THE UNIVERSITY OF CALGARY

Corporate Environmental Responsiveness Strategies and Competitiveness in the North American Oil and Gas Industry

by

Sanjay Sharma

A DISSERTATION SUBMITTED TO THE FACULTY OF GRADUATE STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

FACULTY OF MANAGEMENT

CALGARY, ALBERTA

NOVEMBER, 1995

ISBN 0-612-12929-2

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FACULTY OF GRADUATE STUDIES

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a dissertation entitled "Corporate Environmental Responsiveness Strategies and Competitiveness in the North American Oil and Gas Industry" submitted by Sanjay Sharma in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

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ABSTRACT

For most business firms, environmental responsiveness involves investments in costly end-of-the-pipe pollution controls in response to government mandated regulations. Environmental preservation will continue to be driven mainly by regulation unless businesses understand the ways in which they can reconcile the two seemingly conflicting but equally important objectives of economic performance and environmental protection. This research study was designed to identify organizational strategies that can contribute to an understanding of the reconciliation of these objectives.

In order to gain a preliminary understanding of environmental responsiveness strategies, an exploratory study was conducted in the Canadian oil and gas industry, to build theory from a grounded perspective. Based on this study, and a detailed literature review, hypotheses were formulated regarding organizational determinants of environmental responsiveness strategies and the impact of these strategies on firm performance. These hypotheses were tested through a questionnaire based comparative survey of multiple informants in the Canadian and U.S. oil and gas industries.

The study revealed the primary role of managerial cognitions through interpretation of environmental issues as threats or opportunities in influencing environmental responsiveness strategies of individual companies. Other factors seen as significant were larger company size and resources, the adoption of collaborative/ problem-solving relationship strategies with stakeholders seen as spokespersons for the natural environment, and early response in the environmental issue lifecycle.

Managerial interpretations of environmental issues were seen to be influenced by (a) leadership influenced managerial perceptions of organizational identity as institution-oriented rather than enterprise-oriented, and organizational philosophy toward environmental preservation, and (b) organization design factors such as integration and co-operation between line and staff managers in knowledge-creation and dissemination on the business-natural

environment interface, managerial discretion in decisions on the business/natural environment interface, and the use of environmental performance indicators in employee control systems. Interactive/ proactive environmental responsiveness strategies were found to be related to the emergence of unique organizational capabilities, as well with above-average economic performance for companies.

The research study builds a grounded theory to explain and predict corporate environmental responsiveness strategies and their influence on organizational outcomes. and identifies managerial and public policy levers that can help make companies more environmentally responsive.

DEDICATION

For Pramodita, Smita, and my parents for their support and understanding.

ACKNOWLEDGEMENTS

Special thanks to Dr. Harrie Vredenburg, Dr. Urs Daellenbach, and Dr. Doug Olsen, members of my doctoral committee for their advice and encouragement. This dissertation was made possible by research support from the Canadian Association of Petroleum Producers, the University of Calgary research services, and the Faculty of Management.

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CHAPTER 1 - INTRODUCTION

"Future productivity advances will come from environmental response. Managers are realizing that this is an area with tremendous potential for generating cost reductions and efficiency improvements. The industry has been extremely sloppy in the area of wastes, spill and leaks, because no one focused on wastes and the problem of their disposal. Only when the environment became important did firms start to monitor these seriously. A focus on these aspects of our operations, rather than only on increases in production and sales, has opened up a whole new area of profit improvement and process innovation." (Vice-President - Operations of Buffalo, a 'senior' Canadian oil company.)

"I care as much as any other person about environmental degradation. I do have ideas about how I can reduce some of the environmental impacts of this operation. However, these involve investments for which I cannot guarantee results. If these investments affect output and profits, I am out of a job. Unless I have some discretionary funds to play around with, I can't do anything on my own. The instructions from the top are clear, invest only as much as is necessary to get a clean chit from regulators." (Manager - Refining of Royal, a 'major' Canadian oil company.)

