and Similar Organizations	Social Advocacy Organizations	Social Advocacy Organizations	Other Social Advocacy Organizations
813410	Other Services (except Public Administration)	Religious, Grantmaking, Civic, Professional, and Similar Organizations	Civic and Social Organizations	Civic and Social Organizations	Civic and Social Organizations
813910	Other Services (except Public Administration)	Religious, Grantmaking, Civic, Professional, and Similar Organizations	Business, Professional, Labor, Political, and Similar Organizations	Business Associations	Business Associations
813920	Other Services (except Public Administration)	Religious, Grantmaking, Civic, Professional, and Similar Organizations	Business, Professional, Labor, Political, and Similar Organizations	Professional Organizations	Professional Organizations

813930	Other Services (except Public Administration)	Religious, Grantmaking, Civic, Professional, and Similar Organizations	Business, Professional, Labor, Political, and Similar Organizations	Labor Unions and Similar Labor Organizations	Labor Unions and Similar Labor Organizations
813940	Other Services (except Public Administration)	Religious, Grantmaking, Civic, Professional, and Similar Organizations	Business, Professional, Labor, Political, and Similar Organizations	Political Organizations	Political Organizations
813990	Other Services (except Public Administration)	Religious, Grantmaking, Civic, Professional, and Similar Organizations	Business, Professional, Labor, Political, and Similar Organizations	Other Similar Organizations (except Business, Professional, Labor, and Political Organizations)	Other Similar Organizations (except Business, Professional, Labor, and Political Organizations)
814110	Other Services (except Public Administration)	Private Households	Private Households	Private Households	Private Households
921110	Public Administration	Executive, Legislative, and Other General Government Support	Executive, Legislative, and Other General Government Support	Executive Offices	Executive Offices
921120	Public Administration	Executive, Legislative, and Other General Government Support	Executive, Legislative, and Other General Government Support	Legislative Bodies	Legislative Bodies
921130	Public Administration	Executive, Legislative, and Other General Government Support	Executive, Legislative, and Other General Government Support	Public Finance Activities	Public Finance Activities
921140	Public Administration	Executive, Legislative, and Other General Government Support	Executive, Legislative, and Other General Government Support	Executive and Legislative Offices, Combined	Executive and Legislative Offices, Combined
921150	Public Administration	Executive, Legislative, and Other General Government Support	Executive, Legislative, and Other General Government Support	American Indian and Alaska Native Tribal Governments	American Indian and Alaska Native Tribal Governments
921190	Public Administration	Executive, Legislative, and Other General Government Support	Executive, Legislative, and Other General Government Support	Other General Government Support	Other General Government Support
922110	Public Administration	Justice, Public Order, and Safety Activities	Justice, Public Order, and Safety Activities	Courts	Courts
922120	Public Administration	Justice, Public Order, and Safety Activities	Justice, Public Order, and Safety Activities	Police Protection	Police Protection
922130	Public Administration	Justice, Public Order, and Safety Activities	Justice, Public Order, and Safety Activities	Legal Counsel and Prosecution	Legal Counsel and Prosecution
922140	Public Administration	Justice, Public Order, and Safety Activities	Justice, Public Order, and Safety Activities	Correctional Institutions	Correctional Institutions

922150	Public Administration	Justice, Public Order, and Safety Activities	Justice, Public Order, and Safety Activities	Parole Offices and Probation Offices	Parole Offices and Probation Offices
922160	Public Administration	Justice, Public Order, and Safety Activities	Justice, Public Order, and Safety Activities	Fire Protection	Fire Protection
922190	Public Administration	Justice, Public Order, and Safety Activities	Justice, Public Order, and Safety Activities	Other Justice, Public Order, and Safety Activities	Other Justice, Public Order, and Safety Activities
923110	Public Administration	Administration of Human Resource Programs	Administration of Human Resource Programs	Administration of Education Programs	Administration of Education Programs
923120	Public Administration	Administration of Human Resource Programs	Administration of Human Resource Programs	Administration of Public Health Programs	Administration of Public Health Programs
923130	Public Administration	Administration of Human Resource Programs	Administration of Human Resource Programs	Administration of Human Resource Programs (except Education, Public Health, and Veterans' Affairs Programs)	Administration of Human Resource Programs (except Education, Public Health, and Veterans' Affairs Programs)
923140	Public Administration	Administration of Human Resource Programs	Administration of Human Resource Programs	Administration of Veterans' Affairs	Administration of Veterans' Affairs
924110	Public Administration	Administration of Environmental Quality Programs	Administration of Environmental Quality Programs	Administration of Air and Water Resource and Solid Waste Management Programs	Administration of Air and Water Resource and Solid Waste Management Programs
924120	Public Administration	Administration of Environmental Quality Programs	Administration of Environmental Quality Programs	Administration of Conservation Programs	Administration of Conservation Programs
925110	Public Administration	Administration of Housing Programs, Urban Planning, and Community Development	Administration of Housing Programs, Urban Planning, and Community Development	Administration of Housing Programs	Administration of Housing Programs
925120	Public Administration	Administration of Housing Programs, Urban Planning, and Community Development	Administration of Housing Programs, Urban Planning, and Community Development	Administration of Urban Planning and Community and Rural Development	Administration of Urban Planning and Community and Rural Development
926110	Public Administration	Administration of Economic Programs	Administration of Economic Programs	Administration of General Economic Programs	Administration of General Economic Programs
926120	Public Administration	Administration of Economic Programs	Administration of Economic Programs	Regulation and Administration of Transportation Programs	Regulation and Administration of Transportation Programs

926130	Public Administration	Administration of Economic Programs	Administration of Economic Programs	Regulation and Administration of Communications, Electric, Gas, and Other Utilities	Regulation and Administration of Communications, Electric, Gas, and Other Utilities
926140	Public Administration	Administration of Economic Programs	Administration of Economic Programs	Regulation of Agricultural Marketing and Commodities	Regulation of Agricultural Marketing and Commodities
926150	Public Administration	Administration of Economic Programs	Administration of Economic Programs	Regulation, Licensing, and Inspection of Miscellaneous Commercial Sectors	Regulation, Licensing, and Inspection of Miscellaneous Commercial Sectors
927110	Public Administration	Space Research and Technology	Space Research and Technology	Space Research and Technology	Space Research and Technology
928110	Public Administration	National Security and International Affairs	National Security and International Affairs	National Security	National Security
928120	Public Administration	National Security and International Affairs	National Security and International Affairs	International Affairs	International Affairs

Appendix B

NAICS 2012 Code	Title	L1	Title	L2	Title	L3	Title	L4	Title
211111	Crude Petroleum and Natural Gas Extraction	21	Mining, Quarrying, and Oil and Gas Extraction	211	Oil and Gas Extraction	2111	Oil and Gas Extraction	21111	Oil and Gas Extraction
211112	Natural Gas Liquid Extraction	21	Mining, Quarrying, and Oil and Gas Extraction	211	Oil and Gas Extraction	2111	Oil and Gas Extraction	21111	Oil and Gas Extraction
212111	Bituminous Coal and Lignite Surface Mining	21	Mining, Quarrying, and Oil and Gas Extraction	212	Mining (except Oil and Gas)	2121	Coal Mining	21211	Coal Mining
212112	Bituminous Coal Underground Mining	21	Mining, Quarrying, and Oil and Gas Extraction	212	Mining (except Oil and Gas)	2121	Coal Mining	21211	Coal Mining
212113	Anthracite Mining	21	Mining, Quarrying, and Oil and Gas Extraction	212	Mining (except Oil and Gas)	2121	Coal Mining	21211	Coal Mining
212291	Uranium-Radium-Vanadium Ore Mining	21	Mining, Quarrying, and Oil and Gas Extraction	212	Mining (except Oil and Gas)	2122	Metal Ore Mining	21229	Other Metal Ore Mining
213111	Drilling Oil and Gas Wells	21	Mining, Quarrying, and Oil and	213	Support Activities for Mining	2131	Support Activities for Mining	21311	Support Activities for Mining

			Gas Extraction						
213112	Support Activities for Oil and Gas Operations	21	Mining, Quarrying, and Oil and Gas Extraction	213	Support Activities for Mining	2131	Support Activities for Mining	21311	Support Activities for Mining
213113	Support Activities for Coal Mining	21	Mining, Quarrying, and Oil and Gas Extraction	213	Support Activities for Mining	2131	Support Activities for Mining	21311	Support Activities for Mining
221111	Hydroelectric Power Generation	22	Utilities	221	Utilities	2211	Electric Power Generation, Transmission and Distribution	22111	Electric Power Generation
221112	Fossil Fuel Electric Power Generation	22	Utilities	221	Utilities	2211	Electric Power Generation, Transmission and Distribution	22111	Electric Power Generation
221113	Nuclear Electric Power Generation	22	Utilities	221	Utilities	2211	Electric Power Generation, Transmission and Distribution	22111	Electric Power Generation
221114	Solar Electric Power Generation	22	Utilities	221	Utilities	2211	Electric Power Generation, Transmission and Distribution	22111	Electric Power Generation
221115	Wind Electric Power Generation	22	Utilities	221	Utilities	2211	Electric Power Generation, Transmission and Distribution	22111	Electric Power Generation
221116	Geothermal Electric Power	22	Utilities	221	Utilities	2211	Electric Power Generation,	22111	Electric Power Generation

	Generation						Transmission and Distribution		
221117	Biomass Electric Power Generation	22	Utilities	221	Utilities	2211	Electric Power Generation, Transmission and Distribution	22111	Electric Power Generation
221118	Other Electric Power Generation	22	Utilities	221	Utilities	2211	Electric Power Generation, Transmission and Distribution	22111	Electric Power Generation
221121	Electric Bulk Power Transmission and Control	22	Utilities	221	Utilities	2211	Electric Power Generation, Transmission and Distribution	22112	Electric Power Transmission, Control, and Distribution
221122	Electric Power Distribution	22	Utilities	221	Utilities	2211	Electric Power Generation, Transmission and Distribution	22112	Electric Power Transmission, Control, and Distribution
221210	Natural Gas Distribution	22	Utilities	221	Utilities	2212	Natural Gas Distribution	22121	Natural Gas Distribution
237120	Oil and Gas Pipeline and Related Structures Construction	23	Construction	237	Heavy and Civil Engineering Construction	2371	Utility System Construction	23712	Oil and Gas Pipeline and Related Structures Construction
237130	Power and Communication Line and Related Structures	23	Construction	237	Heavy and Civil Engineering Construction	2371	Utility System Construction	23713	Power and Communication Line and Related Structures Construction

	Construction								
324110	Petroleum Refineries	32	Manufacturing	324	Petroleum and Coal Products Manufacturing	3241	Petroleum and Coal Products Manufacturing	32411	Petroleum Refineries
331318	Other Aluminum Rolling, Drawing, and Extruding	33	Manufacturing	331	Primary Metal Manufacturing	3313	Alumina and Aluminum Production and Processing	33131	Alumina and Aluminum Production and Processing
331420	Copper Rolling, Drawing, Extruding, and Alloying	33	Manufacturing	331	Primary Metal Manufacturing	3314	Nonferrous Metal (except Aluminum) Production and Processing	33142	Copper Rolling, Drawing, Extruding, and Alloying
331491	Nonferrous Metal (except Copper and Aluminum) Rolling, Drawing, and Extruding	33	Manufacturing	331	Primary Metal Manufacturing	3314	Nonferrous Metal (except Aluminum) Production and Processing	33149	Nonferrous Metal (except Copper and Aluminum) Rolling, Drawing, Extruding, and Alloying
333131	Mining Machinery and Equipment Manufacturing	33	Manufacturing	333	Machinery Manufacturing	3331	Agriculture, Construction, and Mining Machinery Manufacturing	33313	Mining and Oil and Gas Field Machinery Manufacturing
333132	Oil and Gas Field Machinery and Equipment Manufacturing	33	Manufacturing	333	Machinery Manufacturing	3331	Agriculture, Construction, and Mining Machinery Manufacturing	33313	Mining and Oil and Gas Field Machinery Manufacturing

333414	Heating Equipment (except Warm Air Furnaces) Manufacturing	33	Manufacturing	333	Machinery Manufacturing	3334	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing	33341	Ventilation, Heating, Air-Conditioning, and Commercial Refrigeration Equipment Manufacturing
334512	Automatic Environmental Control Manufacturing for Residential, Commercial, and Appliance Use	33	Manufacturing	334	Computer and Electronic Product Manufacturing	3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	33451	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing
334515	Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals	33	Manufacturing	334	Computer and Electronic Product Manufacturing	3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	33451	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing
486110	Pipeline Transportation of Crude Oil	48	#N/A	486	Pipeline Transportation	4861	Pipeline Transportation of Crude Oil	48611	Pipeline Transportation of Crude Oil
486210	Pipeline Transportation of Natural Gas	48	#N/A	486	Pipeline Transportation	4862	Pipeline Transportation of Natural Gas	48621	Pipeline Transportation of Natural Gas
486910	Pipeline Transportation of	48	#N/A	486	Pipeline Transportation	4869	Other Pipeline Transportation	48691	Pipeline Transportation of Refined Petroleum Products

	Refined Petroleum Products								
486990	All Other Pipeline Transportation	48	#N/A	486	Pipeline Transportation	4869	Other Pipeline Transportation	48699	All Other Pipeline Transportation
541350	Building Inspection Services	54	Professional, Scientific, and Technical Services	541	Professional, Scientific, and Technical Services	5413	Architectural, Engineering, and Related Services	54135	Building Inspection Services
541620	Environmental Consulting Services	54	Professional, Scientific, and Technical Services	541	Professional, Scientific, and Technical Services	5416	Management, Scientific, and Technical Consulting Services	54162	Environmental Consulting Services
541690	Other Scientific and Technical Consulting Services	54	Professional, Scientific, and Technical Services	541	Professional, Scientific, and Technical Services	5416	Management, Scientific, and Technical Consulting Services	54169	Other Scientific and Technical Consulting Services
624229	Other Community Housing Services	62	Health Care and Social Assistance	624	Social Assistance	6242	Community Food and Housing, and Emergency and Other Relief Services	62422	Community Housing Services
926110	Administration of General Economic Programs	92	Public Administration	926	Administration of Economic Programs	9261	Administration of Economic Program	92611	Administration of General Economic Programs
926130	Regulation and Administration of Communications,	92	Public Administration	926	Administration of Economic Programs	9261	Administration of Economic Program	92613	Regulation and Administration of Communications, Electric, Gas, and Other Utilities

Electric, Gas, and Other Utilities

Appendix C

NAICS 2012 Code	Title	L1	Title	L2	Title	L3	Title	L4	Title
212210	Iron Ore Mining	21	Mining, Quarrying, and Oil and Gas Extraction	212	Mining (except Oil and Gas)	2122	Metal Ore Mining	21221	Iron Ore Mining
322110	Pulp Mills	32	Manufacturing	322	Paper Manufacturing	3221	Pulp, Paper, and Paperboard Mills	32211	Pulp Mills
322121	Paper (except Newsprint) Mills	32	Manufacturing	322	Paper Manufacturing	3221	Pulp, Paper, and Paperboard Mills	32212	Paper Mills
322122	Newsprint Mills	32	Manufacturing	322	Paper Manufacturing	3221	Pulp, Paper, and Paperboard Mills	32212	Paper Mills
322130	Paperboard Mills	32	Manufacturing	322	Paper Manufacturing	3221	Pulp, Paper, and Paperboard Mills	32213	Paperboard Mills
322211	Corrugated and Solid Fiber Box Manufacturing	32	Manufacturing	322	Paper Manufacturing	3222	Converted Paper Product Manufacturing	32221	Paperboard Container Manufacturing
322212	Folding Paperboard Box Manufacturing	32	Manufacturing	322	Paper Manufacturing	3222	Converted Paper Product Manufacturing	32221	Paperboard Container Manufacturing

322219	Other Paperboard Container Manufacturing	32	Manufacturing	322	Paper Manufacturing	3222	Converted Paper Product Manufacturing	32221	Paperboard Container Manufacturing
322220	Paper Bag and Coated and Treated Paper Manufacturing	32	Manufacturing	322	Paper Manufacturing	3222	Converted Paper Product Manufacturing	32222	Paper Bag and Coated and Treated Paper Manufacturing
322230	Stationery Product Manufacturing	32	Manufacturing	322	Paper Manufacturing	3222	Converted Paper Product Manufacturing	32223	Stationery Product Manufacturing
322291	Sanitary Paper Product Manufacturing	32	Manufacturing	322	Paper Manufacturing	3222	Converted Paper Product Manufacturing	32229	Other Converted Paper Product Manufacturing
322299	All Other Converted Paper Product Manufacturing	32	Manufacturing	322	Paper Manufacturing	3222	Converted Paper Product Manufacturing	32229	Other Converted Paper Product Manufacturing
325211	Plastics Material and Resin Manufacturing	32	Manufacturing	325	Chemical Manufacturing	3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	32521	Resin and Synthetic Rubber Manufacturing

325212	Synthetic Rubber Manufacturing	32	Manufacturing	325	Chemical Manufacturing	3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Manufacturing	32521	Resin and Synthetic Rubber Manufacturing
325992	Photographic Film, Paper, Plate, and Chemical Manufacturing	32	Manufacturing	325	Chemical Manufacturing	3259	Other Chemical Product and Preparation Manufacturing	32599	All Other Chemical Product and Preparation Manufacturing
326111	Plastics Bag and Pouch Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32611	Plastics Packaging Materials and Unlaminated Film and Sheet Manufacturing
326112	Plastics Packaging Film and Sheet (including Laminated) Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32611	Plastics Packaging Materials and Unlaminated Film and Sheet Manufacturing
326113	Unlaminated Plastics Film and Sheet (except Packaging) Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32611	Plastics Packaging Materials and Unlaminated Film and Sheet Manufacturing

326121	Unlaminated Plastics Profile Shape Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32612	Plastics Pipe, Pipe Fitting, and Unlaminated Profile Shape Manufacturing
326122	Plastics Pipe and Pipe Fitting Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32612	Plastics Pipe, Pipe Fitting, and Unlaminated Profile Shape Manufacturing
326130	Laminated Plastics Plate, Sheet (except Packaging), and Shape Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32613	Laminated Plastics Plate, Sheet (except Packaging), and Shape Manufacturing
326140	Polystyrene Foam Product Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32614	Polystyrene Foam Product Manufacturing
326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32615	Urethane and Other Foam Product (except Polystyrene) Manufacturing

326160	Plastics Bottle Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32616	Plastics Bottle Manufacturing
326191	Plastics Plumbing Fixture Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32619	Other Plastics Product Manufacturing
326199	All Other Plastics Product Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3261	Plastics Product Manufacturing	32619	Other Plastics Product Manufacturing
326211	Tire Manufacturing (except Retreading)	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3262	Rubber Product Manufacturing	32621	Tire Manufacturing
326212	Tire Retreading	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3262	Rubber Product Manufacturing	32621	Tire Manufacturing
326220	Rubber and Plastics Hoses and Belting Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3262	Rubber Product Manufacturing	32622	Rubber and Plastics Hoses and Belting Manufacturing
326291	Rubber Product Manufacturing for Mechanical Use	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3262	Rubber Product Manufacturing	32629	Other Rubber Product Manufacturing

326299	All Other Rubber Product Manufacturing	32	Manufacturing	326	Plastics and Rubber Products Manufacturing	3262	Rubber Product Manufacturing	32629	Other Rubber Product Manufacturing
327310	Cement Manufacturing	32	Manufacturing	327	Nonmetallic Mineral Product Manufacturing	3273	Cement and Concrete Product Manufacturing	32731	Cement Manufacturing
331110	Iron and Steel Mills and Ferroalloy Manufacturing	33	Manufacturing	331	Primary Metal Manufacturing	3311	Iron and Steel Mills and Ferroalloy Manufacturing	33111	Iron and Steel Mills and Ferroalloy Manufacturing
331210	Iron and Steel Pipe and Tube Manufacturing from Purchased Steel	33	Manufacturing	331	Primary Metal Manufacturing	3312	Steel Product Manufacturing from Purchased Steel	33121	Iron and Steel Pipe and Tube Manufacturing from Purchased Steel
331221	Rolled Steel Shape Manufacturing	33	Manufacturing	331	Primary Metal Manufacturing	3312	Steel Product Manufacturing from Purchased Steel	33122	Rolling and Drawing of Purchased Steel
331222	Steel Wire Drawing	33	Manufacturing	331	Primary Metal Manufacturing	3312	Steel Product Manufacturing from Purchased Steel	33122	Rolling and Drawing of Purchased Steel

331313	Alumina Refining and Primary Aluminum Production	33	Manufacturing	331	Primary Metal Manufacturing	3313	Alumina and Aluminum Production and Processing	33131	Alumina and Aluminum Production and Processing
331314	Secondary Smelting and Alloying of Aluminum	33	Manufacturing	331	Primary Metal Manufacturing	3313	Alumina and Aluminum Production and Processing	33131	Alumina and Aluminum Production and Processing
331315	Aluminum Sheet, Plate, and Foil Manufacturing	33	Manufacturing	331	Primary Metal Manufacturing	3313	Alumina and Aluminum Production and Processing	33131	Alumina and Aluminum Production and Processing
331318	Other Aluminum Rolling, Drawing, and Extruding	33	Manufacturing	331	Primary Metal Manufacturing	3313	Alumina and Aluminum Production and Processing	33131	Alumina and Aluminum Production and Processing
331511	Iron Foundries	33	Manufacturing	331	Primary Metal Manufacturing	3315	Foundries	33151	Ferrous Metal Foundries
331512	Steel Investment Foundries	33	Manufacturing	331	Primary Metal Manufacturing	3315	Foundries	33151	Ferrous Metal Foundries
331513	Steel Foundries (except Investment)	33	Manufacturing	331	Primary Metal Manufacturing	3315	Foundries	33151	Ferrous Metal Foundries
331524	Aluminum Foundries (except Die-Casting)	33	Manufacturing	331	Primary Metal Manufacturing	3315	Foundries	33152	Nonferrous Metal Foundries

332111	Iron and Steel Forging	33	Manufacturing	332	Fabricated Metal Product Manufacturing	3321	Forging and Stamping	33211	Forging and Stamping

Appendix D

Serial	Company Name
1	3MV ENERGY CORP
2	ABRAXAS PETROLEUM CORP/NV
3	ACCESS MIDSTREAM PARTNERS LP
4	ADVANTAGE OIL & GAS LTD
6	AETRIUM INC
7	AGL RESOURCES INC
8	AKITA DRILLING LTD -CL A
9	ALABAMA GAS CORP
10	ALCOA INC
11	ALLEGHENY ENRG SUPPLY CO LLC
12	ALLETE INC
13	ALLIANCE RESOURCE PTNRS -LP
14	ALON USA ENERGY INC
15	ALON USA PARTNERS LP
17	ALTAGAS LTD
18	ALTEX INDUSTRIES INC
19	ALTIMA RESOURCES LTD
20	AMERICAN DG ENERGY INC
21	AMERICAN EAGLE ENERGY CORP
22	AMERICAN ENERGY DEV CORP
23	AMERICAN ENERGY GROUP LTD
24	AMERICAN MIDSTREAM PRTNRS LP
25	AMERICAS PETROGAS INC
26	ANADARKO PETROLEUM CORP
27	ANALOGIC CORP
28	ANDERSON ENERGY LTD
29	ANTERO RESOURCES CORP
30	ANTERRA ENERGY INC
31	APACHE CORP
33	APPROACH RESOURCES INC
34	ARC RESOURCES LTD
35	ARCAN RESOURCES LTD
36	ARETE INDUSTRIES INC
37	ARGENT ENERGY TRUST
38	AROWAY ENERGY INC
39	ARPETROL LTD
40	ARSENAL ENERGY INC

41	ARTEK EXPLORATION LTD
42	ARTISAN ENERGY CORP
43	ATCO LTD -CL I
44	ATHABASCA OIL CORP
45	ATHLON ENERGY INC
46	ATLAS ENERGY LP
47	ATLAS PIPELINE PARTNER LP
48	ATLAS RESOURCE PARTNERS LP
49	ATMOS ENERGY CORP
50	ATWOOD OCEANICS
51	AVEDA TRANSN AND ENERGY SVCS
52	BAKER HUGHES INC
53	BAKKEN RESOURCES INC
54	BANKERS PETROLEUM LTD
55	BARNWELL INDUSTRIES
56	BASIC ENERGY SERVICES INC
57	BAYTEX ENERGY CORP
58	BELDEN INC
59	BELLATRIX EXPLORATION LTD
60	BENGAL ENERGY LTD
61	BERKLEY RENEWABLES INC
63	BILL BARRETT CORP
64	BIRCH LAKE ENERGY INC
65	BIRCHCLIFF ENERGY LTD
66	BLACK RIDGE OIL & GAS INC
67	BLACKBIRD ENERGY INC
68	BLACKDOG RESOURCES LTD
69	BLACKHAWK RESOURCE CORP
70	BLACKPEARL RESOURCES INC
71	BLACKSANDS PETROLEUM INC
72	BLUE DOLPHIN ENERGY CO
73	BLUEKNIGHT ENERGY PRTNRS LP
74	BNK PETROLEUM INC
75	BOARDWALK PIPELINE PRTNRS-LP
76	BOLT TECHNOLOGY CORP
77	BONANZA CREEK ENERGY INC
78	BONAVISTA ENERGY CORP
79	BONTERRA ENERGY CORP
80	BORNEO RESOURCE INVESTMENTS
82	BPZ RESOURCES INC
83	BRAVO ENTERPRISES LTD
84	BREITBURN ENERGY PARTNERS LP

85	BRENHAM OIL & GAS CORP
86	BUCKEYE PARTNERS LP
87	C&J ENERGY SERVICES INC
88	CABOT OIL & GAS CORP
89	CAL DIVE INTERNATIONAL INC
90	CALFRAC WELL SERVICES LTD
91	CALLON PETROLEUM CO/DE
92	CALMENA ENERGY SERVICES INC
93	CALUMET SPECIALTY PRODS -LP
94	CALVALLEY PETROLEUM INC
95	CAMAC ENERGY INC
96	CAMECO CORP
97	CAMERON INTERNATIONAL CORP
98	CANACOL ENERGY LTD
99	CANADIAN ENERGY SVCS & TECH
100	CANADIAN NATURAL RESOURCES
101	CANADIAN OIL SANDS LTD
102	CANADIAN SPIRIT RESOURCES
103	CANADIAN UTILITIES -CL A
104	CANAMAX ENERGY LTD
105	CANDAX ENERGY INC
106	CANELSON DRILLING INC
107	CANUC RESOURCES CORP CDA
108	CANYON SERVICES GROUP INC
109	CARBON NATURAL GAS CO
110	CARDINAL ENERGY GROUP INC
111	CARDINAL ENERGY LTD
113	CARRIZO OIL & GAS INC
114	CASCADE MICROTECH INC
115	CASPIAN ENERGY INC
116	CASPIAN SERVICES INC
117	CATHEDRAL ENERGY SVCS LTD
118	CAZA OIL & GAS INC
119	CENOVUS ENERGY INC
120	CENTERPOINT ENERGY RES CORP
121	CEQUENCE ENERGY LTD
122	CHANGFENG ENERGY INC
123	CHAPARRAL ENERGY INC
124	CHENIERE ENERGY INC
125	CHENIERE ENERGY PTNRS LP LLC
126	CHESAPEAKE ENERGY CORP
127	CHESAPEAKE UTILITIES CORP

128	CHEVRON CORP
132	CHINOOK ENERGY INC
133	CIMAREX ENERGY CO
134	CLAYTON WILLIAMS ENERGY INC
135	CLOUD PEAK ENERGY INC
137	COHU INC
138	COLORADO INTERSTATE GAS CO
139	COMPRESSCO PARTNERS LP
140	COMSTOCK RESOURCES INC
141	CONCHO RESOURCES INC
142	CONDOR PETROLEUM INC
143	CONNACHER OIL & GAS LTD
144	CONOCOPHILLIPS
145	CONSOL ENERGY INC
146	CONSOLIDATED EDISON CO OF NY
147	CONSTELLATION ENERGY PRTNRS
148	CONTANGO OIL & GAS CO
149	CONTINENTAL RESOURCES INC
151	CORNING NATURAL GAS HLDG CP
152	CORRIDOR RESOURCES INC
153	CRESCENT POINT ENERGY CORP
154	CRESTWOOD MIDSTREAM PTNRS LP
155	CREW ENERGY INC
156	CROCOTTA ENERGY INC
157	CROSSTEX ENERGY INC
158	CROWN POINT ENERGY INC
159	CUB ENERGY INC
160	CUBIC ENERGY INC
161	CVR ENERGY INC
162	CVR REFINING LP
163	CWC ENERGY SERVICES CORP
164	CYGAM ENERGY INC
165	CYPRESS ENERGY PARTNERS LP
166	CYPRESS HILLS RESOURCE CORP
167	DALECO RESOURCES CORP
168	DATA I/O CORP
169	DAWSON GEOPHYSICAL CO
170	DAYBREAK OIL & GAS INC
171	DCP MIDSTREAM PARTNERS LP
172	DEEP DOWN INC
173	DEETHREE EXPLORATION LTD
174	DEJOUR ENERGY INC

175	DELEK US HOLDINGS INC
176	DELPHI ENERGY CORP
177	DELTA NATURAL GAS CO INC
178	DENBURY RESOURCES INC
179	DENISON MINES CORP
180	DEVON ENERGY CORP
181	DIAMOND OFFSHRE DRILLING INC
182	DIAMONDBACK ENERGY INC
183	DIVERGENT ENERGY SERVICES
184	DONNYCREEK ENERGY INC
185	DRIL-QUIP INC
186	DUALEX ENERGY INTL INC
187	DUKE ENERGY INDIANA INC
188	DUNDEE ENERGY LTD
189	DUNE ENERGY INC
190	DYCOM INDUSTRIES INC
191	DYNEGY INC
192	EAGLE ENERGY TRUST
193	EAGLE FORD OIL & GAS CORP
194	EAGLE ROCK ENERGY PARTNRS LP
195	EAGLEWOOD ENERGY INC
196	EARTHSTONE ENERGY INC
197	EAST WEST PETROLEUM CORP
198	ECHELON CORP
199	ECLIPSE RESOURCES CORP
200	ECOLOGY AND ENVIRONMENT INC
202	ECOSPHERE TECHNOLOGIES INC
203	EDGE RESOURCES INC
204	EL PASO NATURAL GAS CO
205	EL PASO PIPELINE PARTNERS LP
207	EMERALD OIL INC
208	ENABLE MIDSTREAM PARTNERS LP
209	ENBRIDGE ENERGY PRTNRS -LP
210	ENBRIDGE GAS DISTRIBUTION
211	ENBRIDGE INC
212	ENBRIDGE INCOME FUND HLDGS
213	ENCANA CORP
214	ENCORE WIRE CORP
215	ENDEAVOUR INTERNATIONAL CORP
216	ENERFLEX LTD
217	ENERGEN CORP
218	ENERGY & TECHNOLOGY CORP

219	ENERGY FUELS INC
220	ENERGY SERVICES OF AMERICA
221	ENERGY TRANSFER EQUITY LP
222	ENERGY TRANSFER PARTNERS - LP
224	ENERJEX RESOURCES INC
225	ENERPLUS CORP
226	ENHANCED OIL RESOURCES INC
228	ENLINK MIDSTREAM LLC
229	ENLINK MIDSTREAM PARTNERS LP
231	ENSECO ENERGY SERVICES CORP
232	ENSERVCO CORP
233	ENSIGN ENERGY SERVICES INC
234	ENTERPRISE GROUP INC
235	ENTERPRISE PRODS PRTNRS -LP
236	EOG RESOURCES INC
237	EOS PETRO INC
238	EP ENERGY CORP
239	EPL OIL & GAS INC
240	EPSILON ENERGY LTD
241	EQT CORP
242	EQT MIDSTREAM PARTNERS LP
243	EQUAL ENERGY LTD
244	ESCALERA RESOURCES CO
245	ESSENTIAL ENERGY SVCS LTD
246	ETRION CORP
247	EUROSITE POWER INC
248	EV ENERGY PARTNERS LP
249	EVOLUTION PETROLEUM CORP
250	EXALL ENERGY CORP
251	EXCO RESOURCES INC
252	EXFO INC
253	EXTERRAN HOLDINGS INC
254	EXXON MOBIL CORP
255	FALCON OIL & GAS LTD
256	FALCONRIDGE OIL TECHNOLOGIES
257	FAR EAST ENERGY CORP
258	FIELDPOINT PETROLEUM CORP
259	FMC TECHNOLOGIES INC
261	FORBES ENERGY SERVICES LTD
262	FOREMOST INCOME FUND
263	FORENT ENERGY LTD
264	FORESIGHT ENERGY LP

265	FOREST OIL CORP
266	FORMFACTOR INC
267	FORTALEZA ENERGY INC
268	FORTISBC HOLDINGS INC
269	FORUM ENERGY TECH INC
271	FRONTIER OILFIELD SRVCS INC
272	FUEL PERFORMANCE SOLUTIONS
273	FX ENERGY INC
274	GAS NATURAL INC
275	GASE ENERGY INC
276	GASFRAC ENERGY SERVICES INC
278	GEAR ENERGY LTD
279	GENERAL CABLE CORP/DE
280	GEOMET INC
282	GEOROX RESOURCES INC
283	GIGA-TRONICS INC
284	GLOBAL GEOPHYSICAL SVCS INC
285	GOLDFIELD CORP
286	GOODRICH PETROLEUM CORP
287	GRAN TIERRA ENERGY INC
288	GREENFIELDS PETROLEUM CORP
289	GULF ISLAND FABRICATION INC
290	GULF SHORES RESOURCES LTD
291	GULFPORT ENERGY CORP
292	HALCON RESOURCES CORP
293	HALLADOR ENERGY CO
294	HALLIBURTON CO
295	HELIX ENERGY SOLUTIONS
296	HELMERICH & PAYNE
297	HEMISPHERE ENERGY CORP
298	HERCULES OFFSHORE INC
300	HESS CORP
301	HICKOK INC -CL A
302	HKN INC
303	HOLLY ENERGY PARTNERS LP
304	HOLLYFRONTIER CORP
305	HONEYWELL INTERNATIONAL INC
306	HORIZON NORTH LOGISTICS INC
307	HOUSTON AMERN ENERGY CORP
308	HTC PURENERGY INC
309	HUSKY ENERGY INC
310	HYDROCARB ENERGY CORP

311	HYDUKE ENERGY SERVICES INC
312	IMPERIAL OIL LTD
313	INTEGRATED DRILLING EQPT HLD
314	INTERNATIONAL WIRE GRP HLDGS
315	INTEROIL CORP
316	INTL FRONTIER RESOURCES CORP
317	IONA ENERGY INC
318	IRONHORSE OIL & GAS INC
319	ISRAMCO INC
320	ITHACA ENERGY INC
321	JONES ENERGY INC
322	JOURNEY ENERGY INC
323	JOY GLOBAL INC
324	JP ENERGY PARTNERS LP-REDH
325	JUHL ENERGY INC
326	JUNEX INC
327	JURA ENERGY CORP
328	KAISER ALUMINUM CORP
329	KALLISTO ENERGY CORP
330	KELT EXPLORATION LTD
331	KEY ENERGY SERVICES INC
332	KEYERA CORP
333	KEYSIGHT TECHNOLOGIES -SPN
334	KINDER MORGAN ENERGY -LP
335	KINDER MORGAN INC
336	KINGSLAND ENERGY CORP
337	KODIAK OIL & GAS CORP
339	LACLEDE GAS CO
340	LACLEDE GROUP INC
341	LAREDO PETROLEUM INC
342	LAYNE CHRISTENSEN CO
343	LEGACY OIL PLUS GAS INC
344	LEGACY RESERVES LP
345	LGX OIL PLUS GAS INC
346	LIGHTSTREAM RESOURCES LTD
347	LIHUA INTERNATIONAL INC
348	LILIS ENERGY INC
349	LIME ENERGY CO
350	LINN ENERGY LLC
351	LOGAN INTERNATIONAL INC
352	LONESTAR WEST INC
353	LONG RUN EXPLORATION LTD

354	LRR ENERGY LP
355	LUCAS ENERGY INC
358	LYNDEN ENERGY CORP
359	MACRO ENTERPRISES INC
360	MADALENA ENERGY INC
361	MAGELLAN MIDSTREAM PRTNRS LP
362	MAGELLAN PETROLEUM CORP
363	MAGNUM ENERGY INC
364	MAGNUM HUNTER RESOURCES CORP
365	MANITOK ENERGY INC
366	MARATHON OIL CORP
367	MARATHON PETROLEUM CORP
368	MARKWEST ENERGY PARTNERS LP
369	MARLIN MIDSTREAM PARTNERS LP
370	MARQUEE ENERGY LTD
371	MARRET RESOURCE CORP
372	MART RESOURCES INC
373	MASSIVE INTERACTIVE INC
374	MASTEC INC
375	MATADOR RESOURCES CO
376	MATRRIX ENERGY TECHNOLOGIES
377	MCCHIP RESOURCES INC
378	MCCOY GLOBAL INC
380	MDU RESOURCES GROUP INC
381	MEG ENERGY CORP
382	MEMORIAL PRODUCTION PRTRS LP
383	MEMORIAL RESOURCE DEV CORP
384	METALORE RESOURCES LTD
385	MEXCO ENERGY CORP
386	MGM ENERGY CORP
387	MICHIGAN CONSOLIDATED GAS CO
388	MIDAMERICAN FUNDING LLC
389	MIDCOAST ENERGY PARTNERS LP
390	MID-CON ENERGY PARTNERS -LP
391	MIDSTATES PETROLEUM CO INC
392	MONDIAL VENTURES INC
393	MONTANA EXPLORATION CORP
394	MOUNTAINVIEW ENERGY LTD
395	MPLX LP
396	MUELLER INDUSTRIES
397	MURPHY OIL CORP
399	NATIONAL FUEL GAS CO

400	NATIONAL OILWELL VARCO INC
401	NATURAL GAS SERVICES GROUP
402	NEW JERSEY RESOURCES CORP
403	NEW SOURCE ENERGY PRTRS LP
404	NEW WESTERN ENERGY CORP
405	NEW ZEALAND ENERGY CORP
406	NEWFIELD EXPLORATION CO
407	NEWPORT EXPLORATION LTD
408	NEXT GENERATION MGMT CORP
409	NIKO RESOURCES LTD
410	NISKA GAS STORAGE PARTNERS
411	NISOURCE INC
412	NITRO PETROLEUM INC
414	NOBLE ENERGY INC
417	NORTH SHORE GAS CO
418	NORTHERN OIL & GAS INC
419	NORTHERN SPIRIT RESOURCES
420	NORTHERN STATES POWER/WI
421	NORTHERN TIER ENERGY LP
422	NORTHWEST NATURAL GAS CO
423	NORTHWEST PIPELINE CORP
424	NUSTAR ENERGY LP
425	NUVERRA ENVIRONMENTAL SOLUTN
426	NUVISTA ENERGY LTD
427	OANDO ENERGY RESOURCES INC
428	OASIS PETROLEUM INC
429	OCCIDENTAL PETROLEUM CORP
431	OCEANEERING INTERNATIONAL
432	OIL STATES INTL INC
433	OLD DOMINION ELECTRIC COOP
434	ONE GAS INC
435	ONENERGY INC
436	ONEOK INC
437	ONEOK PARTNERS -LP
438	OPLINK COMMUNICATIONS INC
439	ORCA EXPLORATION GROUP INC
440	OSAGE EXPLORATION AND DEV
441	OXFORD RESOURCE PARTNERS LP
443	PACIFIC PARADYM ENERGY INC
444	PACIFIC RUBIALES ENERGY CORP
445	PAINTED PONY PETROLEUM LTD
447	PALLISER OIL & GAS CORP

448	PAN ORIENT ENERGY CORP
449	PANHANDLE EASTERN PIPE LINE
450	PANHANDLE OIL & GAS INC
451	PAR PETROLEUM CORP
452	PARALLEL ENERGY TRUST
453	PARAMOUNT RESOURCES LTD
454	PAREX RESOURCES INC
455	PARKER DRILLING CO
456	PARSLEY ENERGY INC
457	PASON SYSTEMS INC
458	PATTERN ENERGY GROUP INC
459	PATTERSON-UTI ENERGY INC
460	PBF ENERGY INC
461	PDC ENERGY INC
462	PEABODY ENERGY CORP
463	PEDEVCO CORP
464	PEGASI ENERGY RESOURCES CORP
465	PEMBINA PIPELINE CORP
466	PENGROWTH ENERGY CORP
467	PENN VIRGINIA CORP
468	PENN WEST PETROLEUM LTD
469	PEOPLES GAS LIGHT & COKE CO
470	PERPETUAL ENERGY INC
471	PETRO VISTA ENERGY CORP
472	PETROAMERICA OIL CORP
476	PETROHAWK ENERGY CORP
477	PETROLIA INC
478	PETROLOGISTICS LP
479	PETROQUEST ENERGY INC
480	PETROSHALE INC
481	PEYTO EXPLORATION & DEVELPMT
482	PHILLIPS 66
483	PHILLIPS 66 PARTNERS LP
484	PHOENIX CANADA OIL CO LTD
485	PHX ENERGY SERVICES CORP
486	PIEDMONT NATURAL GAS CO
487	PINE CLIFF ENERGY LTD
488	PINECREST ENERGY INC
489	PIONEER ENERGY SERVICES CORP
490	PIONEER NATURAL RESOURCES CO
491	POSTROCK ENERGY CORP
492	POWDER MOUNTAIN ENERGY-OLD