These quotes taken from interviews with managers of two different companies in the Canadian oil industry represent contrasting organizational and managerial viewpoints and philosophies toward environmental responsiveness. These two firms operate within the context of similar levels of regulatory and media scrutiny, societal and environmental group pressures, and technological environments. The objective of this study is to identify the organizational factors that influence different approaches to managing the interface between business and the natural environment. Literature on corporate environmental responsiveness has recently begun to conceptually discuss this interface (Shrivastava, 1992, 1995; Throop, Starik & Rands, 1993). Most of the existing literature discusses categories and typologies of organizational motivations for environmental action (Rands & Marcus, 1991; Vredenburg & Westley, 1993) and environmental strategies of individual firms (Hunt & Auster, 1990; Post & Altman, 1992).

It is argued that the impact of the natural environment on business differs from the impact of social issues such as employment equity, and strategic issues such as changing competitive and technological environments. This is because the natural environment has a systemic impact on business firms ranging from the inputs they consume, to their processes and operations, to the products and services they produce, extending to the waste generated by consumption of their products/services (Shrivastava, 1992). Organizational actions on a social issue such as employment equity may require a firm to just alter its human resources practices. Response on strategic issues such as technological change may require only increased resource commitments to research and development and innovation efforts. However, response on the natural environment requires a consideration of the systemic consequences of each action.

Besides consideration of the systemic impact of the natural environment on business, considerations of sustainability[1] require radical change in organizational thinking. The concept of sustainability includes considerations of ecological preservation, global equity and justice, appropriate size and technology (Schumacher, 1974), equity between generations and equitable income distribution (Schmidheiny, 1992), and a re-evaluation of current economic development paradigms (Sharma, Vredenburg & Westley, 1994).

Thus corporate environmental responsiveness is an emerging holistic field of inquiry that needs to draw from different management disciplines such as strategic management, strategic

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[1]The term "sustainability" is equated here with the term "sustainable development", for which the UNWCED's (1987: 43) definition is accepted as the "development that meets the needs of the present without compromising the ability of the future generations to meet their own needs." In literal terms, sustainable means "continuation at an acceptable level for a very long time" (Throop, Starik & Rands, 1993: 3).

issue management, organization theory, organizational behavior/ design, corporate social responsibility, as well as from related disciplines such as biology, ecology, and economics, etc.

In order to extract predictive and explanatory frameworks from the complexity that surrounds this phenomenon, the present research was carried out in two phases: (a) a grounded study using multiple case studies within a single industrial context for the purpose of building such a framework, and (b) a mail survey to test this framework within a single industry context in the Canadian and U.S. oil and gas sectors. The first phase of the research study was specifically designed to gain insight into the dimensions that distinguish various strategies followed by individual firms to manage the business-natural environment interface, the factors that influence these approaches, as also the organizational outcomes in terms of impact upon competitiveness of individual companies. Findings from the exploratory case studies used in this research are presented and used to derive a theoretical foundation for understanding corporate strategies of environmental responsiveness and to suggest a set of empirically testable hypotheses flowing from the model. The second phase of the research study is designed to test this framework within the Canadian and U.S. oil and gas sectors.

1.1. The importance of corporate actions for environmental protection

With the thinning of the Earth's ozone layer and indications of global warming, the damage to the planet's natural environment has become an issue of increasing importance to society (Colby, 1990; Daly & Cobb, 1989; Schmidheiny, 1992). The magnitude of our ecological crisis is documented periodically by the World Resources Institute, Washington D.C. (Brown, 1994). The human population is increasing at an accelerating rate and is expected to double by the middle of the next

century. This is putting an increasing strain on the environment and has led to an increasing consumption of natural resources. Resources are not being given the time to renew, leading to a depletion of the planet's capital (Daly & Cobb, 1989). According to the World Resources Institute, the combination of population growth and wasteful consumption of resources has turned agriculturally fruitful drylands into deserts; forests into poor pastures; freshwater wetlands into salty, dead soils; rich coral reefs into lifeless stretches of ocean (Brown, 1994). As ecosystems are degraded, the biological diversity that they contain are lost. This is an irreversible and permanent loss (Wilson, 1992). This pressure on the environment leads to increasing pollution that exceeds the absorption capacity of the planet and leads to climate change that further accelerates the process of environmental destruction. In the long-term, this impending loss of resources undermines the very foundations of business enterprise.