493	POWERSECURE INTL INC
494	PRAIRIESKY ROYALTY LTD
495	PRECISION DRILLING CORP
496	PRIMEENERGY CORP
497	PRIMORIS SERVICES CORP
498	PROFIRE ENERGY INC
499	PUBLIC SERVICE CO OF N C
500	PVR PARTNERS LP
501	PYRAMID OIL CO
502	QEP MIDSTREAM PARTNERS LP
503	QEP RESOURCES INC
504	QR ENERGY LP
505	QUEST SOLUTION INC
506	QUESTAR CORP
507	QUESTAR GAS CO
508	QUESTAR PIPELINE CO
509	QUESTERRE ENERGY CORP
510	QUESTOR TECHNOLOGY INC
511	QUICKSILVER RESOURCES INC
512	RAGING RIVER EXPLORATION INC
513	RAISE PRODUCTION INC
514	RAM POWER CORP
515	RANGE RESOURCES CORP
516	REGENCY ENERGY PARTNERS LP
517	RELENTLESS RESOURCES LTD
518	RENEGADE PETROLEUM LTD
520	RESERVE PETROLEUM CO
521	RESOLUTE ENERGY CORP
522	REX ENERGY CORP
523	RGC RESOURCES INC
524	RICE ENERGY INC
525	RING ENERGY INC
526	RIO BRAVO OIL INC
527	RMP ENERGY INC
528	ROCK ENERGY INC
529	ROSETTA RESOURCES INC
532	ROYALE ENERGY INC
533	RPC INC
534	RSP PERMIAN INC
536	SANCHEZ ENERGY CORP
537	SANDRIDGE ENERGY INC
538	SANTONIA ENERGY INC

540	SARATOGA RESOURCES INC
542	SAVANNA ENERGY SVCS CORP
544	SEA DRAGON ENERGY INC
547	SECURE ENERGY SERVICES INC
548	SERINUS ENERGY INC
549	SEVENTY SEVEN ENERGY INC
550	SHORELINE ENERGY CORP
551	SM ENERGY CO
552	SMARTHEAT INC
553	SOUTH JERSEY GAS CO
554	SOUTH JERSEY INDUSTRIES INC
555	SOUTHCROSS ENERGY PRTNRS LP
556	SOUTHERN CALIFORNIA EDISON
557	SOUTHERN CALIFORNIA GAS CO
558	SOUTHERN NATURAL GAS CO
559	SOUTHERN PACIFIC RESOURCE CP
560	SOUTHERN STAR CENTRAL CORP
561	SOUTHWEST GAS CORP
562	SOUTHWESTERN ENERGY CO
563	SPARK ENERGY INC-REDH
564	SPARTAN ENERGY CORP
565	SPECTRA ENERGY CORP
566	SPECTRA ENERGY PARTNERS LP
567	SPINDLETOP OIL & GAS CO
568	SPROTT RESOURCE CORP
569	SPYGLASS RESOURCES CORP
570	STANDARD EXPLORATION LTD
572	STEALTH VENTURES INC
573	STEEL EXCEL INC
574	STERLING RESOURCES LTD
575	STONE ENERGY CORP
576	STORM RESOURCES LTD
577	STRAD ENERGY SERVICES LTD
578	STRATA-X ENERGY LTD
579	STRATEGIC OIL & GAS LTD
580	STRATEX OIL & GAS HLDGS INC
581	STREAM OIL & GAS LTD
582	SUMMIT MIDSTREAM PARTNERS LP
583	SUNCOR ENERGY INC
584	SUNOCO LOGISTICS PARTNERS LP
585	SUPERIOR DRILLING PRODUCTS
586	SUPERIOR ENERGY SERVICES INC

587	SUPERNOVA ENERGY INC
588	SURGE ENERGY INC
589	SUROCO ENERGY INC
590	SWIFT ENERGY CO
591	SYNERGY RESOURCES CORP
592	SYSTEM ENERGY RESOURCES INC
593	TAG OIL LTD
594	TALISMAN ENERGY INC
595	TALLGRASS ENERGY PRT LP
596	TAMARACK VALLEY ENERGY LTD
597	TAMPA ELECTRIC CO
598	TARGA RESOURCES CORP
599	TARGA RESOURCES PARTNERS LP
600	TEL-INSTRUMENT ELECTRONICS
601	TENGASCO INC
602	TENNESSEE VALLEY AUTHORITY
603	TERADYNE INC
604	TERRA ENERGY CORP
605	TERRACE ENERGY CORP
606	TERRAFORM POWER INC-REDH
607	TERRAVEST CAPITAL INC
608	TESCO CORP
609	TESLA EXPLORATION LTD
610	TESORO CORP
612	TETRA TECH INC
613	TETRA TECHNOLOGIES INC/DE
614	TEXAS NEW MEXICO POWER CO
615	TEXAS VANGUARD OIL CO
616	TN-K ENERGY GROUP INC
617	TORC OIL & GAS LTD
618	TORCHLIGHT ENERGY RESOURCES
619	TOSCANA ENERGY INCOME CORP
621	TOUCHSTONE EXPLORATION -OLD
622	TOURMALINE OIL CORP
623	TRANS ENERGY INC
624	TRANSATLANTIC PETROLEUM LTD
625	TRANSCANADA CORP
626	TRANSCOASTAL CORP
627	TRANSCONTINENTAL GAS PIPE LN
628	TRANSGLOBE ENERGY CORP
629	TRANSMONTAIGNE PARTNERS LP
632	TRAVERSE ENERGY LTD

633	TRECORA RESOURCES
634	TRIANGLE PETROLEUM CORP
635	TRICAN WELL SERVICE LTD
636	TRILOGY ENERGY CORP
637	TRINIDAD DRILLING LTD
638	TUCSON ELECTRIC POWER CO
639	TUDOR CORP LTD
640	TUSCANY INTL DRILLING INC
641	TWIN BUTTE ENERGY LTD
642	U S CHINA MINING GROUP INC
643	U S ENERGY CORP/WY
644	U S GEOTHERMAL INC
645	UGI CORP
646	UGI UTILITIES INC
647	ULTRA PETROLEUM CORP
648	UNION GAS LTD
649	UNIT CORP
650	UNITED REFINING CO
651	UR ENERGY INC
652	URANIUM ENERGY CORP
653	URANIUM ONE INC
654	US OIL SANDS INC
655	USA COMPRESSION PRTNRS LP
656	VAALCO ENERGY INC
657	VALERO ENERGY CORP
658	VALEURA ENERGY INC
659	VANGUARD NATURAL RESOURCES
661	VECTREN CORP
662	VECTREN UTILITY HOLDINGS INC
663	VERESEN INC
664	VERMILION ENERGY INC
665	VERSAR INC
666	VOC ENERGY TRUST
667	W&T OFFSHORE INC
668	WALDRON ENERGY CORP
669	WARREN RESOURCES INC
670	WASHINGTON GAS LIGHT CO
671	WATERFURNACE RENEWABLE ENERGY
672	WAVEFRONT TECHNOLOGY SOLTNS
674	WENTWORTH RESOURCES LTD
675	WESTERN ENERGY SERVICES CORP
676	WESTERN GAS EQUITY PRTNRS LP

677	WESTERN GAS PARTNERS LP
678	WESTERN MASSACHUSETTS EL CO
679	WESTERN REFINING INC
680	WGL HOLDINGS INC
681	WHITECAP RESOURCES INC
682	WHITING PETROLEUM CORP
683	WILLBROS GROUP INC
684	WILLIAMS COS INC
685	WILLIAMS PARTNERS LP
686	WILTON RESOURCES INC
687	WINALTA INC
688	WPX ENERGY INC
689	WSP GLOBAL INC
690	XCERRA CORP
691	XTREME DRILLING & COIL SVCS
692	XXL ENERGY CORP
694	YANGARRA RESOURCES LTD
696	YOHO RESOURCES INC
697	ZARGON OIL & GAS LTD
698	ZAZA ENERGY CORP
699	ZTEST ELECTRONICS INC

Appendix E

Serial	Company Name
1	3M CO
2	ADF GROUP INC
3	AEP INDUSTRIES INC
4	AIRBOSS OF AMERICA CORP
5	AK STEEL HOLDING CORP
6	ALCOA INC
7	ALERIS CORP
8	ALLEGHENY TECHNOLOGIES INC
9	ALPHA PRO TECH LTD
10	AMERITYRE CORP
11	AMPCO-PITTSBURGH CORP
12	APPLETON PAPERS INC
13	APTARGROUP INC
14	ARMSTRONG WORLD INDUSTRIES
15	ASPEN AEROGELS INC
16	ASSOCIATED MATERIALS LLC
17	ATKORE INTERNATIONAL HLDGS
18	AVERY DENNISON CORP
19	AXION INTL HOLDINGS INC
20	BEMIS CO INC
21	BUCKEYE TECHNOLOGIES INC
22	CANFOR PULP PRODUCTS INC
23	CARPENTER TECHNOLOGY CORP
24	CASCADES INC
25	CATALYST PAPER CORP
26	CENTURY ALUMINUM CO

27	CHEMTURA CORP
28	CLEARWATER PAPER CORP
29	CLIFFS NATURAL RESOURCES INC
30	COOPER TIRE & RUBBER CO
31	CORE MOLDING TECHNOLOGIES
32	CSS INDUSTRIES INC
33	CTI INDUSTRIES CORP
34	DOMTAR CORP
35	DOW CHEMICAL
36	EASTMAN CHEMICAL CO
37	EASTMAN KODAK CO
38	ECOSYNTHETIX INC
39	ENTEGRIS INC
40	FEMALE HEALTH CO
41	FORTRESS PAPER LTD
42	FRIEDMAN INDUSTRIES INC
43	GIBRALTAR INDUSTRIES INC
44	GLATFELTER
45	GOODYEAR TIRE & RUBBER CO
46	GRAPHIC PACKAGING HOLDING CO
47	GREIF INC -CL A
48	GSE HOLDING INC
49	HANWEI ENERGY SERVICES CORP
50	HARSCO CORP
51	HAYNES INTERNATIONAL INC
52	INTERTAPE POLYMER GROUP INC
53	INTL PAPER CO
54	INVENTRONICS LTD
55	JARDEN CORP
56	KAISER ALUMINUM CORP

57	KAPSTONE PAPER & PACKAGING
58	KIMBERLY-CLARK CORP
59	KRATON PERFORMANCE POLYMERS
60	LABRADOR IRON MINES HLDG LTD
61	LAPOLLA INDUSTRIES INC
62	MARTINREA INTL INC
63	MEADWESTVACO CORP
64	MERCER INTL INC
65	MUELLER WATER PRODUCTS INC
66	MYERS INDUSTRIES INC
67	NEENAH PAPER INC
68	NEW MILLENNIUM IRON CORP
69	NEWPAGE CORP
70	NORANDA ALUMINUM HOLDING CP
71	NORTHWEST PIPE CO
72	NOVELIS INC
73	NUCOR CORP
74	OMNOVA SOLUTIONS INC
75	ORCHIDS PAPER PRODUCTS
76	OURPETS CO
77	PACKAGING CORP OF AMERICA
78	POLLARD BANKNOTE LTD
79	POLYONE CORP
80	QUANEX BUILDING PRODUCTS
81	RAYONIER INC
82	RELIABRAND INC
83	RESOLUTE FOREST PRODUCTS INC
84	ROCK-TENN CO
85	ROGERS CORP
86	SCHULMAN (A.) INC

87	SCHWEITZER-MAUDUIT INTL INC
88	SEALED AIR CORP
89	SONOCO PRODUCTS CO
90	STEEL DYNAMICS INC
91	SYNALLOY CORP
92	TEMBEC INC
93	TIMKENSTEEL CORP
94	TITAN INTERNATIONAL INC
95	TREDEGAR CORP
96	TUPPERWARE BRANDS CORP
97	UFP TECHNOLOGIES INC
98	UNITED STATES STEEL CORP
99	UNVL STAINLESS & ALLOY PRODS
100	VERSO PAPER CORP
101	VERSO PAPER HOLDINGS LLC
102	VISKASE COMPANIES INC
103	WAUSAU PAPER CORP
104	WEBCO INDUSTRIES INC
105	WEST PHARMACEUTICAL SVSC INC
106	WORTHINGTON INDUSTRIES
107	ZAGG INC
108	ZCL COMPOSITES INC

Appendix F

Sector	Name	S&P Business Description	Web URL
Energy	ACCESS MIDSTREAM PARTNERS LP	Access Midstream Partners, L.P. owns, operates, develops, and acquires natural gas, natural gas liquids (NGLs) and oil gathering systems, and other midstream energy assets in the United States. It focuses on natural gas and NGL gathering operations.	www.accessmidstream.com
Energy	AGL RESOURCES INC	AGL Resources Inc., an energy services holding company, distributes natural gas to residential, commercial, industrial, and governmental customers in Illinois, Georgia, Virginia, New Jersey, Florida, Tennessee, and Maryland.	www.aglresources.com

Energy	ALLETE INC	ALLETE, Inc., together with its subsidiaries, generates, transmits, and distributes electricity in the United States. It operates through Regulated Operations, and Investments and Other segments. The company generates electricity from coal, hydel, wind, and biomass.	www.allete.com
Energy	ALLIANCE RESOURCE PTNRS -LP	Alliance Resource Partners, L.P. is engaged in the production and marketing of coal primarily to utilities and industrial users in the United States. It operates 10 underground mining complexes in Illinois, Indiana, Kentucky, Maryland, and West Virginia.	www.arlp.com
Energy	ALON USA ENERGY INC	Alon USA Energy, Inc. operates as an independent refiner and marketer of petroleum products primarily in the South Central,	www.alonusa.com

		Southwestern, and the Western regions of the United States. The company operates in three segments: Refining and Marketing, Asphalt, and Retail.		
Energy	ALON USA PARTNERS LP	Alon USA Partners, LP refines and markets petroleum products primarily in the South Central and Southwestern regions of the United States. The company owns and operates a crude oil refinery in Big Spring, Texas with crude oil throughput capacity of 70,000 barrels per day.		www.alonpartners.com
Energy	ALTAGAS LTD	AltaGas Ltd., a diversified energy infrastructure company, is engaged in gas, power, and regulated utilities businesses in Canada, and the northern and western United States. It operates through three segments: Gas, Power, and Utilities.		www.altagas.ca

Energy	ANADARKO PETROLEUM CORP	Anadarko Petroleum Corporation is engaged in the exploration, development, production, and marketing of oil and gas properties. It operates through three segments: Oil and Gas Exploration and Production; Midstream; and Marketing.	www.anadarko.com
Energy	ANTERO RESOURCES CORP	Antero Resources Corporation, an independent oil and natural gas company, acquires, explores for, and develops natural gas, natural gas liquids, and oil properties in the United States.	www.anteroresources.com
Energy	APACHE CORP	Apache Corporation, an independent energy company, explores for, develops, and produces natural gas, crude oil, and natural gas liquids.	www.apachecorp.com
Energy	APPROACH RESOURCES INC	Approach Resources Inc., an independent energy company, is engaged in the acquisition, development,	www.approachresources.com

		exploration, and production of oil and gas properties in the United States.	
Energy	ARC RESOURCES LTD	ARC Resources Ltd., together with its subsidiaries, is engaged in the acquisition, exploration, development, production, and sale of crude oil, natural gas, and natural gas liquids in Western Canada.	www.arcresources.com
Energy	ARTISAN ENERGY CORP	Artisan Energy Corporation engages in the exploration for, development of, and production of oil and natural gas reserves in western Canada. The company is headquartered in Calgary, Canada.	www.artisanenergy.ca
Energy	ATCO LTD -CL I	ATCO Ltd. is engaged in structures and logistics, utilities, energy, and technology operations worldwide.	www.atco.com

Energy	ATHABASCA OIL CORP	Athabasca Oil Corporation is engaged in the exploration, development, and production of thermal and light oil resource plays in the Western Canadian Sedimentary Basin in Alberta, Canada. It operates through Thermal Oil and Light Oil segments.	www.atha.com
Energy	ATLAS PIPELINE PARTNER LP	Atlas Pipeline Partners, L.P. operates in the gathering and processing segments of the midstream natural gas industry. It operates through two segments, Gathering and Processing; and Transportation, Treating, and Other.	www.atlaspipelinepartners.com
Energy	ATLAS RESOURCE PARTNERS LP	Atlas Resource Partners, L.P. operates as an independent developer and producer of natural gas, crude oil, and natural gas liquids in the United States. The company operates in	www.atlasresourcepartners.com

		three segments: Gas and Oil Production, Well Construction and Completion, and Other Partnership Management.		
Energy	BAKER HUGHES INC	Baker Hughes Incorporated supplies oilfield services, products, technology, and systems to the oil and natural gas industry worldwide.		www.bakerhughes.com
Energy	BANKERS PETROLEUM LTD	Bankers Petroleum Ltd. is engaged in the exploration, development, and production of oil and gas in Albania.		www.bankerspetroleum.com
Energy	BASIC ENERGY SERVICES INC	Basic Energy Services, Inc. provides well site services to oil and natural gas drilling and producing companies in the United States.		www.basicenergyservices.com
Energy	BAYTEX ENERGY CORP	Baytex Energy Corp., an oil and gas company, is engaged in the acquisition, development, and production of oil and natural gas in the		www.baytex.ab.ca

		Western Canadian Sedimentary Basin and the United States. The company offers heavy oil, light oil, and natural gas liquids.	
Energy	BNK PETROLEUM INC	BNK Petroleum Inc., an international energy company, focuses on the acquisition, exploration, development, production, and marketing of unconventional oil and gas resource plays in the United States and Europe. The company produces crude oil, natural gas, and natural gas liquids.	www.bnkpetroleum.com
Energy	BONANZA CREEK ENERGY INC	Bonanza Creek Energy, Inc., together with its subsidiaries, operates as an independent energy company in the United States.	www.bonanzacrk.net
Energy	BONAVISTA ENERGY CORP	Bonavista Energy Corporation is engaged in the acquisition, exploration, development, and production of oil and natural gas assets	www.bonavistaenergy.com

		in Canada. The company's properties are located in Alberta and British Columbia.	
Energy	BPZ RESOURCES INC	BPZ Resources, Inc., together with its subsidiaries, focuses on the exploration, development, and production of oil and natural gas in Peru and Ecuador.	www.bpzenergy.com
Energy	C&J ENERGY SERVICES INC	C&J Energy Services, Inc., through its subsidiaries, provides hydraulic fracturing, coiled tubing, wireline, and other complementary services to oil and gas exploration and production companies in the United States.	www.cjenergy.com
Energy	CABOT OIL & GAS CORP	Cabot Oil & Gas Corporation, an independent oil and gas company, is engaged in the development, exploitation, exploration, production, and marketing of natural gas, crude oil, and	www.cabotog.com

		natural gas liquids in the United States.	
Energy	CAL DIVE INTERNATIONAL INC	Cal Dive International, Inc., a marine contractor, provides manned diving, pipelay, and pipe burial services; platform installation and salvage services; and light well intervention services to customers in the offshore oil and natural gas industry.	www.caldive.com
Energy	CALFRAC WELL SERVICES LTD	Calfrac Well Services Ltd., together with its subsidiaries, provides specialized oilfield services in Canada, the United States, Russia, Mexico, Argentina, and Colombia.	www.calfrac.com
Energy	CALMENA ENERGY SERVICES INC	Calmena Energy Services Inc., a diversified energy services company, provides well construction services for the exploration and development of oil and gas reserves in Canada, the	www.calmena.com

		United States, Latin America, the Middle East, and North Africa.		
Energy	CAMECO CORP	Cameco Corporation produces and sells uranium worldwide. The company operates through four segments: Uranium, Fuel Services, Electricity, and NUKEM. The Uranium segment is involved in the exploration for, mining, milling, purchase, and sale of uranium concentrate.		www.cameco.com
Energy	CAMERON INTERNATIONAL CORP	Cameron International Corporation provides flow equipment products, systems, and services worldwide.		www.c-a-m.com
Energy	CANACOL ENERGY LTD	Canacol Energy Ltd., an international oil and gas company, together with its subsidiaries, explores for, develops, and produces petroleum and natural gas		www.canacolenergy.com

		primarily in Colombia, Ecuador, Brazil, Guyana, and Peru.		
Energy	CANADIAN NATURAL RESOURCES	Canadian Natural Resources Limited explores for, develops, produces, markets, and sells crude oil, natural gas liquids (NGLs), and natural gas in North America.		www.cnrl.com
Energy	CANADIAN OIL SANDS LTD	Canadian Oil Sands Limited, through its interests in the Syncrude Joint Venture, mines, extracts, and upgrades bitumen from oil sands in northern Alberta. The company has 8 leases located in the Athabasca Oil Sands deposit covering 101,960 hectares.		www.cos-trust.com
Energy	CANADIAN UTILITIES - CL A	Canadian Utilities Limited is engaged in the utilities, energy, and technologies businesses.		www.canadian-utilities.com

Energy	CANYON SERVICES GROUP INC	Canyon Services Group Inc. provides fracturing and chemical stimulation services to oil and gas exploration and production companies in the Western Canadian Sedimentary Basin.		www.canyontech.ca
Energy	CENOVUS ENERGY INC	Cenovus Energy Inc., an integrated oil company, together with its subsidiaries, develops, produces, and markets crude oil, natural gas, and natural gas liquids (NGLs) in Canada with refining operations in Illinois and Texas, the United States.		www.cenovus.com
Energy	CHESAPEAKE ENERGY CORP	Chesapeake Energy Corporation is engaged in the acquisition, exploration, and development of properties for the production of natural gas, oil, and natural gas liquids (NGL) from underground reservoirs in the United States.		www.chk.com

Energy	CHESAPEAKE UTILITIES CORP	Chesapeake Utilities Corporation operates as a diversified energy company. The company operates in three segments: Regulated Energy, Unregulated Energy, and Other.	www.chpk.com
Energy	CHEVRON CORP	Chevron Corporation, through its subsidiaries, is engaged in petroleum, chemicals, mining, power generation, and energy operations worldwide. The company operates in two segments, Upstream and Downstream.	www.chevron.com
Energy	CIMAREX ENERGY CO	Cimarex Energy Co. operates as an independent oil and gas exploration and production company primarily in Texas, Oklahoma, and New Mexico. The company owns interests in 4,160 net productive oil and gas wells.	www.cimarex.com

Energy	CLOUD PEAK ENERGY INC	Cloud Peak Energy Inc., through its subsidiaries, produces coal in the Powder River Basin (PRB) and the United States. The company operates through Owned and Operated Mines, Logistics and Related Activities, and Corporate and Other segments.		www.cloudpeakenergy.com
Energy	CONNACHER OIL & GAS LTD	Connacher Oil and Gas Limited, an oil company, is engaged in the exploration for, and the development, production, and marketing of bitumen in Canada.		www.connacheroil.com
Energy	CONOCOPHILLIPS	ConocoPhillips explores for, develops, and produces crude oil, bitumen, natural gas, liquefied natural gas, and natural gas liquids worldwide.		www.conocophillips.com
Energy	CONSOL ENERGY INC	CONSOL Energy Inc. produces coal and natural gas for energy and raw material markets in the		www.consolenergy.com

		United States, Canada, and Western Europe. It operates in Coal and Gas divisions.		
Energy	CRESTWOOD MIDSTREAM PTNRS LP	Crestwood Midstream Partners LP is engaged in the gathering, processing, treating, compression, storage, and transportation of natural gas; storage and transportation of natural gas liquids (NGLs); and gathering, storage, and terminalling of crude oil in the United States.		www.crestwoodlp.com
Energy	CREW ENERGY INC	Crew Energy Inc. is engaged in acquisition, exploration, development, and production of crude oil and natural gas in western Canada.		www.crewenergy.com
Energy	CVR REFINING LP	CVR Refining, LP operates as a petroleum refiner in the United States.		www.cvrrefining.com

Energy	CWC ENERGY SERVICES CORP	CWC Energy Services Corp., a well servicing company, provides oilfield services in the Western Canadian Sedimentary Basin. It operates through two segments, Well Servicing and Other Oilfield Services.	www.cawsc.com
Energy	DCP MIDSTREAM PARTNERS LP	DCP Midstream Partners, LP, together with its subsidiaries, owns, operates, acquires, and develops a diversified portfolio of midstream energy assets in the United States. It operates in three segments: Natural Gas Services, NGL Logistics, and Wholesale Propane Logistics.	www.dcppartners.com
Energy	DEETHREE EXPLORATION LTD	DeeThree Exploration Ltd. is engaged in the exploration, exploitation, development, and production of light crude oil and natural gas in the Western Canada Sedimentary Basin.	www.deethree.ca

Energy	DEJOUR ENERGY INC	Dejour Energy Inc. is engaged in acquiring, exploring, and developing energy projects with a focus on oil and gas exploration in Canada and the United States.	www.dejour.com
Energy	DELEK US HOLDINGS INC	Delek US Holdings, Inc. operates as an integrated downstream energy company that operates in petroleum refining, logistics, and convenience store retailing businesses. The company operates in three segments: Refining, Logistics, and Retail.	www.delekus.com
Energy	DENBURY RESOURCES INC	Denbury Resources Inc. operates as an oil and natural gas company in the United States. The company primarily focuses on enhanced oil recovery utilizing carbon dioxide.	www.denbury.com

Energy	DEVON ENERGY CORP	Devon Energy Corporation, an independent energy company, is engaged primarily in the exploration, development, and production of oil, natural gas, and natural gas liquids.	www.devonenergy.com
Energy	DIAMOND OFFSHRE DRILLING INC	Diamond Offshore Drilling, Inc. provides contract drilling services to the energy industry world wide. The company provides drilling services in ultra-deepwater, deepwater, and mid-water; and non-floater or jack-up markets.	www.diamondoffshore.com
Energy	DIAMONDBACK ENERGY INC	Diamondback Energy, Inc., an independent oil and natural gas company, focuses on the acquisition, development, exploration, and exploitation of onshore oil and natural gas reserves in the Permian Basin in West Texas.	www.diamondbackenergy.com

Energy	DRIL-QUIP INC	Dril-Quip, Inc. designs, manufactures, sells, and services engineered offshore drilling and production equipment for use in deepwater, harsh environment, and severe service applications worldwide.		www.dril-quip.com
Energy	EAST WEST PETROLEUM CORP	East West Petroleum Corp. is engaged in the acquisition, exploration, development, and production of petroleum and natural gas properties. It primarily invests in conventional and unconventional resource plays.		www.eastwestpetroleum.ca
Energy	ECOLOGY AND ENVIRONMENT INC	Ecology and Environment, Inc., an environmental consulting firm, provides professional services to the government and private sectors worldwide.		www.ene.com

Energy	ENBRIDGE ENERGY PRTNRS -LP	Enbridge Energy Partners, L.P. owns and operates crude oil and liquid petroleum transportation and storage assets; and natural gas gathering, treating, processing, transportation, and marketing assets in the United States. It operates through three segments: Liquids, Natural Gas, and Marketing.		www.enbridgepartners.com
Energy	ENBRIDGE INC	Enbridge Inc. operates as an energy transportation and distribution company in the United States and Canada. Its Liquids Pipelines segment operates common carrier and contract crude oil, natural gas liquids (NGL), and refined products pipelines and terminals.		www.enbridge.com
Energy	ENCANA CORP	Encana Corporation, together with its subsidiaries, is engaged in exploration for, development, production, and		www.encana.com

		marketing of natural gas, oil, and natural gas liquids in Canada and the United States.	
Energy	ENERGEN CORP	Energen Corporation is engaged in the development and exploration of oil, natural gas, and natural gas liquids in the continental United States.	www.energen.com
Energy	ENERGY FUELS INC	Energy Fuels Inc. explores for, mines, develops, and produces uranium and vanadium properties in the United States. Its principal properties are located in Utah, Arizona, Colorado, New Mexico, and Wyoming. The company was formerly known as Volcanic Metals Exploration Inc.	www.energyfuels.com
Energy	ENHANCED OIL RESOURCES INC	Enhanced Oil Resources Inc., through its subsidiaries, engages in the acquisition, development, operation, and exploration of crude oil and	www.enhancedoilres.com

		gas properties in the United States.		
Energy	ENSIGN ENERGY SERVICES INC	Ensign Energy Services Inc., together with its subsidiaries, provides oilfield services to the crude oil and natural gas industries worldwide.		www.ensignenergy.com
Energy	EOG RESOURCES INC	EOG Resources, Inc., together with its subsidiaries, explores for, develops, produces, and markets crude oil and natural gas.		www.eogresources.com
Energy	EOS PETRO INC	Eos Petro, Inc. engages in the acquisition, development, and operation of onshore oil and gas properties. It has 100% interests in the Works Property that consist of 5 oil and gas leases in an approximately 510 acre tract of land in Edwards County, Illinois.		www.eos-petro.com

Energy	EQT CORP	EQT Corporation, together with its subsidiaries, operates as a natural gas company in the United States. It operates in two segments, EQT Production and EQT Midstream.		www.eqt.com
Energy	EQUAL ENERGY LTD	Equal Energy Ltd. is engaged in the acquisition, exploration, development, and production of petroleum and natural gas properties in the United States. The company's principal assets are located in Lincoln and Logan counties of Oklahoma.		www.equalenergy.ca
Energy	ESSENTIAL ENERGY SVCS LTD	Essential Energy Services Ltd., together with its subsidiaries, provides oilfield services for producing wells and new drilling activity to oil and gas producers in western Canada and the United States. It operates through two segments, Well Servicing		www.essentialenergy.ca

		and Downhole Tools & Rentals.	
Energy	EXTERRAN HOLDINGS INC	Exterran Holdings, Inc., together with its subsidiaries, provides operations, maintenance, service, and equipment for the oil and natural gas production, processing, and transportation applications. The company's North America Contract Operations segment offers natural gas compression services.	www.exterran.com
Energy	EXXON MOBIL CORP	Exxon Mobil Corporation explores and produces for crude oil and natural gas. As of December 31, 2013, the company had approximately 37,661 gross and 31,823 net operated wells.	www.exxonmobil.com
Energy	FMC TECHNOLOGIES INC	FMC Technologies, Inc. provides technology solutions	www.fmctechnologies.com

		for the energy industry worldwide.	
Energy	FORBES ENERGY SERVICES LTD	Forbes Energy Services Ltd., an independent oilfield services contractor, provides a range of well site services for oil and natural gas drilling and producing companies to develop and enhance the production of oil and natural gas in the United States.	www.forbesenergyservices.com
Energy	FORUM ENERGY TECH INC	Forum Energy Technologies, Inc. designs, manufactures, and distributes products to the oil and natural gas industry in the United States and internationally. The company operates in two segments, Drilling & Subsea, and Production & Infrastructure.	www.f-e-t.com
Energy	GAS NATURAL INC	Gas Natural Inc. is engaged in the distribution and sale of natural gas to residential, commercial, and industrial customers. It	www.ewst.com

		operates through Natural Gas Operations, Marketing and Production Operations, and Pipeline Operations segments.		
Energy	GASFRAC ENERGY SERVICES INC	GASFRAC Energy Services Inc., an oil and gas service company, provides liquid petroleum gas fracturing services to oil and natural gas exploration and production companies in Canada and the United States.		www.gasfrac.com
Energy	GENERAL CABLE CORP/DE	General Cable Corporation designs, develops, manufactures, markets, and distributes copper, aluminum, and fiber optic wire and cable products for the energy, industrial, construction, specialty, and communications markets worldwide.		www.generalcable.com

Energy	GEOMET INC	GeoMet, Inc., an independent energy company, primarily explores for, develops, and produces natural gas from coal seams and non-conventional shallow gas. The company was formerly known as GeoMet Resources, Inc. and changed its name to GeoMet, Inc. in April 2005. GeoMet, Inc.		www.geometinc.com
Energy	GOODRICH PETROLEUM CORP	Goodrich Petroleum Corporation, an independent oil and natural gas company, is engaged in the exploration, development, and production of oil and natural gas.		www.goodrichpetroleum.com
Energy	HALLIBURTON CO	Halliburton Company provides a range of services and products for the exploration, development, and production of oil and natural gas to oil and gas companies worldwide. The company operates in two segments, Completion and		www.halliburton.com

		Production, and Drilling and Evaluation.		
Energy	HELMERICH & PAYNE	Helmerich & Payne, Inc. primarily operates as a contract drilling company in North and South America.		www.hpinc.com
Energy	HERCULES OFFSHORE INC	Hercules Offshore, Inc., together with its subsidiaries, provides shallow-water drilling and marine services to the oil and natural gas exploration and production industry worldwide. The company operates through Domestic Offshore, International Offshore, and International Liftboats segments.		www.herculesoffshore.com
Energy	HESS CORP	Hess Corporation, an exploration and production company, develops, produces, purchases, transports, and sells crude oil and natural gas worldwide.		www.hess.com

		The company operates through 722 wells. As of December 31, 2013, it had total proved reserves of 1,437 million barrels of oil equivalent.	
Energy	HOLLYFRONTIER CORP	HollyFrontier Corporation operates as an independent petroleum refiner in the United States. It produces high-value refined products, such as gasoline, diesel fuel, jet fuel, specialty lubricant products, liquid petroleum gas, fuel oil, and specialty and modified asphalt.	www.hollyfrontier.com
Energy	HONEYWELL INTERNATIONAL INC	Honeywell International Inc. operates as a diversified technology and manufacturing company worldwide.	www.honeywell.com
Energy	HORIZON NORTH LOGISTICS INC	Horizon North Logistics Inc., a remote resource development service company, provides workforce accommodation solutions,	www.horizonnorth.ca

		camp management and catering services, and road and access matting solutions. The company operates through two segments, Camps & Catering, and Matting.		
Energy	HTC PURENERGY INC	HTC Purenergy Inc. engages in the development, aggregation, and commercialization of proprietary technologies relating to carbon dioxide (CO2) capture and storage, and CO2 and polymer enhanced oil recovery, as well as carbon credit origination, inventorying, and monetization.		www.htcenergy.com
Energy	HUSKY ENERGY INC	Husky Energy Inc., together with its subsidiaries, operates as an integrated energy company primarily in Canada and the United States. The company		www.huskyenergy.com

		operates in two segments, Upstream and Downstream.	
Energy	HYDROCARB ENERGY CORP	Hydrocarb Energy Corporation is engaged in the acquisition, exploration, development, and production of oil and gas properties in the United States and onshore in Namibia, Africa.	www.hydrocarb.com
Energy	IMPERIAL OIL LTD	Imperial Oil Limited is engaged in the exploration for, production, and sale of crude oil and natural gas in Canada. The company operates through three segments: Upstream, Downstream, and Chemical.	www.imperialoil.ca
Energy	IONA ENERGY INC	Iona Energy Inc., together with its subsidiaries, is engaged in the evaluation, acquisition, exploration, and development of oil and gas properties in the United	www.ionaenergy.com

		Kingdom's North Sea and Alaska.		
Energy	IRONHORSE OIL & GAS INC	Ironhorse Oil & Gas Inc., a junior oil and natural gas production company, engages in the exploration, development, and production of petroleum and natural gas reserves in western Canada.		www.ihorse.ca
Energy	JUNEX INC	Junex Inc. operates as an oil and natural gas exploration company in Quebec, Canada. The company's properties are located in sedimentary basins in the St. Lawrence Lowlands, on the Gaspe Peninsula, on Anticosti Island, and in the Appalachian region.		www.junex.ca
Energy	KEY ENERGY SERVICES INC	Key Energy Services, Inc. operates as an onshore rig-based well servicing contractor in the United States and internationally.		www.keyenergy.com

		The company operates in U.S. and International segments.		
Energy	KEYERA CORP	Keyera Corp. provides various services and products to oil and gas producers in the United States and Canada. The company operates in four segments: Marketing, Gathering and Processing, NGL Infrastructure, and Corporate and Other.		www.keyera.com
Energy	KINDER MORGAN ENERGY -LP	Kinder Morgan Energy Partners, L.P. operates as a pipeline transportation and energy storage company in North America.		www.kindermorgan.com
Energy	KINDER MORGAN INC	Kinder Morgan, Inc. operates as a midstream and energy company in North America. It operates through Natural Gas Pipelines, CO2 KMP, Products Pipelines KMP, Terminals KMP, Kinder		www.kindermorgan.com

		Morgan Canada KMP, and Other segments.		
Energy	KODIAK OIL & GAS CORP	Kodiak Oil & Gas Corp., an independent energy company, is engaged in the acquisition, exploration, exploitation, development, and production of crude oil and natural gas in the Rocky Mountain region of the United States.		www.kodiakog.com
Energy	LAYNE CHRISTENSEN CO	Layne Christensen Company provides water management, construction, and drilling services in North America and internationally.		www.layne.com
Energy	LEGACY OIL PLUS GAS INC	Legacy Oil + Gas Inc. is engaged in the acquisition, exploration, exploitation, and development of oil and natural gas properties in Canada.		www.crescentpointenergy.com/legacy

Energy	LGX OIL PLUS GAS INC	LGX Oil + Gas Inc., a junior oil and natural gas company, is engaged in the exploration, development, and production of oil and natural gas primarily in western Canada. The company produces light crude oil, natural gas liquids, and natural gas.		www.lgxoil.com
Energy	LIGHTSTREAM RESOURCES LTD	Lightstream Resources Ltd. is engaged in the exploration and development of oil and natural gas in Western Canada.		www.lightstreamresources.com
Energy	LONESTAR WEST INC	LoneStar West Inc. provides vacuum and hydro-vacuum (HVAC) truck services primarily to infrastructure, and oil and gas sectors. It offers hydrovac trucks, hydro-cutting, drilling fluids removal and disposal, aluminum shoring equipment, and sump reclamation services.		www.lonestarwest.com

Energy	MACRO ENTERPRISES INC	Macro Enterprises Inc., through its subsidiaries, provides pipeline construction and maintenance, and facility/compression construction services to the oil and gas companies in northeastern British Columbia and northwestern Alberta.	www.macroindustries.ca
Energy	MAGELLAN MIDSTREAM PRTNRS LP	Magellan Midstream Partners, L.P. is engaged in the transportation, storage, and distribution of refined petroleum products and crude oil in the United States. It operates in three segments: Refined Products, Crude Oil, and Marine Storage.	www.magellanlp.com
Energy	MAGELLAN PETROLEUM CORP	Magellan Petroleum Corporation, an independent energy company, explores for, develops, produces, and sells crude oil and natural gas in the United States,	www.magellanpetroleum.com

		Australia, and the United Kingdom.		
Energy	MARATHON OIL CORP	Marathon Oil Corporation operates as an energy company worldwide. The company's North America Exploration and Production segment explores for, produces, and markets liquid hydrocarbons and natural gas in North America.		www.marathonoil.com
Energy	MARATHON PETROLEUM CORP	Marathon Petroleum Corporation, together with its subsidiaries, is engaged in refining, transporting, and marketing petroleum products primarily in the United States. It operates through three segments: Refining & Marketing, Speedway, and Pipeline Transportation.		www.marathonpetroleum.com

Energy	MARQUEE ENERGY LTD	Marquee Energy Ltd., a junior oil and gas company, is engaged in the acquisition, exploration, development, and production of petroleum and natural gas reserves in Western Canada.	www.marquee-energy.com
Energy	MART RESOURCES INC	Mart Resources, Inc., an international upstream oil and gas company, is engaged in the exploration, development, and production of oil and gas in the Federal Republic of Nigeria.	www.martresources.com
Energy	MCCOY GLOBAL INC	McCoy Corporation provides tubular handling, assembly, and measurement equipment used for making up threaded connections in the oil and gas industry worldwide. It designs, manufactures, services, and distributes drilling and completions equipment.	www.mccoyglobal.com

Energy	MDU RESOURCES GROUP INC	MDU Resources Group, Inc. operates as a diversified natural resource company in the United States. The company's Electric segment generates, transmits, and distributes electricity in Montana, North Dakota, South Dakota, and Wyoming.	www.mdu.com
Energy	MEG ENERGY CORP	MEG Energy Corp. engages in the development and production of in situ oil sands in Alberta, Canada. The company is developing enhanced oil recovery projects that utilize steam assisted gravity drainage extraction methods.	www.megenergy.com
Energy	MIDCOAST ENERGY PARTNERS LP	Midcoast Energy Partners, L.P. is engaged in gathering, processing, treating, transporting, and marketing natural gas and natural gas liquids (NGL) the Gulf Coast and Mid-Continent regions of the United States.	www.midcoastpartners.com

Energy	MIDSTATES PETROLEUM CO INC	Midstates Petroleum Company, Inc. is engaged in the exploration, development, and production of oil, natural gas liquids, and natural gas in the United States.	www.midstatespetroleum.com
Energy	MUELLER INDUSTRIES	Mueller Industries, Inc. manufactures and sells copper, brass, aluminum, and plastic products in the United States, Canada, Mexico, Great Britain, and China. It operates in two segments, Plumbing & Refrigeration and Original Equipment Manufacturers (OEM).	www.muellerindustries.com
Energy	MURPHY OIL CORP	Murphy Oil Corporation is engaged in the exploration and production of oil and gas properties. The company explores for and produces crude oil, natural gas, and natural gas liquids.	www.murphyoilcorp.com