Although many firms have made explicit declarations about their commitment to the natural environment, few have been able to effectively integrate these concerns into their strategic planning processes. Most firms tend to the viewpoint that there exists a conflict between their economic objectives, and responsibility towards the natural environment. Indeed, for most firms, environmental responsiveness involves investment in costly end-of-pipe pollution controls in response to government mandated regulations (Commoner, 1990; Porter, 1991; Porter & van der Linde, 1995).

Opinion surveys in several countries (Canada - Angus Reid 1988-1994; U.S.A. - Barnes, 1990, Chase & Smith 1992, Coddington, 1990; U.K.- *The Economist* 1990; Europe - Evans, 1990) have shown that the natural environment is seen as an increasingly important issue in developed countries. It has remained one of the most important issues among Canadians, even during the current recession (Angus Reid, 1992 & 1993). Surveys reveal that consumers increasingly buy products based on

corporate reputation for social performance rather than purely on the basis of brand image (Barrow, 1989; *Chief Executive*, 1991; Stisser, 1994).

While consumers may not significantly alter their consumption patterns in the short-term, they as members of society increasingly vote for stricter environmental regulation. Other segments of society or stakeholders also impact upon corporations by investing in stocks of socially responsive companies. This is the largest growing segment of mutual funds investment constituting US$ 625 billion in assets in 1992 (Kinder, Lydenberg, & Domini, 1993). In response to this increasing concern, *Fortune* magazine has initiated ratings of corporations based on environmental response indicators (*Fortune,* 1993). It can be assumed that consumers are, and will become in the future, increasingly knowledgeable about a company's social and environmental policies, and will want to look beyond the quality and physical and utility attributes of the product or service they consume (Dowling, 1993; *Fortune,* 1993; Fombrun & Shanley, 1990; Smith 1994; Wartick, 1992; Weigelt & Camerer, 1988).

Even within industries, such as oil and gas, chemicals, and utilities, that either use up non-renewable resources and/or follow unsustainable production practices, some firms have managed to engender positive and caring images among consumers (Sharma, 1995, 1994; Sharma & Vredenburg, 1994, 1994a; Shrivastava, 1992). It would be reasonable to argue that such an image adds value, and differentiates a firm's product or service, as societal concern for environmental protection increases. Environmental responsibility can also be a source of cost reduction and a stimulus for engendering innovation and organisational learning (Porter, 1991; Porter & van der Linde, 1995; Schmidheiny, 1992; Sharma, 1995). Thus, corporations may become environmentally responsive to meet regulations, enhance corporate image among consumers, regulators, and their other stakeholders, and as a potential

source of productivity improvement, innovation, and cost reduction (Sharma, 1995; Vredenburg & Westley, 1993).

1.2. The Management Problem

(1) Why should firms undertake proactive corporate environmental responsiveness strategies that are not required by regulations? Underlying this question are the imperatives of maintaining competitiveness and economic performance, especially when competitors may adopt minimum possible regulatory compliance. This problem becomes more acute in the global market place where different firms are subject to asymmetrical regulations in their home economies.

(2) What internal organisational changes need to be made in organisations that follow proactive environmental responsiveness strategies that go beyond regulatory requirements?

(3) What is the impact of different environmental responsiveness strategies on the economic performance of individual firms?