Energy	NATIONAL OILWELL VARCO INC	National Oilwell Varco, Inc. provides equipment and components for oil and gas drilling and production; oilfield services; and supply chain integration services to the upstream oil and gas industry worldwide.	www.natoil.com
Energy	NEW JERSEY RESOURCES CORP	New Jersey Resources Corporation, an energy services holding company, provides retail and wholesale natural gas energy services. The company operates through four segments: Natural Gas Distribution, Clean Energy Ventures, Energy Services, and Midstream.	www.njresources.com
Energy	NEW ZEALAND ENERGY CORP	New Zealand Energy Corp., through its subsidiaries, engages in the exploration, development, and production of conventional and unconventional oil and	www.newzealandenergy.com

		natural gas resources in New Zealand.		
Energy	NEWFIELD EXPLORATION CO	Newfield Exploration Company, an independent energy company, is engaged in the exploration, development, and production of crude oil, natural gas, and natural gas liquids. Its primary areas of operation include the Mid-Continent, the Rocky Mountains, and onshore Gulf Coast.		www.newfld.com
Energy	NIKO RESOURCES LTD	Niko Resources Ltd. is engaged in the exploration for, development, and production of natural gas and crude oil. Its principal producing natural gas and crude oil assets include the D6 Block in India and Block 9 in Bangladesh.		www.nikoresources.com
Energy	NISKA GAS STORAGE PARTNERS	Niska Gas Storage Partners LLC owns and		www.niskapartners.com

		operates natural gas storage assets in North America.		
Energy	NISOURCE INC	NiSource Inc., an energy holding company, provides natural gas, electricity, and other products and services. It operates through three segments: Gas Distribution Operations, Columbia Pipeline Group Operations, and Electric Operations.		www.nisource.com
Energy	NOBLE ENERGY INC	Noble Energy, Inc., an independent energy company, is engaged in the exploration and production of crude oil and natural gas properties worldwide.		www.nobleenergyinc.com
Energy	NORTHERN TIER ENERGY LP	Northern Tier Energy LP, an independent downstream energy company, is engaged in refining, retail, and pipeline operations in the United States. It operates through two segments, Refining and Retail.		www.ntenergy.com

Energy	NORTHWEST NATURAL GAS CO	Northwest Natural Gas Company stores and distributes natural gas primarily in Oregon, Washington, and California. The company operates in two segments, Local Gas Distribution and Gas Storage.	www.nwnatural.com
Energy	NUSTAR ENERGY LP	NuStar Energy L.P. is engaged in the terminalling, storage, and marketing of petroleum products, and transportation of petroleum products and anhydrous ammonia primarily in the United States and the Netherlands. The company operates in three segments: Storage, Pipeline, and Fuels Marketing.	www.nustarenergy.com
Energy	OCCIDENTAL PETROLEUM CORP	Occidental Petroleum Corporation is engaged in the acquisition, exploration, and development of oil and gas properties in the United States and internationally.	www.oxy.com

		The company operates in three segments: Oil and Gas; Chemical; and Midstream, Marketing and Other.		
Energy	ONEOK PARTNERS -LP	ONEOK Partners, L.P. is engaged in the gathering, processing, storage, and transportation of natural gas in the United States. It operates in three segments: Natural Gas Gathering and Processing, Natural Gas Liquids, and Natural Gas Pipelines.		www.oneokpartners.com
Energy	OXFORD RESOURCE PARTNERS LP	Oxford Resource Partners, LP produces and markets thermal coal in the United States. The company markets its thermal coal to utilities, industrial customers, municipalities, and other coal-related entities.		www.oxfordresources.com

Energy	PACIFIC PARADYM ENERGY INC	Pacific Paradym Energy Inc., a junior oil and gas company, engages in the acquisition, exploration, and development of oil and gas properties primarily in North America. Its principal properties include the Taber Property in southern Alberta; and the Sinclair Property in Manitoba.		www.pacificparadym.com
Energy	PACIFIC RUBIALES ENERGY CORP	Pacific Rubiales Energy Corp. explores, develops, and produces oil and natural gas in Colombia, Peru, Guatemala, Brazil, Papua New Guinea, Guyana, and Belize.		www.petrorubiales.com
Energy	PAINTED PONY PETROLEUM LTD	Painted Pony Petroleum Ltd., a junior oil and gas company, explores, develops, and produces petroleum and natural gas resources in Western Canada. The company focuses primarily on natural		www.paintedpony.ca

		gas in northeast British Columbia; and crude oil in southeast Saskatchewan.	
Energy	PARKER DRILLING CO	Parker Drilling Company, together with its subsidiaries, provides contract drilling and drilling-related services and rental tools in the United States, Latin America, Africa, the Middle East, the Asia Pacific, Europe, and the Commonwealth of Independent States.	www.parkerdrilling.com
Energy	PASON SYSTEMS INC	Pason Systems Inc. rents and sells instrumentation systems to land and offshore drilling operations in the oil and gas industry. Its solutions include data acquisition, wellsite reporting, remote communications, and Web-based information management.	www.pason.com
Energy	PBF ENERGY INC	PBF Energy Inc., together with its subsidiaries, is	www.pbfenergy.com

		engaged in the refining and supply of petroleum products.	
Energy	PDC ENERGY INC	PDC Energy, Inc., an independent exploration and production company, acquires, explores for, develops, and produces crude oil, natural gas, and natural gas liquids in the United States.	www.pdce.com
Energy	PEABODY ENERGY CORP	Peabody Energy Corporation is engaged in the mining of coal. The company operates through Western U.S. Mining, Midwestern U.S. Mining, Australian Mining, Trading and Brokerage, and Corporate and Other segments.	www.peabodyenergy.com
Energy	PEMBINA PIPELINE CORP	Pembina Pipeline Corporation provides transportation and midstream services for the energy industry in North America. It operates through four segments: Conventional	www.pembina.com

		Pipelines, Oil Sands and Heavy Oil, Gas Services, and Midstream.	
Energy	PENGROWTH ENERGY CORP	Pengrowth Energy Corporation, together with its subsidiaries, acquires, explores for, develops, and produces oil and natural gas reserves in the provinces of Alberta, British Columbia, Saskatchewan, and Nova Scotia in Canada.	www.pengrowth.com
Energy	PENN WEST PETROLEUM LTD	Penn West Petroleum Ltd., an exploration and production company, acquires, explores, develops, exploits, and holds interests in petroleum and natural gas properties and related assets in western Canada.	www.pennwest.com
Energy	PERPETUAL ENERGY INC	Perpetual Energy Inc., an independent energy company, explores, develops, and markets oil and gas based energy in Canada. It produces heavy	www.perpetualenergyinc.com

		oil, tight gas, liquids-rich gas, and bitumen.		
Energy	PHILLIPS 66	Phillips 66 operates as an energy manufacturing and logistics company. It operates in four segments: Midstream, Chemicals, Refining, Marketing and Specialties.		www.phillips66.com
Energy	PIEDMONT NATURAL GAS CO	Piedmont Natural Gas Company, Inc., an energy services company, distributes natural gas in the United States. It operates in two segments, Regulated Utility and Non-Utility Activities.		www.piedmontng.com
Energy	PINECREST ENERGY INC	Pinecrest Energy Inc., a junior oil and gas company, acquires, explores, exploits, develops, and produces petroleum and natural gas primarily in the Western Sedimentary Basin.		www.pinecrestenergy.com

Energy	PIONEER ENERGY SERVICES CORP	Pioneer Energy Services Corp., through its subsidiaries, provides contract land drilling services and production services in the United States and Colombia.	www.pioneeres.com
Energy	PIONEER NATURAL RESOURCES CO	Pioneer Natural Resources Company operates as an independent oil and gas exploration and production company in the United States. The company produces and sells oil, natural gas liquids (NGL), and gas.	www.pxd.com
Energy	POWERSECURE INTL INC	PowerSecure International, Inc. provides products and services to electric utilities and to their commercial, institutional, and industrial customers in the United States.	www.powersecure.com

Energy	PRECISION DRILLING CORP	Precision Drilling Corporation provides energy services primarily to the North American oil and gas industry. It operates in two segments, Contract Drilling Services, and Completion and Production Services.	www.precisiondrilling.com
Energy	PRIMORIS SERVICES CORP	Primoris Services Corporation, a specialty contractor and infrastructure company, provides a range of construction, fabrication, maintenance, replacement, water and wastewater, and engineering services in the United States and internationally.	www.prim.com
Energy	QEP RESOURCES INC	QEP Resources, Inc., through its subsidiaries, operates as an independent oil and natural gas exploration and production company.	www.qepres.com

Energy	QR ENERGY LP	QR Energy, LP, through its subsidiary, QRE Operating, LLC, is engaged in the acquisition, exploitation, development, and production of oil and natural gas properties in the United States.	www.qrenergylp.com
Energy	QUESTAR CORP	Questar Corporation operates as an integrated natural gas company in the United States.	www.questar.com
Energy	QUESTOR TECHNOLOGY INC	Questor Technology Inc., an environmental oilfield services company, focuses on clean air technologies in Canada, the United States, Europe, and Asia.	www.questortech.com
Energy	QUICKSILVER RESOURCES INC	Quicksilver Resources Inc., an independent oil and gas company, is engaged in the acquisition, exploration, development, production, and sale of natural gas, natural gas liquids, and oil in North America.	www.qrinc.com

Energy	RANGE RESOURCES CORP	Range Resources Corporation operates as an independent natural gas, natural gas liquids (NGLs), and oil company in the United States. The company acquires, explores, and develops natural gas and oil properties.	www.rangeresources.com
Energy	REGENCY ENERGY PARTNERS LP	Regency Energy Partners LP is engaged in the gathering and processing, compression, treating, and transportation of natural gas; and the transportation, fractionation, and storage of natural gas liquids (NGLs).	www.regencyenergy.com
Energy	REX ENERGY CORP	Rex Energy Corporation operates as an independent oil and gas exploration and production company in the Appalachian and Illinois basins in the United States.	www.rexenergycorp.com
Energy	ROCK ENERGY INC	Rock Energy Inc. is engaged in the exploration for, and development and	www.rockenergy.ca

		production of crude oil and natural gas in Western Canada.		
Energy	ROSETTA RESOURCES INC	Rosetta Resources Inc., an independent exploration and production company, is engaged in the acquisition and development of onshore energy resources in the United States.		www.rosettaresources.com
Energy	SANDRIDGE ENERGY INC	SandRidge Energy, Inc., together with its subsidiaries, explores for and produces oil and natural gas properties primarily in the Mid-Continent region of the United States. It operates through three segments: Exploration and Production, Drilling and Oil Field Services, and Midstream Services.		www.sandridgeenergy.com
Energy	SAVANNA ENERGY SVCS CORP	Savanna Energy Services Corp., through its subsidiaries, provides various oil and natural gas services in Canada, the United States,		www.savannaenergy.com

		and Australia. It operates through Services and Drilling segments.		
Energy	SECURE ENERGY SERVICES INC	Secure Energy Services Inc., an energy services company, through its subsidiaries, provides specialized services to upstream oil and natural gas companies operating in the Western Canadian Sedimentary Basin, Canada; and the Rocky Mountain region, North Dakota.		www.secure-energy.ca
Energy	SHORELINE ENERGY CORP	Shoreline Energy Corp. explores for, develops, produces, and sells crude oil and natural gas in Canada and the United States.		www.shorelineenergy.ca
Energy	SOUTH JERSEY INDUSTRIES INC	South Jersey Industries, Inc., through its subsidiaries, is engaged in the purchase, transmission, and sale of natural gas, as well as		www.sjindustries.com

		provision of other energy related services.	
Energy	SOUTHERN PACIFIC RESOURCE CP	Southern Pacific Resource Corp. is engaged in the development, exploration, and production of in-situ oil sands and heavy oil properties in Western Canada.	www.shpacific.com
Energy	SPECTRA ENERGY CORP	Spectra Energy Corp., through its subsidiaries, owns and operates a portfolio of natural gas-related energy assets in North America.	www.spectraenergy.com
Energy	SPINDLETOP OIL & GAS CO	Spindletop Oil & Gas Co., an independent oil and gas company, engages in the acquisition, exploration, development, and production of oil and natural gas in the United States. It is also involved in the rental of oilfield equipment, as well as in gathering and marketing natural gas.	www.spindletopoil.com

Energy	SPYGLASS RESOURCES CORP	Spyglass Resources Corp., an intermediate oil and gas company, operates oil and natural gas properties in Alberta, Saskatchewan, and British Columbia. The company's principal properties are located in Dixonville, Southern Alberta, and Halkirk-Provost in Alberta; and Noel, British Columbia.	www.spyglassresources.com
Energy	STERLING RESOURCES LTD	Sterling Resources Ltd., an energy company, is engaged in the acquisition, exploration, development, and production of crude oil and natural gas. It holds interests in various offshore and onshore properties located in the United Kingdom, Romania, the Netherlands, and France.	www.sterling-resources.com
Energy	STONE ENERGY CORP	Stone Energy Corporation, an independent oil and natural gas company,	www.stoneenergy.com

		acquires, explores, exploits, develops, and operates oil and gas properties in the Gulf of Mexico and the Appalachia region.	
Energy	STRAD ENERGY SERVICES LTD	Strad Energy Services Ltd., an energy services company, provides various well-site infrastructure solutions to oil and gas industry in Canada and the United States. The company operates in three segments: Canadian Operations, U.S. Operations, and Product Sales.	www.stradenergy.com
Energy	SUNCOR ENERGY INC	Suncor Energy Inc., together with its subsidiaries, operates as an integrated energy company.	www.suncor.com
Energy	SUNOCO LOGISTICS PARTNERS LP	Sunoco Logistics Partners L.P. is engaged in the transport, terminalling, and storage of crude oil, refined products, and natural gas	www.sunocologistics.com

		liquids (NGL) in the United States.		
Energy	SUPERIOR ENERGY SERVICES INC	Superior Energy Services, Inc. provides specialized oilfield services and equipment to oil and gas companies in the United States, the Gulf of Mexico, and internationally.		www.superiorenergy.com
Energy	SYNERGY RESOURCES CORP	Synergy Resources Corporation acquires, explores, develops, produces, and exploits crude oil and natural gas properties primarily located in the Wattenberg field in Denver-Julesburg Basin in northeast Colorado.		www.syrginfo.com
Energy	TALISMAN ENERGY INC	Talisman Energy Inc., an oil and gas company, explores for, develops, produces, transports, and markets crude oil, natural gas, and natural gas liquids.		www.talisman-energy.com

Energy	TARGA RESOURCES CORP	Targa Resources Corp., through its general and limited partner interests in Targa Resources Partners LP, provides midstream natural gas and natural gas liquid (NGL) services in the United States. The company operates in two divisions, Gathering and Processing, and Logistics and Marketing.	www.targaresources.com
Energy	TARGA RESOURCES PARTNERS LP	Targa Resources Partners LP is engaged in the ownership, operation, acquisition, and development of midstream energy assets in the United States. The company operates through two divisions, Gathering and Processing, and Logistics and Marketing.	www.targaresources.com
Energy	TERRA ENERGY CORP	Terra Energy Corp., a junior exploration and production company, engages in the exploration, development, and production	www.terraenergy.ca

		of petroleum and natural gas in Western Canada. Its operations are primarily located in northeastern British Columbia and the Peace River Arch region of Alberta.		
Energy	TESCO CORP	Tesco Corporation, together with its subsidiaries, is engaged in the design, manufacture, and service delivery of technology-based solutions for the upstream energy industry worldwide. The company operates through Top Drive and Tubular Services segments.		www.tescocorp.com
Energy	TESORO CORP	Tesoro Corporation, together with its subsidiaries, is engaged in refining and marketing petroleum products in the United States. It operates in two segments, Refining and Retail.		www.tsocorp.com

Energy	TETRA TECH INC	Tetra Tech, Inc., together with its subsidiaries, provides consulting, engineering, program management, construction management, and technical services for water, environment, energy, infrastructure, and natural resources sectors.		www.tetratech.com
Energy	TORC OIL & GAS LTD	TORC Oil & Gas Ltd. explores for and produces crude oil and natural gas properties in Western Canada.		www.torcoil.com
Energy	TOUCHSTONE EXPLORATION -OLD	Touchstone Exploration Inc., through its subsidiaries, acquires, explores for, and develops prospective onshore petroleum and natural gas properties in the Republic of Trinidad and Tobago. The company was founded in 1982 and is headquartered in Calgary, Canada.		www.touchstoneexploration.com

Energy	TRANSCANADA CORP	TransCanada Corporation operates as an energy infrastructure company in North America. The company operates in three segments: Natural Gas Pipelines, Oil Pipelines, and Energy.		www.transcanada.com
Energy	UNIT CORP	Unit Corporation, together with its subsidiaries, operates as an oil and natural gas contract drilling company primarily in the United States. The company operates through three segments: Oil and Natural Gas, Contract Drilling, and Mid-Stream.		www.unitcorp.com
Energy	VAALCO ENERGY INC	VAALCO Energy, Inc., an independent energy company, acquires, explores for, develops, and produces crude oil and natural gas.		www.vaalco.com
Energy	VALERO ENERGY CORP	Valero Energy Corporation operates as an independent petroleum refining and marketing company in the United States, Canada, the		www.valero.com

		Caribbean, the United Kingdom, and Ireland. It operates through two segments, Refining and Ethanol.		
Energy	VECTREN CORP	Vectren Corporation, through its subsidiaries, provides energy delivery services to residential, commercial, and industrial and other contract customers in Indiana and Ohio.		www.vectren.com
Energy	VERMILION ENERGY INC	Vermilion Energy Inc. is engaged in the exploitation, development, acquisition, and production of oil and natural gas in Australia, Canada, France, Ireland, and the Netherlands.		www.vermilionenergy.com
Energy	WARREN RESOURCES INC	Warren Resources, Inc., an independent energy company, is engaged in the exploration, development, and production of onshore crude oil and gas reserves. The company holds interests		www.warrenresources.com

		in various properties that are located in California, Wyoming, New Mexico, and Texas.	
Energy	WATERFURNACE RENEWABLE ENRGY	WaterFurnace Renewable Energy, Inc. designs, develops, manufactures, and distributes geothermal water source heating, cooling, hot water, and control systems for residential, commercial, and institutional buildings in the United States, Canada, and internationally.	www.waterfurnace.com
Energy	WESTERN ENERGY SERVICES CORP	Western Energy Services Corp., an oilfield service company, provides contract drilling services oil and natural gas exploration and production companies in Canada and the United States.	www.wesc.ca
Energy	WESTERN GAS PARTNERS LP	Western Gas Partners, LP owns, operates, acquires, and develops midstream energy assets in east, west,	www.westerngas.com

		and south Texas; the Rocky Mountains; north-central Pennsylvania; and the Mid-Continent.	
Energy	WESTERN REFINING INC	Western Refining, Inc. operates as an independent crude oil refiner and marketer of refined products.	www.wnr.com
Energy	WHITECAP RESOURCES INC	Whitecap Resources Inc. is engaged in the acquisition, development, optimization, and production of crude oil and natural gas in western Canada.	www.wcap.ca
Energy	WILLBROS GROUP INC	Willbros Group, Inc. operates as an energy infrastructure contractor serving the oil, gas, refinery, petrochemical, and power industries worldwide.	www.willbros.com
Energy	WILLIAMS COS INC	The Williams Companies, Inc. operates as an energy infrastructure company.	www.williams.com

Energy	WPX ENERGY INC	WPX Energy, Inc., an independent natural gas and oil exploration and production company, is engaged in the exploitation and development of unconventional properties in the United States.		www.wpxenergy.com
Energy	WSP GLOBAL INC	WSP Global Inc. provides various professional services in Canada, Sweden, the United Kingdom, the United States, the United Arab Emirates, South Africa, Germany, Australia, and internationally.		www.wspgroup.com
Energy	ZARGON OIL & GAS LTD	Zargon Oil & Gas Ltd. explores for, develops, and produces oil and natural gas in Canada and the United States. The company holds interest in the Williston Basin area; Alberta Plains South area; and Alberta Plains North area.		www.zargon.ca
Energy	ABB LTD	ABB Ltd provides power and automation technologies		www.abb.com

		for utility and industrial customers worldwide.		
Energy	ABENGOA SA	Abengoa, S.A., an engineering and clean technology company, provides solutions for energy and environmental sectors worldwide. It operates in three segments: Engineering and Construction, Concession-Type Infrastructures, and Industrial Production.		www.abengoa.es
Energy	ALSTOM SA	Alstom SA designs, supplies, and services various products and systems for power generation and transmission markets in France and internationally.		www.alstom.com
Energy	ARCADIS NV	Arcadis N.V. provides consultancy, design, engineering, and management services for infrastructure, water, environment, and buildings worldwide.		www.arcadis.com

Energy	BP PLC	BP p.l.c. provides fuel for transportation, energy for heat and light, lubricants to engines, and petrochemicals products worldwide.	www.bp.com
Energy	BRASKEM SA	Braskem S.A., together with its subsidiaries, produces and sells thermoplastic resins.	www.braskem.com.br
Energy	CARIBBEAN UTILITIES CO LTD	Caribbean Utilities Company, Ltd. is engaged in the generation, transmission, and distribution of electricity to residential and commercial customers in Grand Cayman, the Cayman Islands. It generates electricity primarily from diesel.	www.cuc-cayman.com
Energy	CBD ENERGY LTD	CBD Energy Limited operates as a diversified renewable energy company in Australia and internationally.	www.cbdenergy.com.au

Energy	CHINA HYDROELECTRIC CORP-ADR	China Hydroelectric Corporation, through its subsidiaries, identifies, evaluates, acquires, develops, constructs, and finances hydroelectric power projects in China. It is also engaged in the generation and distribution of hydroelectric power in China.		www.chinahydroelectric.com
Energy	CHINA MING YANG WIND PWR-ADR	China Ming Yang Wind Power Group Limited designs, manufactures, sells, and services megawatt-class wind turbines in the People's Republic of China and the Republic of India. The company provides wind turbines with a rated power capacity of 1.5MW and 2.0MW; and 2.5/3.0MW SCD wind turbines.		www.mywind.com.cn
Energy	CHINA PETROLEUM & CHEM CORP	China Petroleum & Chemical Corporation, an energy and chemical company, through its		www.sinopec.com

		subsidiaries, is engaged in the oil and gas, and chemical operations in the People's Republic of China.	
Energy	CHINA RECYCLING ENERGY CORP	China Recycling Energy Corporation is engaged in the recycling energy business primarily in the People's Republic of China.	www.creg-cn.com
Energy	CLEANTECH SOLUTIONS INTL INC	Cleantech Solutions International, Inc., through its subsidiaries, manufactures and sells forged products and fabricated products to a range of clean technology customers in the People's Republic of China.	www.cleantechsolutionsinternational.com
Energy	CONSOLIDATED WATER CO INC	Consolidated Water Co. Ltd., together with its subsidiaries, develops and operates seawater desalination plants and water distribution systems. It operates in three segments: Retail, Bulk, and Services.	www.cwco.com

Energy	EATON CORP PLC	Eaton Corporation plc operates as a power management company worldwide.	www.eaton.com
Energy	ECOPETROL SA	Ecopetrol S.A., an integrated oil company, is engaged in the exploration, development, and production of crude oil and natural gas primarily in Colombia, Peru, Brazil, and the United States Gulf Coast.	www.ecopetrol.com.co
Energy	ENI SPA	Eni S.p.A., together with its subsidiaries, is engaged in the exploration and production, gas and power, refining and marketing, engineering and construction, and chemicals and other activities.	www.eni.com
Energy	GAZPROM OAO	OAO Gazprom, an energy company, is engaged in the geological exploration, production, storage, transportation, and sale of gas, gas condensate, and oil	www.gazprom.com

		worldwide. It is also involved in processing oil, gas condensate, and other hydrocarbons; and sale of refined products.		
Energy	JINPAN INTERNATIONAL LTD	Jinpan International Limited, through its subsidiaries, designs, manufactures, and sells electrical power control and distribution equipment in the People's Republic of China, the United States, and Europe.		www.jinpaninternational.com
Energy	LUKOIL OIL COMPANY	Open Joint Stock Company Oil company LUKOIL operates as an integrated oil and gas company. The company's Exploration and Production segment explores for, develops, and produces crude oil.		www.lukoil.com

Energy	MISSION NEWENERGY LTD	Mission NewEnergy Limited, a renewable energy company, refines and sells biodiesel. The company operates in Australia, Malaysia, and Indonesia. Mission NewEnergy Limited was incorporated in 2005 and is headquartered in Subiaco, Australia.	www.missionnewenergy.com
Energy	NIDEC CORP	NIDEC Corporation manufactures and sells electric motors and related components and equipment worldwide.	www.nidec.co.jp
Energy	PETROBRAS ARGENTINA SA	Petrobras Argentina S.A. operates as an integrated energy company. Its Oil and Gas Exploration and Production segment is engaged in the oil and gas exploration and production activities primarily in Argentina, Bolivia, Ecuador, Mexico, and Venezuela.	www.petrobras.com.ar

Energy	PETROCHINA CO LTD	PetroChina Company Limited produces and sells oil and gas in the People's Republic of China. The company operates in four segments: Exploration and Production, Refining and Chemicals, Marketing, and Natural Gas and Pipeline.	www.petrochina.com.cn
Energy	PETROBRAS-PETROLEO BRASILIER	Petroleo Brasileiro S.A. - Petrobras operates as an integrated oil and gas company in Brazil and internationally.	www.petrobras.com.br
Energy	REPSOL SA	Repsol, S.A. operates as an integrated energy company engaged in upstream and downstream activities worldwide.	www.repsol.com
Energy	ROYAL DUTCH SHELL PLC	Royal Dutch Shell plc operates as an independent oil and gas company worldwide. The company explores for and extracts crude oil, natural gas, and natural gas liquids.	www.shell.com

Energy	SASOL LTD	Sasol Limited operates as an integrated energy and petrochemicals company worldwide.	www.sasol.com
Energy	STATOIL ASA	Statoil ASA, an integrated energy company, is engaged in the exploration, production, transportation, refining, and marketing of petroleum and petroleum-derived products in Norway and internationally.	www.statoil.com
Energy	TOTAL SA	TOTAL S.A., together with its subsidiaries, operates as an oil and gas company worldwide. The company operates in three segments: Upstream, Refining & Chemicals, and Marketing & Services.	www.total.com
Energy	TURBO POWER SYSTEMS INC	Turbo Power Systems Inc., through its subsidiary, Turbo Power Systems Limited, engages in the design, manufacture, and marketing of electric motors and generators, drives, and	www.turbopowersystems.com

		power electronics in the United Kingdom, the United States, Canada, and internationally.		
Energy	UNITED UTILITIES GROUP PLC	United Utilities Group PLC provides water and wastewater services in the United Kingdom. The company collects water from catchment land.		www.unitedutilities.com
Energy	VEOLIA ENVIRONNEMENT	Veolia Environnement SA provides a range of environmental services in the fields of water, waste, and energy management worldwide.		www.veolia.com
Energy	YACIMIENTOS PETE FISCALES SA	YPF Sociedad Anonima, an energy company, is engaged in the exploration, development, and production of crude oil, natural gas, and liquefied petroleum gas (LPG) in Argentina.		www.ypf.com

Material	3M CO	3M Company operates as a diversified technology company worldwide.	www.3m.com
Material	ADF GROUP INC	ADF Group Inc. is engaged in the design and engineering of connections; and fabrication and installation of complex steel superstructures and heavy steel built-ups, as well as architectural and miscellaneous metalwork primarily in North America.	www.adfgroup.com
Material	AEP INDUSTRIES INC	AEP Industries Inc. manufactures and markets plastic packaging films in North America. It offers a range of polyethylene and polyvinyl chloride flexible packaging products for consumer, industrial, and agricultural applications.	www.aepinc.com

Material	AIRBOSS OF AMERICA CORP	AirBoss of America Corp., through its subsidiaries, develops, manufactures, and sells rubber-based products primarily in North America. The company operates through AirBoss Rubber Compounding and AirBoss Engineered Products segments.		www.airbossofamerica.com
Material	AK STEEL HOLDING CORP	AK Steel Holding Corporation, through its subsidiary, AK Steel Corporation, produces flat-rolled carbon, stainless and electrical steel, and tubular products in the United States and internationally.		www.aksteel.com
Material	ALCOA INC	Alcoa Inc. produces and manages primary aluminum, fabricated aluminum, and alumina. The company operates in four segments: Alumina, Primary Metals, Global Rolled Products, and		www.alcoa.com

		Engineered Products and Solutions.		
Material	ALLEGHENY TECHNOLOGIES INC	Allegheny Technologies Incorporated produces and sells specialty materials and components worldwide. The company operates through two segments, High Performance Materials and Components, and Flat-Rolled Products.		www.atimetals.com
Material	ALPHA PRO TECH LTD	Alpha Pro Tech, Ltd. is engaged in developing, manufacturing, and marketing a line of disposable protective apparel, building supply products, and infection control products in the United States and internationally.		www.alphaprotech.com
Material	AMERITYRE CORP	Amerityre Corporation is engaged in the research and development, manufacture,		www.amerityre.com

		and sale of polyurethane tires in the United States.		
Material	AMPCO-PITTSBURGH CORP	Ampco-Pittsburgh Corporation, together with its subsidiaries, manufactures and sells custom designed engineering products to commercial and industrial users worldwide. It operates in two segments, Forged and Cast Rolls, and Air and Liquid Processing.		www.ampcopittsburgh.com
Material	APTARGROUP INC	AptarGroup, Inc. develops, manufactures, and sells consumer product dispensing systems in North America, Europe, Asia, and Latin America. The company operates in three segments: Beauty + Home, Pharma, and Food + Beverage.		www.aptar.com
Material	ARMSTRONG WORLD INDUSTRIES	Armstrong World Industries, Inc. designs, manufactures, and sells		www.armstrong.com

		flooring products and ceiling systems worldwide.		
Material	AVERY DENNISON CORP	Avery Dennison Corporation produces and sells pressure-sensitive materials worldwide. It operates through Pressure-Sensitive Materials, and Retail Branding and Information Solutions segments.		www.averydennison.com
Material	AXION INTL HOLDINGS INC	Axion International Holdings, Inc., a green technology company, provides solutions to plastics manufacturers and infrastructure needs in the United States and internationally. The company operates in two segments, Engineered Products and Reprocessed Plastics.		www.axionintl.com

Material	BEMIS CO INC	Bemis Company, Inc. manufactures and sells packaging products and pressure sensitive materials in North America, Latin America, Europe, and the Asia-Pacific. The company operates in three segments: U.S. Packaging, Global Packaging, and Pressure Sensitive Materials.		www.bemis.com
Material	BUCKEYE TECHNOLOGIES INC	Buckeye Technologies Inc. manufactures and distributes cellulose-based specialty products worldwide. It operates in two segments, Specialty Fibers and Nonwoven Materials.		www.bkitech.com
Material	CANFOR PULP PRODUCTS INC	Canfor Pulp Products Inc. engages in the production and supply of pulp and paper products worldwide. The company offers softwood kraft pulps and ECF or enhanced ECF softwood kraft pulps, as well as bleached,		www.canforpulp.com

		unbleached, unbleached electrical, and semi-bleached pulps.		
Material	CARPENTER TECHNOLOGY CORP	Carpenter Technology Corporation manufactures, fabricates, and distributes specialty metals worldwide. It operates in three segments: Specialty Alloys Operations, Latrobe, and Performance Engineered Products.		www.cartech.com
Material	CASCADES INC	Cascades Inc., together with its subsidiaries, is engaged in the production, conversion, and marketing of packaging and tissue products primarily in Canada, the United States, and Europe. It operates in four segments: Containerboard, Boxboard Europe, Specialty Products, and Tissue Papers.		www.cascades.com

Material	CATALYST PAPER CORP	Catalyst Paper Corporation, together with its subsidiaries, produces and sells mechanical printing papers in western North America. The company operates through three segments: Specialty Printing Papers, Newsprint, and Pulp.	www.catalystpaper.com
Material	CENTURY ALUMINUM CO	Century Aluminum Company, together with its subsidiaries, produces and sells primary aluminum in the United States and Iceland. It provides standard grade and value-added primary aluminum products; and carbon products, such as anodes and cathodes.	www.centuryaluminum.com
Material	CHEMTURA CORP	Chemtura Corporation, together with its subsidiaries, develops, manufactures, and markets performance-driven engineered specialty chemicals primarily for	www.chemtura.com

		industrial manufacturing customers.	
Material	CLEARWATER PAPER CORP	Clearwater Paper Corporation manufactures and sells private label tissue and paperboard products in the United States and internationally. The company operates through two segments, Consumer Products, and Pulp and Paperboard.	www.clearwaterpaper.com
Material	CLIFFS NATURAL RESOURCES INC	Cliffs Natural Resources Inc., a mining and natural resources company, produces iron ore and metallurgical coal.	www.cliffsnaturalresources.com
Material	COOPER TIRE & RUBBER CO	Cooper Tire & Rubber Company, together with its subsidiaries, manufactures and markets replacement tires worldwide. It operates in two segments, North American Tire Operations	www.coopertire.com

		and International Tire Operations.		
Material	CORE MOLDING TECHNOLOGIES	Core Molding Technologies, Inc., together with its subsidiaries, manufactures sheet molding compounds (SMC) and molds of fiberglass reinforced plastics.		www.coremt.com
Material	CSS INDUSTRIES INC	CSS Industries, Inc., a consumer products company, is engaged in the design, manufacture, procurement, distribution, and sale of various occasion and seasonal social expression products primarily to mass market retailers primarily in the United States and Canada.		www.cssindustries.com
Material	CTI INDUSTRIES CORP	CTI Industries Corporation develops, manufactures, and supplies flexible film products for novelty, packaging and container, and custom		www.ctiindustries.com

		product applications worldwide.	
Material	DOMTAR CORP	Domtar Corporation designs, manufactures, markets, and distributes communications papers, specialty and packaging papers, and absorbent hygiene products in the United States, Canada, Europe, Asia, and internationally. It operates in two segments, Pulp and Paper, and Personal Care.	www.domtar.com
Material	DOW CHEMICAL	The Dow Chemical Company manufactures and supplies chemical products for use as raw materials in the manufacture of customer products and services worldwide.	www.dow.com
Material	EASTMAN CHEMICAL CO	Eastman Chemical Company, a specialty chemical company, manufactures and sells chemicals, plastics, and	www.eastman.com

		fibers in the United States and internationally.		
Material	EASTMAN KODAK CO	Eastman Kodak Company, a technology company, provides products and services in entertainment imaging and commercial films worldwide. It operates in two segments, Graphics, Entertainment and Commercial Films (GECF) and Digital Printing and Enterprise (DP&E).		www.kodak.com
Material	ECOSYNTHETIX INC	EcoSynthetix Inc., a renewable chemicals company, is engaged in the development and commercialization of bio-based products that are used as inputs in industrial manufacturing for a range of consumer and industrial products worldwide.		www.ecosynthetix.com

Material	ENTEGRIS INC	Entegris, Inc. develops, manufactures, and supplies products and materials that are used in processing and manufacturing in the microelectronics and other high-technology industries worldwide.		www.entegris.com
Material	FEMALE HEALTH CO	The Female Health Company manufactures, markets, and distributes consumer health care products. It offers the FC2 female condom that provides women dual protection against unintended pregnancy and sexually transmitted infections, including HIV/AIDS; and male condoms.		www.femalehealth.com
Material	FORTRESS PAPER LTD	Fortress Paper Ltd. produces and sells dissolving pulp and security paper products.		www.fortresspaper.com

Material	FRIEDMAN INDUSTRIES INC	Friedman Industries, Incorporated is engaged in steel processing, pipe manufacturing and processing, and steel and pipe distribution activities in the United States.	www.friedmanindustries.com
Material	GIBRALTAR INDUSTRIES INC	Gibraltar Industries, Inc. manufactures and distributes building products. The company operates in two business segments, Residential Products, and Industrial and Infrastructure Products.	www.gibraltar1.com
Material	GLATFELTER	P. H. Glatfelter Company manufactures and sells specialty papers and fiber-based engineered materials worldwide.	www.glatfelter.com
Material	GOODYEAR TIRE & RUBBER CO	The Goodyear Tire & Rubber Company, together with its subsidiaries, develops, manufactures, markets, and distributes tires, and related products and	www.goodyear.com

		services in the United States and internationally.		
Material	GRAPHIC PACKAGING HOLDING CO	Graphic Packaging Holding Company, together with its subsidiaries, provides packaging solutions in the United States, Canada, Central/South America, Europe, and the Asia-Pacific. The company operates in two segments, Paperboard Packaging and Flexible Packaging.		www.graphicpkg.com
Material	GREIF INC -CL A	Greif, Inc. produces and sells industrial packaging products worldwide.		www.greif.com
Material	GSE HOLDING INC	GSE Holding, Inc. manufactures and markets engineered geosynthetic lining products for environmental protection and confinement applications worldwide.		www.gseworld.com

Material	HANWEI ENERGY SERVICES CORP	Hanwei Energy Services Corp., through its subsidiaries, engineers and produces fiberglass reinforced plastic (FRP) pipe products for oil and gas, marine and offshore, chemical, salt, infrastructure, and municipal applications.		www.hanweienergy.com
Material	HARSCO CORP	Harsco Corporation provides industrial services and engineered products worldwide. The company operates in three segments: Harsco Metals and Minerals, Harsco Rail, and Harsco Industrial.		www.harsco.com
Material	HAYNES INTERNATIONAL INC	Haynes International, Inc. develops, manufactures, markets, and distributes high-performance nickel- and cobalt-based alloys in sheet, coil, and plate forms primarily in the United States, Europe, and Asia.		www.haynesintl.com

Material	INTERTAPE POLYMER GROUP INC	Intertape Polymer Group Inc. operates in the packaging industry in North America and internationally.	www.intertapepolymer.com
Material	INTL PAPER CO	International Paper Company operates as a paper and packaging company in North America, Europe, Latin America, Russia, Asia, and the Middle East.	www.internationalpaper.com
Material	INVENTRONICS LTD	Inventronics Limited designs and manufactures custom enclosures and related products in North America.	www.inventronics.com
Material	JARDEN CORP	Jarden Corporation manufactures, markets, and distributes consumer products in the Unites States and internationally.	www.jarden.com
Material	KAISER ALUMINUM CORP	Kaiser Aluminum Corporation, together with its subsidiaries, produces semi-	www.kaiseraluminum.com

		fabricated specialty aluminum products.		
Material	KAPSTONE PAPER & PACKAGING	KapStone Paper and Packaging Corporation produces and sells containerboard, corrugated products, and specialty paper products in the United States and internationally.		www.kapstonepaper.com
Material	KIMBERLY-CLARK CORP	Kimberly-Clark Corporation, together with its subsidiaries, manufactures and markets personal care, consumer tissue, and health care products worldwide. It operates through four segments: Personal Care, Consumer Tissue, K-C Professional, and Health Care.		www.kimberly-clark.com
Material	KRATON PERFORMANCE POLYMERS	Kraton Performance Polymers, Inc. manufactures and markets styrenic block copolymers (SBCs) and other engineered polymers worldwide. The company		www.kraton.com

		offers highly-engineered synthetic elastomers that enhance the performance of various end use products.		
Material	LABRADOR IRON MINES HLDG LTD	Labrador Iron Mines Holdings Limited is engaged in the exploration, development, and mining of iron ore projects in Canada.		www.labradorironmines.ca
Material	LAPOLLA INDUSTRIES INC	Lapolla Industries, Inc. manufactures and distributes foam, coatings, and equipment used in commercial, industrial, and residential applications in the insulation and construction industries. The company operates through two segments, Foams and Coatings.		www.lapolla.com
Material	MARTINREA INTL INC	Martinrea International Inc. designs, manufactures, and sells metal parts, assemblies and modules, fluid management systems, and aluminum products primarily		www.martinrea.com

		for the automotive sector in North America, Europe, and internationally.		
Material	MEADWESTVACO CORP	MeadWestvaco Corporation provides packaging solutions to healthcare, beauty and personal care, food, beverage, home and garden, tobacco, and agricultural industries worldwide.		www.meadwestvaco.com
Material	MERCER INTL INC	Mercer International Inc., together with its subsidiaries, manufactures and sells northern bleached softwood kraft (NBSK) pulp worldwide.		www.mercerint.com
Material	MUELLER WATER PRODUCTS INC	Mueller Water Products, Inc. manufactures and markets products and services used in the transmission, distribution, and measurement of water primarily in the United States and Canada. The company operates through two		www.muellerwaterproducts.com

		segments, Mueller Co. and Anvil. The Mueller Co.	
Material	MYERS INDUSTRIES INC	Myers Industries, Inc. manufactures and sells polymer products for industrial, agricultural, automotive, commercial, and consumer markets worldwide.	www.myersindustries.com
Material	NEENAH PAPER INC	Neenah Paper, Inc. produces and sells technical products and fine papers worldwide.	www.neenah.com
Material	NEW MILLENNIUM IRON CORP	New Millennium Iron Corp. explores for and develops magnetic iron ore deposits in Canada.	www.nmliron.com
Material	NORANDA ALUMINUM HOLDING CP	Noranda Aluminum Holding Corporation produces and sells primary aluminum and rolled aluminum coils in the United States. The company's	www.norandaaluminum.com

		Bauxite segment mines, produces, and sells bauxite used for alumina production.	
Material	NORTHWEST PIPE CO	Northwest Pipe Company manufactures and markets welded steel pipe and tube products in the United States, Canada, and Mexico.	www.nwpipe.com
Material	NUCOR CORP	Nucor Corporation, together with its subsidiaries, manufactures and sells steel and steel products in North America and internationally. It operates through three segments: Steel Mills, Steel Products, and Raw Materials.	www.nucor.com
Material	OMNOVA SOLUTIONS INC	OMNOVA Solutions Inc. provides emulsion polymers, specialty chemicals, and engineered surfaces for various commercial, industrial, and residential end uses primarily in North America, Europe, and Asia. The company operates in two segments, Performance	www.omnova.com