1.3. The Research objectives

In order to facilitate comparison, the research study included companies from two separate populations of the Canadian and the U.S. oil and gas industries. The following broad research objectives drove this study:

1. What are the different environmental responsiveness strategies followed by business firms within a single industry context? Do these strategies differ between the Canadian and U.S. oil and gas industries?

2(a). What are the internal organisational variables that accompany and influence these different strategies of corporate environmental responsiveness? Do these internal variables differ between the Canadian and U.S. oil and gas industries?

2(b) What are public policy implications of any differences in environmental responsiveness strategies followed by firms in the U.S. and in Canada? This is important in view of differing environmental regulatory approaches in Canada and the U.S. - the former relies more on broader guidelines and public consultation processes while the latter relies upon detailed regulations and negative sanctions.

3. Do certain types of environmental responsiveness strategies lead to any beneficial economic performance outcomes for business firms?

1.4. Defining the terms

This section defines some of the terms that are frequently used from the outset in this research study.

1.4.1. The *Environment:* In strategic management literature, the term *environment* encompasses the social, political, legal, economic, and technological environment of business (Porter, 1980). The natural environment is seen as being significant only when it impacts on the social environment as a part of the social responsibility of business. Although, the word *environment* is criticised for its anthropocentric connotations (Colby, 1990; Daly & Cobb, 1989), it is used here since the viewpoint adopted is that of the business firm attempting to reduce and eliminate the degradation caused by it to its natural surroundings. The words *natural environment* and *environment* are used interchangeably in this paper, and defined as *the biological, physical, geological, chemical, and*

geographic environment impacting upon and impacted upon by the business firm. These impacts may be indirect, such as ozone-depletion and global warming.

1.4.2. *Corporate Environmental Performance, Responsibility,* and *Responsiveness:* The three components of the corporate environmental performance are: (a) motivating principles, (b) behavioural processes, and (c) observable outcomes of managerial and corporate actions relating to a firm's relationships with the natural environment. Adapting some components of the definition of corporate social performance used by Wood (1991), corporate environmental performance is defined as *a business organization's configuration of philosophies of environmental protection* (the extent to which philosophies of environmental preservation motivate actions taken on behalf of the company), *processes of environmental responsiveness* (including strategies of environmental responsiveness), *and policies, programs, and observable outcomes as they relate to the firm's interactions with, and impact on the natural environment.* Corporate actions of environmental protection that are not supported by organizational philosophies that recognize the dimensions of environmental degradation, the concept of sustainability, and a genuine desire for environmental preservation, need not constitute effective corporate environmental performance. Responsiveness, responsibility, and outcomes go together in measuring performance. The focus of this research proposal is corporate environmental responsiveness, i.e., strategies and actions for environmental preservation.

1.4.3. Strategies of corporate environmental responsiveness: *Voluntary* and *Reactive-Proactive-Interactive*: The term *voluntary* strategies has been mentioned by Galbraith (1977) to indicate strategies that are not mandated by legal or economic considerations. Carroll (1979) calls these *discretionary* strategies. Davis (1973), in defining corporate social responsibility, refers to these

discretionary actions as those that go beyond legal and economic considerations of business. *Voluntary* strategies are considered likely to be a part of only *proactive* and *interactive* strategies and not of *reactive* strategies.

Reactive-proactive-interactive strategies: The dimension of *reactive-proactive-interactive* is mainly derived from corporate social responsibility literature. Sethi (1979) used the terms *reactive, defensive* and *responsive* to describe the strategies of corporate social responsibility of business firms. The term *reactive* is adopted here to indicate corporate environmental strategies that indicate a passive reaction to changing regulations and demands of traditional principal stakeholders of the business firm - investors, regulators, customers, and employees. These reactive responses cover a range of strategies from defensive to aggressive, and no distinction is made between passive or aggressive forms of reactive strategies.