		Chemicals and Engineered Surfaces.		
Material	ORCHIDS PAPER PRODUCTS	Orchids Paper Products Company manufactures and sells tissue products for the at-home market in the United States. Its products include paper towels, bathroom tissue, and paper napkins.		www.orchidspaper.com
Material	OURPETS CO	OurPet's Company designs, develops, produces, and markets a range of accessory and consumable pet products for the retail pet business in the United States and internationally.		www.ourpets.com
Material	PACKAGING CORP OF AMERICA	Packaging Corporation of America manufactures and sells containerboard and corrugated packaging products in the United States, Mexico, Canada, and Europe. The company		www.packagingcorp.com

		operates through three segments: Packaging, Paper, and Corporate and Other.		
Material	POLLARD BANKNOTE LTD	Pollard Banknote Limited, together with its subsidiaries, supplies lottery and charitable gaming products and services to lottery and charitable gaming industries worldwide.		www.pollardbanknote.com
Material	POLYONE CORP	PolyOne Corporation provides specialized polymer materials, services, and solutions with operations in specialty polymer formulations, color and additive systems, plastic sheet and packaging solutions, and polymer distribution.		www.polyone.com
Material	QUANEX BUILDING PRODUCTS	Quanex Building Products Corporation, together with its subsidiaries, provides engineered materials and		www.quanex.com

		aluminum sheet products worldwide.	
Material	RAYONIER INC	Rayonier, Inc. engages in the sale and development of real estate and timberland management, as well as in the production and sale of cellulose fibers in the United States, New Zealand, and Australia.	www.rayonier.com
Material	RELIABRAND INC	Reliabrand Inc. manufactures and sells baby bottles and related components. It also develops a version of baby bottle that is free of estrogenic activity, as well as being BPA-free; and related components, such as sippy cups. Reliabrand Inc.	www.reliabrand.com
Material	RESOLUTE FOREST PRODUCTS INC	Resolute Forest Products Inc. manufactures and sells newsprint, specialty papers, market pulp, and wood products. It operates through four segments: Newsprint,	www.resolutefp.com

		Specialty Papers, Market Pulp, and Wood Products.		
Material	ROCK-TENN CO	Rock-Tenn Company manufactures and sells corrugated and consumer packaging products in the United States, Canada, Mexico, Chile, Argentina, Puerto Rico, and China. The company operates in three segments: Corrugated Packaging, Consumer Packaging, and Recycling.		www.rocktenn.com
Material	ROGERS CORP	Rogers Corporation develops, manufactures, and distributes specialty material-based products worldwide.		www.rogerscorp.com
Material	SCHULMAN (A.) INC	A. Schulman, Inc. supplies plastic compounds and resins for packaging, automotive, consumer products, and industrial applications.		www.aschulman.com

Material	SCHWEITZER-MAUDUIT INTL INC	Schweitzer-Mauduit International, Inc., together with its subsidiaries, manufactures and sells paper and reconstituted tobacco products to the tobacco industry worldwide. The company operates in three segments: Paper, Reconstituted Tobacco, and Filtration.		www.swmintl.com
Material	SEALED AIR CORP	Sealed Air Corporation, through its subsidiaries, provides food safety and security, facility hygiene, and product protection solutions worldwide. The company operates through three segments: Food Care, Diversey Care, and Product Care.		www.sealedair.com
Material	SONOCO PRODUCTS CO	Sonoco Products Company manufactures and sells industrial and consumer packaging products in the United States, Europe, and		www.sonoco.com

		Canada. The company operates in four segments: Consumer Packaging, Paper and Industrial Converted Products, Display and Packaging, and Protective Solutions.		
Material	STEEL DYNAMICS INC	Steel Dynamics, Inc., together with its subsidiaries, manufactures and sells steel products, processes and sells recycled ferrous and nonferrous metals, and fabricates and sells steel joist and decking products in the United States and internationally.		www.steeldynamics.com
Material	SYNALLOY CORP	Synalloy Corporation is engaged in metals and specialty chemicals businesses in the United States and internationally.		www.synalloy.com
Material	TEMBEC INC	Tembec Inc., an integrated forest products company, produces and sells forest, pulp, and paper products		tembec.com

		worldwide. It operates through four segments: Forest Products, Specialty Cellulose Pulp, Paper Pulp, and Paper.	
Material	TITAN INTERNATIONAL INC	Titan International, Inc., together with its subsidiaries, manufactures and sells wheels, tires, and undercarriage systems and components for off-highway vehicles used in the agricultural, earthmoving/construction, and consumer markets in the United States and internationally.	www.titan-intl.com
Material	TREDEGAR CORP	Tredegar Corporation, through its subsidiaries, is engaged in the manufacture and sale of plastic films and aluminum extrusions worldwide.	www.tredegar.com
Material	TUPPERWARE BRANDS CORP	Tupperware Brands Corporation operates as a direct-to-consumer marketer	www.tupperwarebrands.com

		of various products across a range of brands and categories worldwide.	
Material	UFP TECHNOLOGIES INC	UFP Technologies, Inc. produces and sells custom-engineered components, products, and specialty packaging solutions to medical, automotive, aerospace and defense, and packaging markets in the United States. The company operates in two segments, Component Products and Packaging.	www.ufpt.com
Material	UNITED STATES STEEL CORP	United States Steel Corporation produces and sells flat-rolled and tubular steel products in North America and Europe. The company operates in three segments: Flat-Rolled Products (Flat-Rolled), U. S. Steel Europe (USSE), and Tubular Products (Tubular).	www.ussteel.com

Material	UNVL STAINLESS & ALLOY PRODS	Universal Stainless & Alloy Products, Inc. and its subsidiaries manufacture and market semi-finished and finished specialty steel products in the United States and internationally. The company's products include stainless steel, nickel alloys, tool steel, and various other alloyed steels.		www.univstainless.com
Material	VERSO PAPER CORP	Verso Paper Corp. produces and sells coated papers in the United States. The company offers coated groundwood paper used primarily for catalogs and magazines; and coated freesheet paper used primarily for annual reports, brochures, and magazine covers.		www.versopaper.com
Material	VISKASE COMPANIES INC	Viskase Companies, Inc., together with its subsidiaries, produces and sells non-edible cellulosic, fibrous, and		www.viskase.com

		plastic casings used to prepare and package processed meat products worldwide.	
Material	WAUSAU PAPER CORP	Wausau Paper Corp. manufactures, converts, and sells towel and tissue products primarily in the United States and Canada.	www.wausaupaper.com
Material	WEST PHARMACEUTICAL SVSC INC	West Pharmaceutical Services, Inc. develops, manufactures, and sells components and systems for the packaging and delivery of injectable drugs, as well as delivery system components for the pharmaceutical, healthcare, and consumer products industries.	www.westpharma.com
Material	WORTHINGTON INDUSTRIES	Worthington Industries, Inc., a metals manufacturing company, focuses on value-added steel processing and manufactured metal products in the United States, Canada, Europe, and internationally. It	www.worthingtonindustries.com

		operates through three segments: Steel Processing, Pressure Cylinders, and Engineered Cabs.		
Material	ZAGG INC	ZAGG Inc and its subsidiaries design, produce, and distribute mobile accessory solutions. It offers solutions for mobile and media accessories, such as protective coverings, cases, keyboards, keyboard cases, earbuds, portable power, and device cleaning products under the family of ZAGG brands.		www.zagg.com
Material	ZCL COMPOSITES INC	ZCL Composites Inc. designs, manufactures, and supplies fiberglass reinforced plastic (FRP) underground storage tanks.		www.zcl.com
Material	ALUMINUM CORP OF CHINA LTD	Aluminum Corporation of China Limited manufactures and distributes alumina and primary aluminum in the		www.chalco.com.cn

		People's Republic of China and internationally.	
Material	Amcor Ltd	Amcor Limited, together with its subsidiaries, provides packaging solutions primarily in Australia, the United States, and Switzerland.	www.amcor.com
Material	ANNEC GREEN REFRACTORIES CORP	Annec Green Refractories Corporation, a refractory company, designs, develops, produces, and markets refractory products in the People's Republic of China. The company operates through two segments, Zhengzhou Annec and Beijing Annec.	en.annec.com.cn
Material	Arcelormittal SA	ArcelorMittal, Societe Anonyme, together with its subsidiaries, operates as an integrated steel and mining company worldwide. The company operates in six segments: Flat Carbon Americas; Flat Carbon Europe; Long Carbon	www.arcelormittal.com

		Americas and Europe; AACIS; Distribution Solutions; and Mining.		
Material	Cementos Pacasmayo SAA	Cementos Pacasmayo S.A.A., a cement company, produces, distributes, and sells cement and cement-related materials in the northern region of Peru. It operates in three segments: Cement, Concrete and Blocks; Quicklime; and Construction Supplies.		www.cementospacasmayo .com.pe
Material	Cemex SAB de CV	CEMEX, S.A.B. de C.V. produces, markets, distributes, and sells cement, ready-mix concrete, clinker, aggregates, and other construction materials for home construction and concrete pavement applications.		www.cemex.com

Material	Chang-On International Inc	Chang-On International, Inc., a development stage company, is engaged in waste recycling and reutilization business in the People's Republic of China. It also manufactures construction materials from waste products.	www.Chang-On International Inc.com
Material	CHINA ADVANCED CONSTRUCTION MATERIALS GROUP INC	China Advanced Construction Materials Group, Inc., through its subsidiaries, produces and sells construction materials for large scale infrastructure, commercial, and residential developments primarily in the People's Republic of China.	www.china-acm.com
Material	China GengSheng Minerals Inc	China GengSheng Minerals, Inc., through its subsidiaries, operates in the materials technology industry. The company develops, manufactures, and sells a range of mineral-	www.gengsheng.com

		based, heat-resistant industrial material products.		
Material	CHINA GERUI ADVANCED MATERIALS GROUP LTD	China Gerui Advanced Materials Group Limited operates as a contract manufacturer of cold-rolled narrow strip steel products in the People's Republic of China and internationally. The company converts steel manufactured by third parties into thin steel sheets and strips.		www.geruigroup.com
Material	China Precision Steel Inc	China Precision Steel, Inc. engages in the manufacture and sale of high precision cold-rolled steel products in the People's Republic of China and internationally.		www.chinaprecisionsteelinc.com
Material	China XD Plastics Co Ltd	China XD Plastics Company Limited, through its subsidiary, Harbin Xinda Macromolecule Material Co., Ltd., engages in the development, manufacture,		www.chinaxd.net

		and distribution of modified plastics primarily for use in the production of automobile parts and components in the People's Republic of China.		
Material	COMPANHIA SIDERURGICA NACIONAL	Companhia Siderurgica Nacional operates as an integrated steel producer primarily in Brazil. It operates through five segments: Steel, Mining, Cement, Logistics, and Energy.		www.csn.com.br
Material	Constellium NV	Constellium N.V. is engaged in the design, manufacture, and sale of specialty rolled and extruded aluminum products. The company operates in three segments: Aerospace & Transportation, Packaging & Automotive Rolled Products, and Automotive Structures & Industry.		www.constellium.com

Material	CRH PLC	CRH public limited company, through its subsidiaries, manufactures and supplies building materials. The company produces and sells a range of primary materials, including cement, aggregates, ready-mixed concrete, asphalt/bitumen, and agricultural and chemical lime.	www.crh.ie
Material	Deswell Industries Inc	Deswell Industries, Inc. engages in the manufacture and sale of injection-molded plastic parts and components, electronic products and subassemblies, and metallic molds and accessory parts for original equipment manufacturers and contract manufacturers.	www.deswell.com
Material	EVRAZ HIGHVELD STEEL AND VANADIUM LTD	EVRAZ Highveld Steel and Vanadium Limited produces and sells iron ore, flat products, and steel and	www.evrazhighveld.co.za

		vanadium slag in South Africa, Africa, the Americas, Europe, and Australasia.		
Material	Fibria Celulose SA	Fibria Celulose S.A. is engaged in the production, sale, and export of short fiber pulp. The company primarily offers bleached eucalyptus kraft pulp used in the manufacture of toilet paper; uncoated and coated paper for printing and writing; and coated cardboard for packaging.		www.fibria.com.br
Material	FUWEI FILMS (HOLDINGS) CO LTD	Fuwei Films (Holdings) Co., Ltd., through its subsidiary, Fuwei Films (Shandong) Co., Ltd., develops, manufactures, and distributes plastic films using the biaxially- oriented stretch technique in the People's Republic of China.		www.fuweiholdings.com
Material	General Steel Holdings Inc	General Steel Holdings, Inc., through its subsidiaries, manufactures and sells steel		www.gshi-steel.com

		products in the People's Republic of China.		
Material	Gerdau SA	Gerdau S.A. produces and commercializes steel products worldwide.		www.gerdau.com.br
Material	GRUPO SIMEC SA DE C.V.	Grupo Simec, S.A.B. de C.V., together with its subsidiaries, manufactures, processes, and distributes special bar quality (SBQ) steel and structural products in Mexico, the United States, Canada, Latin America, and internationally.		www.gsimec.com.mx
Material	Guanwei Recycling Corp	Guanwei Recycling Corp. manufactures and distributes low density polyethylene (LDPE) and other recycled plastics products primarily in the People's Republic of China and internationally.		www.guanweirecycling.com
Material	Harmonic Energy Inc	Harmonic Energy, Inc., a development stage company, focuses on the provision of solution for the disposition		www.harmonicenergyinc.com

		and recycling of scrap tires through tire re-manufacturing and carbonization of scrap tire components.		
Material	James Hardie Industries Plc	James Hardie Industries plc, together with its subsidiaries, manufactures and sells fiber cement products and systems for interior and exterior building construction applications primarily in the United States, Canada, Australia, New Zealand, the Philippines, and Europe.		www.jameshardie.com
Material	Lafarge SA	Lafarge S.A. produces and sells building materials under the Lafarge brand worldwide. It provides a range of cement and hydraulic binders, including Portland and masonry cements; and products, such as white cement, oil-well cements, road surfacing binders, etc.		www.lafarge.com

		for use in specific applications.		
Material	L'AIR LIQUIDE	L'Air Liquide S.A. provides gases, technologies, and services worldwide. The company operates through Gas and Services, Engineering and Technology, and Other Activities segments.		www.airliquide.com
Material	LUXFER HOLDINGS PLC	Luxfer Holdings PLC, a materials technology company, designs, manufactures, and supplies materials, components, and gas cylinders. The company operates through two divisions, Gas Cylinders and Elektron.		www.luxfer.com
Material	LyondellBasell Industries NV	LyondellBasell Industries N.V., together with its subsidiaries, manufactures chemicals and polymers; refines crude oil; produces		www.lyondellbasell.com

		gasoline blending components; and develops and licenses technologies for production of polymers.		
Material	Mechel OAO	Mechel OAO, together with its subsidiaries, is engaged in mining and steel businesses in the Russian Federation, other CIS countries, Europe, Asia, the Middle East, the United States, and internationally. The company operates through four segments: Mining, Steel, Ferroalloys, and Power.		www.mechel.ru
Material	Norsk Hydro ASA	Norsk Hydro ASA, an integrated aluminum company, is engaged in power production, bauxite extraction, alumina refining, aluminum smelting, remelting and recycling, and rolling activities.		www.hydro.com

Material	Orient Paper Inc	Orient Paper, Inc. produces and distributes packaging and printing paper products in the People's Republic of China. It operates through two segments, Orient Paper HB and Orient Paper Shengde.	www.orientpaperinc.com
Material	Posco	POSCO, together with its subsidiaries, manufactures and sells steel rolled products and plates. It operates through four segments: Steel, Trading, Construction, and Others.	www.posco.co.kr
Material	Sappi Ltd	Sappi Limited manufactures and sells dissolving wood pulp, paper pulp, and paper based solutions to direct and indirect customers worldwide.	www.sappi.com
Material	Shiner International Inc	Shiner International, Inc., through its subsidiaries, manufactures and sells biaxially oriented polypropylene (BOPP)	www.shinerinc.com

		tobacco films, coated films, color printing products, advanced films, and water based coatings in China, Asia, Australia, Europe, the Middle East, and North America.		
Material	STORA ENSO OYJ, HELSINKI	Stora Enso Oyj produces and sells paper, biomaterials, packaging, and wood products worldwide. The company's Printing and Reading segment produces newsprint, book papers, super-calendered magazine papers, coated papers, and office papers for print media and office use.		www.storaenso.com
Material	Sutor Technology Group Ltd	Sutor Technology Group Limited, through its subsidiaries, manufactures and sells finished steel products in the People's Republic of China.		www.sutorcn.com

Material	SVENSKA CELLULOSA SCA AB	Svenska Cellulosa Aktiebolaget SCA (publ) engages in the development, production, and marketing of personal care products, tissues, and forest products worldwide.	www.sca.com
Material	TENARIS SA, LUXEMBOURG	Tenaris S.A., through its subsidiaries, is engaged in the steel pipe manufacturing and distribution activities.	www.tenaris.com
Material	Uni Core Holdings Corp	Uni Core Holdings Corporation, through its subsidiaries, develops, manufactures, and distributes environmental friendly paper products and agricultural products based upon its proprietary technology and supply chains in the People's Republic of China.	www.unicoreholdings.com

Appendix G

DATE: 8/ 7/2015
TIME: 21:32

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BY

Karl G. Jöreskog and Dag Sörbom

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The following lines were read from file C:\Users\hossein\Desktop\10 august\adjustment.SPJ:

Sample Size = 380
Latent Variables Performa Innovati Sustaina
Relationships
ROA = Performa
ROE = Performa
ROI = Performa
MV = Performa
TobinQ = Performa
PR = Performa
SGR = Performa
RandDint= Innovati
R_D = Innovati
R_D_Prio = Innovati
GrantedP = Innovati
PatentAp = Innovati
GHG = Sustaina
Flaredan = Sustaina
SOandNO = Sustaina
VOCs = Sustaina
waterrec = Sustaina

Spills = Sustaina
WasteRec = Sustaina
Energy = Sustaina
Energyge = Sustaina
Reclaime = Sustaina
wildlife = Sustaina
EnvExp = Sustaina
losttime = Sustaina
recordab = Sustaina
LTIR = Sustaina
RIR = Sustaina
Fataliti = Sustaina
NewHires = Sustaina
Turnover = Sustaina
Unionize = Sustaina
Diversit = Sustaina
Minority = Sustaina
localpur = Sustaina
CNGvehic = Sustaina
Plantedt = Sustaina
Grasssee = Sustaina
ForestLa = Sustaina
communit = Sustaina
voluntee = Sustaina
Path Diagram
End of Problem

Sample Size = 380

Covariance Matrix

	ROA	ROE	ROI	MV	TobinQ	PR
	--------	--------	--------	--------	--------	--------
ROA	0.01					
ROE	0.01	0.03				
ROI	0.00	0.00	0.05			
MV	-0.01	0.00	0.01	0.95		
TobinQ	0.01	0.01	0.00	0.05	0.24	
PR	-0.01	-0.01	0.00	0.08	0.00	0.22
SGR	0.01	0.02	0.00	-0.03	0.00	-0.01
R_D	-0.90	0.33	-1.78	58.11	5.50	-6.35
R_D_Prio	0.13	1.34	-1.25	49.14	10.72	-6.23
GrantedP	0.01	0.00	0.00	0.05	0.01	-0.01
PatentAp	0.00	0.00	0.00	0.06	0.01	-0.01
RandDint	0.00	0.00	0.00	-0.01	0.01	0.00
GHG	-0.01	0.00	0.00	0.17	-0.01	0.02
Flaredan	0.00	0.00	-0.01	0.12	0.01	0.00
SOandNO	-0.01	0.00	0.01	0.19	-0.04	0.06
VOCs	0.00	0.01	0.00	0.18	-0.02	0.03
waterrec	0.00	0.00	0.00	0.00	0.01	0.00
Spills	0.00	0.00	0.00	0.00	0.00	0.00

WasteRec	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.00	0.00	-0.01	0.11	-0.01	0.01
Energyge	0.01	0.02	-0.01	-0.14	0.08	0.01
Reclaime	0.00	0.00	0.00	0.00	0.00	0.00
wildlife	0.00	0.00	0.00	-0.02	-0.01	0.05
EnvExp	-0.01	-0.01	0.03	0.45	-0.06	0.11
losttime	0.00	0.00	0.01	0.09	-0.01	0.01
recordab	0.00	-0.01	0.00	0.07	-0.01	-0.01
LTIR	0.00	0.00	0.00	0.02	0.00	0.01
RIR	0.00	0.00	0.00	-0.01	-0.01	0.01
Fataliti	0.01	0.01	0.01	-0.07	0.03	0.00
NewHires	-0.02	-0.02	-0.01	0.39	-0.05	0.03
Turnover	0.00	0.00	0.00	0.00	0.00	0.00
Unionize	-0.01	-0.01	-0.02	0.33	-0.01	0.05
Diversit	-0.01	0.00	-0.01	0.29	0.00	0.04
Minority	-0.02	0.00	0.00	0.22	0.02	0.00
localpur	-0.01	-0.01	0.01	0.50	-0.08	0.10
CNGvehic	0.00	0.00	0.00	-0.01	0.00	0.00
Plantedt	0.00	0.00	0.00	-0.05	0.01	-0.03
Grasssee	0.00	0.00	-0.01	-0.01	0.02	0.01
ForestLa	0.00	0.00	-0.01	-0.03	0.01	0.02
communit	0.00	0.00	0.00	0.14	0.01	0.01
voluntee	0.00	0.00	0.00	0.07	0.01	0.02

Covariance Matrix

	SGR	R_D	R_D_Prio	GrantedP	PatentAp	RandDint
SGR	0.03					
R_D	-2.80	71106.25				
R_D_Prio	-0.48	39214.13	39578.63			
GrantedP	0.00	42.86	30.15	0.27		
PatentAp	0.00	44.76	28.31	0.20	0.26	
RandDint	0.00	-0.06	-0.34	0.02	0.01	0.07
GHG	0.00	48.95	35.81	0.08	0.06	0.00
Flaredan	0.00	46.75	31.93	0.07	0.05	-0.01
SOandNO	0.00	40.93	23.45	0.04	0.05	0.00
VOCs	0.01	70.49	35.28	0.10	0.07	-0.01
waterrec	0.00	-6.03	-5.37	0.00	-0.01	0.00
Spills	0.00	4.37	1.93	0.00	0.00	0.00
WasteRec	0.00	0.07	-0.01	0.00	0.00	0.00
Energy	0.00	31.82	16.89	0.03	0.03	0.00
Energyge	0.05	40.15	48.07	0.12	0.10	0.01
Reclaime	0.00	0.32	0.15	0.00	0.00	0.00
wildlife	0.00	12.65	-0.54	-0.02	-0.02	-0.01
EnvExp	-0.01	117.01	57.50	0.09	0.07	0.00
losttime	-0.01	-5.19	-7.19	-0.02	-0.01	0.00
recordab	-0.01	8.82	6.69	0.01	0.01	0.00
LTIR	0.00	5.53	2.02	0.00	0.00	-0.01
RIR	0.00	-0.39	-1.95	-0.01	-0.01	0.00
Fataliti	0.02	75.30	47.54	0.06	0.09	-0.03
NewHires	-0.01	21.38	13.90	-0.07	-0.14	0.03
Turnover	0.00	-1.41	-0.72	0.00	0.00	0.00

Unionize	0.01	57.50	35.99	0.02	0.01	0.02
Diversit	0.01	43.59	34.09	0.00	-0.02	0.04
Minority	0.01	10.52	14.25	0.02	0.00	0.00
localpur	0.00	193.84	97.62	0.03	0.06	0.01
CNGvehic	0.00	22.19	3.91	0.01	0.01	0.02
Plantedt	0.01	20.16	6.90	0.01	0.01	0.06
Grasssee	0.00	0.42	-4.02	-0.01	0.00	0.00
ForestLa	0.00	-0.90	-3.68	0.00	0.00	0.00
communit	-0.01	61.39	33.39	0.03	0.04	-0.01
voluntee	0.00	43.00	20.32	0.02	0.02	0.00

Covariance Matrix

	GHG	Flaredan	SOandNO	VOCs	waterrec	Spills
GHG	0.96					
Flaredan	0.99	1.35				
SOandNO	0.53	0.45	0.81			
VOCs	0.87	1.00	0.46	1.31		
waterrec	-0.01	0.00	-0.02	-0.01	0.07	
Spills	0.01	0.01	0.01	0.00	0.00	0.01
WasteRec	0.00	0.00	0.00	0.00	0.00	0.00
Energy	0.43	0.47	0.15	0.50	0.00	0.00
Energyge	1.03	1.43	-0.18	1.50	-0.01	0.00
Reclaime	0.00	0.00	0.00	0.00	0.00	0.00
wildlife	0.13	0.17	0.05	0.22	0.00	0.01
EnvExp	0.37	0.31	0.36	0.57	-0.01	0.00
losttime	-0.15	-0.24	0.08	-0.19	0.01	0.00
recordab	-0.19	-0.27	-0.05	-0.21	0.00	0.00
LTIR	0.00	0.01	0.00	0.02	0.00	0.00
RIR	0.01	0.01	0.02	0.03	0.00	0.00
Fataliti	0.48	0.60	-0.01	0.71	-0.01	-0.01
NewHires	-0.14	-0.31	0.17	-0.17	0.02	0.01
Turnover	0.00	-0.01	0.00	-0.01	0.00	0.00
Unionize	0.40	0.43	0.19	0.50	0.01	0.00
Diversit	0.22	0.20	0.18	0.25	0.03	0.00
Minority	0.11	0.04	0.06	0.14	0.02	0.02
localpur	0.36	0.26	0.31	0.48	-0.02	0.00
CNGvehic	0.01	-0.01	0.01	0.03	0.00	0.01
Plantedt	0.03	0.11	-0.05	0.12	0.01	0.00
Grasssee	-0.02	-0.03	0.00	-0.01	0.00	0.00
ForestLa	0.07	0.09	0.00	0.10	0.00	0.00
communit	0.20	0.23	0.13	0.34	-0.01	0.00
voluntee	0.19	0.21	0.07	0.27	0.00	0.00

Covariance Matrix

	WasteRec	Energy	Energyge	Reclaime	wildlife	EnvExp
WasteRec	0.00					
Energy	0.00	0.66				
Energyge	0.00	1.19	6.52			
Reclaime	0.00	0.00	0.00	0.00		

wildlife	0.00	0.14	0.43	0.00	0.50	
EnvExp	0.00	0.27	0.78	0.00	0.13	2.01
losttime	0.00	-0.17	-0.73	0.00	-0.06	0.01
recordab	0.00	-0.14	-0.64	0.00	-0.10	-0.02
LTIR	0.00	0.02	0.00	0.00	-0.01	0.02
RIR	0.00	-0.01	0.01	0.00	0.02	0.04
Fataliti	0.00	0.32	1.57	0.00	0.24	0.26
NewHires	0.00	-0.07	-0.96	0.00	-0.14	0.33
Turnover	0.00	0.00	-0.01	0.00	0.00	0.00
Unionize	0.00	0.33	1.14	0.00	0.12	0.64
Diversit	0.00	0.15	0.47	0.00	0.05	0.41
Minority	0.00	0.13	0.46	0.01	0.03	0.41
localpur	0.00	0.30	0.45	0.00	0.14	1.39
CNGvehic	0.00	0.00	-0.01	0.00	-0.03	0.02
Plantedt	0.00	0.06	0.22	0.00	0.03	0.10
Grasssee	0.00	0.00	0.02	0.00	0.01	0.02
ForestLa	0.00	0.10	0.34	0.00	0.05	0.01
communit	0.00	0.19	0.40	0.00	0.05	0.28
voluntee	0.00	0.18	0.48	0.00	0.09	0.26

Covariance Matrix

	losttime	recordab	LTIR	RIR	Fataliti	NewHires
	--------	--------	--------	--------	--------	--------
losttime	0.71					
recordab	0.38	0.71				
LTIR	0.01	-0.02	0.08			
RIR	0.02	0.02	0.01	0.09		
Fataliti	-0.17	-0.21	0.02	-0.05	2.63	
NewHires	0.13	0.20	0.02	0.02	-0.54	2.61
Turnover	0.00	0.00	0.00	0.00	-0.01	0.01
Unionize	-0.13	-0.16	0.01	-0.02	0.57	0.97
Diversit	-0.03	-0.07	0.00	0.02	0.11	1.09
Minority	-0.03	-0.13	0.02	-0.01	0.14	1.09
localpur	0.00	-0.02	0.06	0.01	0.31	0.49
CNGvehic	0.05	0.05	-0.01	0.01	0.02	-0.01
Plantedt	-0.06	-0.09	0.00	0.03	0.10	-0.07
Grasssee	0.00	-0.01	0.01	0.01	0.00	0.01
ForestLa	-0.06	-0.04	0.00	0.02	0.08	-0.11
communit	-0.06	-0.02	0.02	0.01	0.27	0.08
voluntee	-0.08	-0.07	0.02	0.00	0.29	-0.02

Covariance Matrix

	Turnover	Unionize	Diversit	Minority	localpur	CNGvehic
	--------	--------	--------	--------	--------	--------
Turnover	0.00					
Unionize	0.00	2.05				
Diversit	0.00	1.18	1.42			
Minority	-0.01	1.18	1.00	2.86		
localpur	0.00	0.75	0.52	0.20	2.46	
CNGvehic	0.00	-0.02	-0.02	0.01	0.03	0.26
Plantedt	0.00	0.13	0.13	0.01	0.10	0.03

Grasssee	0.00	-0.04	-0.03	-0.01	0.01	0.00
ForestLa	0.00	0.07	0.02	0.01	0.00	-0.01
communit	0.00	0.27	0.14	0.11	0.30	0.02
voluntee	0.00	0.21	0.10	0.09	0.24	0.00

Covariance Matrix

	Plantedt	Grasssee	ForestLa	communit	voluntee
Plantedt	0.95				
Grasssee	0.05	0.15			
ForestLa	0.02	0.02	0.21		
communit	0.08	0.03	0.00	0.36	
voluntee	0.09	0.02	0.04	0.21	0.31

Number of Iterations = 28

LISREL Estimates (Maximum Likelihood)

Measurement Equations

```
    ROA = 0.064*Performa, Errorvar.= 0.0065  , Rý = 0.39
         (0.0050)               (0.00051)
          12.77                  12.62

    ROE = 0.16*Performa, Errorvar.= 0.0015 , Rý = 0.95
         (0.0073)               (0.0013)
          21.89                  1.16

    ROI = 0.019*Performa, Errorvar.= 0.049  , Rý = 0.0075
         (0.012)                (0.0035)
          1.65                   13.76

     MV =  - 0.044*Performa, Errorvar.= 0.95  , Rý = 0.0020
            (0.051)                 (0.069)
            -0.85                   13.76

 TobinQ = 0.058*Performa, Errorvar.= 0.24  , Rý = 0.014
         (0.026)                (0.017)
          2.26                   13.76

     PR =  - 0.075*Performa, Errorvar.= 0.21  , Rý = 0.026
            (0.024)                 (0.015)
            -3.07                   13.75

    SGR = 0.14*Performa, Errorvar.= 0.012  , Rý = 0.64
         (0.0085)               (0.0013)
          17.07                  8.79
```

```
    R_D = 234.38*Innovati, Errorvar.= 16172.01, Rý = 0.77
         (13.28)                 (3853.38)
          17.65                   4.20

R_D_Prio = 163.80*Innovati, Errorvar.= 12746.90, Rý = 0.68
         (9.96)                 (2023.98)
          16.45                   6.30

GrantedP = 0.21*Innovati, Errorvar.= 0.23  , Rý = 0.17
         (0.028)               (0.017)
          7.68                 13.29

PatentAp = 0.21*Innovati, Errorvar.= 0.21  , Rý = 0.17
         (0.027)               (0.016)
          7.87                 13.26

RandDint = 0.0025*Innovati, Errorvar.= 0.065  , Rý = 0.00
         (0.014)                 (0.0047)
          0.17                   13.77

    GHG = 0.88*Sustaina, Errorvar.= 0.18  , Rý = 0.81
         (0.040)               (0.020)
          22.22                 9.36

Flaredan = 1.02*Sustaina, Errorvar.= 0.31  , Rý = 0.77
         (0.048)               (0.030)
          21.34                 10.27

 SOandNO = 0.46*Sustaina, Errorvar.= 0.61  , Rý = 0.26
         (0.045)               (0.045)
          10.25                 13.42

   VOCs = 1.00*Sustaina, Errorvar.= 0.32  , Rý = 0.76
         (0.047)               (0.030)
          21.00                 10.55

waterrec =  - 0.0073*Sustaina, Errorvar.= 0.067  , Rý = 0.00080
            (0.014)                 (0.0048)
            -0.53                   13.77

  Spills = 0.0057*Sustaina, Errorvar.= 0.010   , Rý = 0.0032
         (0.0054)                (0.00075)
          1.07                   13.76

WasteRec =  - 0.00*Sustaina, Errorvar.= 0.00051, Rý = 0.00
            (0.0012)              (0.00)
            -0.038                13.77

  Energy = 0.51*Sustaina, Errorvar.= 0.41  , Rý = 0.39
         (0.039)               (0.031)
          13.09                 13.13
```

Energyge = 1.41*Sustaina, Errorvar.= 4.52 , Rý = 0.31
(0.12) (0.34)
11.37 13.32

Reclaime = 0.00*Sustaina, Errorvar.= 0.00089, Rý = 0.00
(0.0016) (0.00)
0.011 13.77

wildlife = 0.20*Sustaina, Errorvar.= 0.46 , Rý = 0.078
(0.037) (0.033)
5.37 13.68

EnvExp = 0.51*Sustaina, Errorvar.= 1.75 , Rý = 0.13
(0.073) (0.13)
6.96 13.62

losttime = - 0.21*Sustaina, Errorvar.= 0.67 , Rý = 0.064
(0.044) (0.049)
-4.85 13.70

recordab = - 0.24*Sustaina, Errorvar.= 0.65 , Rý = 0.082
(0.044) (0.048)
-5.49 13.68

LTIR = 0.015*Sustaina, Errorvar.= 0.075 , Rý = 0.0031
(0.015) (0.0054)
1.05 13.76

RIR = 0.012*Sustaina, Errorvar.= 0.093 , Rý = 0.0015
(0.016) (0.0068)
0.73 13.76

Fataliti = 0.64*Sustaina, Errorvar.= 2.22 , Rý = 0.16
(0.083) (0.16)
7.76 13.58

NewHires = - 0.15*Sustaina, Errorvar.= 2.59 , Rý = 0.0081
(0.086) (0.19)
-1.70 13.76

Turnover = - 0.0057*Sustaina, Errorvar.= 0.0026 , Rý = 0.012
(0.0027) (0.00019)
-2.07 13.75

Unionize = 0.54*Sustaina, Errorvar.= 1.76 , Rý = 0.14
(0.073) (0.13)
7.35 13.60

Diversit = 0.29*Sustaina, Errorvar.= 1.34 , Rý = 0.059
(0.062) (0.097)
4.63 13.70

Minority = 0.18*Sustaina, Errorvar.= 2.82 , Rý = 0.011

```
          (0.090)               (0.21)
           2.01                 13.75

localpur = 0.48*Sustaina, Errorvar.= 2.23 , Rý = 0.093
          (0.081)               (0.16)
           5.86                 13.66

CNGvehic = 0.0098*Sustaina, Errorvar.= 0.26  , Rý = 0.00037
          (0.027)                 (0.019)
           0.36                   13.77

Plantedt = 0.10*Sustaina, Errorvar.= 0.94  , Rý = 0.011
          (0.052)               (0.068)
           1.99                 13.75

Grasssee =  - 0.011*Sustaina, Errorvar.= 0.15  , Rý = 0.00076
             (0.021)                (0.011)
             -0.52                  13.77

ForestLa = 0.096*Sustaina, Errorvar.= 0.20  , Rý = 0.044
          (0.024)                (0.015)
           3.98                  13.72

communit = 0.29*Sustaina, Errorvar.= 0.28  , Rý = 0.24
          (0.030)               (0.021)
           9.74                 13.46

voluntee = 0.26*Sustaina, Errorvar.= 0.24  , Rý = 0.23
          (0.028)               (0.018)
           9.50                 13.48



        Correlation Matrix of Independent Variables

           Performa   Innovati   Sustaina
           --------   --------   --------
Performa       1.00
Innovati       0.01       1.00
             (0.06)
               0.24
Sustaina       0.02       0.28       1.00
             (0.05)     (0.05)
               0.29       5.27


                          Goodness of Fit Statistics

                            Degrees of Freedom = 776
              Minimum Fit Function Chi-Square = 3066.98 (P = 0.231)
      Normal Theory Weighted Least Squares Chi-Square = 3469.56 (P = 0.283)
               Estimated Non-centrality Parameter (NCP) = 2693.56
          90 Percent Confidence Interval for NCP = (2514.60 ; 2879.96)
```

Minimum Fit Function Value = 8.09
Population Discrepancy Function Value (F0) = 7.11
90 Percent Confidence Interval for F0 = (6.63 ; 7.60)
Root Mean Square Error of Approximation (RMSEA) = 0.0274
90 Percent Confidence Interval for RMSEA = (0.00 ; 0.0688)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.793

Expected Cross-Validation Index (ECVI) = 0.960
90 Percent Confidence Interval for ECVI = (0.913 ; 1.009)
ECVI for Saturated Model = 0.454
ECVI for Independence Model = 2.084

Chi-Square for Independence Model with 820 Degrees of Freedom = 7817.11
Independence AIC = 7899.11
Model AIC = 3639.56
Saturated AIC = 1722.00
Independence CAIC = 8101.65
Model CAIC = 4059.47
Saturated CAIC = 5975.49

Normed Fit Index (NFI) = 0.941
Non-Normed Fit Index (NNFI) = 0.980
Parsimony Normed Fit Index (PNFI) = 0.852
Comparative Fit Index (CFI) = 0.989
Incremental Fit Index (IFI) = 0.990
Relative Fit Index (RFI) = 0.89

Critical N (CN) = 289.965

Root Mean Square Residual (RMR) = 29.22
Standardized RMR = 0.0542
Goodness of Fit Index (GFI) = 0.972
Adjusted Goodness of Fit Index (AGFI) = 0.937
Parsimony Goodness of Fit Index (PGFI) = 0.962

The Modification Indices Suggest to Add the

Path to	from	Decrease in Chi-Square	New Estimate
MV	Innovati	25.3	0.27
MV	Sustaina	12.8	0.19
Flaredan	Innovati	10.9	-0.12
EnvExp	Innovati	17.4	0.32
localpur	Innovati	50.9	0.62
communit	Innovati	29.9	0.17
voluntee	Innovati	10.0	0.09

The Modification Indices Suggest to Add an Error Covariance

Between	and	Decrease in Chi-Square	New Estimate
MV	ROE	21.4	0.03
PR	MV	11.2	0.08
SGR	MV	13.7	-0.02
GrantedP	ROA	10.2	0.01

GrantedP	R_D	20.4	-28.14
PatentAp	R_D	10.0	-19.42
PatentAp	R_D_Prio	14.3	-16.32
PatentAp	GrantedP	206.9	0.17
GHG	R_D	11.6	-15.81
Flaredan	GHG	189.8	0.31
SOandNO	GHG	89.8	0.20
Energy	Flaredan	8.9	-0.07
Energy	SOandNO	12.3	-0.09
Energyge	MV	13.0	-0.39
Energyge	GHG	35.0	-0.35
Energyge	SOandNO	100.7	-0.88
Energyge	Energy	49.3	0.51
Reclaime	Spills	15.3	0.00
wildlife	GHG	10.1	-0.06
EnvExp	MV	30.5	0.37
EnvExp	PR	9.8	0.10
EnvExp	R_D	15.4	47.59
EnvExp	GHG	9.4	-0.11
EnvExp	Flaredan	39.5	-0.28
losttime	MV	10.2	0.13
losttime	GHG	8.3	0.06
losttime	SOandNO	31.9	0.19
losttime	Energyge	23.4	-0.44
recordab	Energyge	11.8	-0.31
recordab	losttime	93.1	0.33
Fataliti	GHG	11.0	-0.13
Fataliti	SOandNO	26.9	-0.31
Fataliti	Energyge	17.4	0.69
NewHires	MV	26.0	0.41
NewHires	PatentAp	15.0	-0.15
NewHires	Flaredan	15.7	-0.21
NewHires	SOandNO	14.3	0.25
NewHires	Energyge	18.8	-0.77
NewHires	EnvExp	13.5	0.40
NewHires	Fataliti	13.2	-0.45
Unionize	MV	13.2	0.24
Unionize	GHG	11.2	-0.12
Unionize	Flaredan	12.5	-0.16
Unionize	EnvExp	16.5	0.37
Unionize	NewHires	92.5	1.06
Diversit	MV	16.9	0.24
Diversit	RandDint	8.1	0.04
Diversit	Flaredan	11.1	-0.13
Diversit	EnvExp	11.1	0.26
Diversit	NewHires	141.2	1.14
Diversit	Unionize	170.9	1.04
Minority	Flaredan	12.1	-0.19
Minority	NewHires	64.4	1.11
Minority	Unionize	89.7	1.09
Minority	Diversit	91.6	0.96
localpur	MV	30.8	0.42
localpur	R_D	49.2	95.75

localpur	GrantedP	9.0	-0.11
localpur	Flaredan	38.2	-0.31
localpur	EnvExp	130.7	1.17
localpur	NewHires	20.7	0.56
localpur	Unionize	24.3	0.51
localpur	Diversit	18.5	0.38
CNGvehic	R_D	13.1	16.93
CNGvehic	Spills	8.1	0.01
Plantedt	RandDint	23.8	0.06
Plantedt	GHG	11.3	-0.09
Grasssee	Plantedt	8.3	0.06
ForestLa	Energy	11.2	0.05
ForestLa	Energyge	18.5	0.21
communit	MV	10.6	0.09
communit	R_D	21.5	22.49
communit	GHG	32.2	-0.08
communit	Flaredan	31.2	-0.10
communit	VOCs	12.6	0.06
communit	EnvExp	14.8	0.14
communit	NewHires	8.1	0.13
communit	Unionize	10.6	0.12
communit	localpur	16.0	0.16
voluntee	R_D	15.0	17.42
voluntee	GHG	29.6	-0.07
voluntee	Flaredan	23.2	-0.08
voluntee	Energy	10.3	0.05
voluntee	EnvExp	15.9	0.13
voluntee	Fataliti	10.1	0.12
voluntee	localpur	9.6	0.12
voluntee	communit	101.2	0.14

Time used: 0.312 Seconds

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