Post (1978) used the terms *adaptive, proactive,* and *interactive* to describe corporate strategies for coping with changes in the external environment. According to him, *adaptive* strategies referred to organizational reaction to external events by changing the characteristics within the organization such as its awareness, perceptions, and images of the environment, its functions, or its internal responsiveness to the changing environment. *Proactive* strategies referred to organizational attempts to initiate, alter, or modify the characteristics of the environment either directly by the organization or by utilizing other systems in the environment. *Interactive* strategies referred to organizational recognition that corporate purposes and public purposes are both changing, though not at the same rate or in the same direction. These strategies attempted to change the intersystem relationship between the organization and its environment by (a) altering the boundary between the organizational and public

purposes; and (b) establishing direct links between features of the environment and parts of the organization, in order to regulate, stabilize, and manage the channels of interaction between the system and the environment, or by lessening the disjunctive connections between the system and the environment.

In this study the term *reactive* is used to refer to a passive following of environmental regulations as they change over time, without effecting internal organizational changes in response to anticipatory changes in the realities of the increasing business-natural environment interface. The term *proactive* indicates the seizing of initiative by a company for environmental protection mainly through internal organizational change. This differs from Post's (1978) definition, which indirectly imbues the term *proactive* with negative overtones of manipulation of the environment to suit a company's traditional economic strategies. The term *interactive* is used in the same sense as defined by Post (1978), i.e. a progressive process of simultaneous change in tune with the environmental concerns of the organization's various constituents - external and internal. The natural environment becomes a domain issue for the organization. Each of these categories will contain a range of environmental strategies, as will be discussed subsequently.

1.5. Plan for the dissertation

This dissertation is presented as follows. Chapter two discusses literature in the areas of corporate environmental responsiveness, corporate social responsibility, strategic management, organization theory, and ecology, that discusses corporate environmental performance. Chapter three describes the research methods used in the first phase of the research - the exploratory study in the Canadian oil and gas industry for theory development. The fourth chapter discusses the structure and

the evolution of the regulatory framework in the oil and gas industry, and its impact upon the natural environment. The fifth chapter integrates the discussions of literature in chapter two with an analysis of data from the exploratory study in chapter three to develop a theoretical model of corporate environmental responsiveness. Hypotheses that are sought to be tested in this research study are presented. Chapter six describes the research methods used during the theory testing phase of the study - questionnaire based mail survey in the U.S. and Canadian oil and gas industry. Chapter seven describes the development of the measures for the constructs including results of data reduction of the items used as measures and tests for scale reliability. Chapter eight describes the results of the multivariate statistical analysis of the data from the survey of the Canadian and U.S. oil and gas companies. Chapter nine is the concluding chapter that discusses the results and implications of this research study.

CHAPTER 2 - LITERATURE REVIEW

The first section of this chapter discusses literature in the area of corporate environmental performance. Some of this literature comes from the area of corporate social responsibility and responsiveness which discusses the philosophy and process of corporate response to social issues in the external environment (including the natural environment). Environmental issues may initially be perceived by organisations similarly to external social issues, and useful lessons can be learned from the corporate social responsibility literature. This section draws from the corporate environmental and social responsiveness literature to develop a continuum of organizational environmental philosophies that accompany different corporate environmental responsiveness strategies. A major premise and finding of this study is that fundamental philosophical changes within an organization lead to a questioning of conventional wisdom. This can change decision frameworks and can spark processes of organizational learning and innovation.

Accordingly, the second section discusses literature in the areas of organisational learning, internal innovation, and organisational change and adaptation. Organization learning is argued to result in knowledge-based unique organizational capabilities. To highlight the importance of organizational capabilities as sources of competitive advantage, the third section discusses the resource-based view of the firm literature and relates this to processes of organisational learning and internal innovation as well as to positions of competitive advantage.

2.1. Corporate environmental responsiveness.

Corporate environmental performance is an emerging area of discussion and research in management literature. Theoretical discussions and the limited research in this area span several

sub-disciplines within management, from strategic management to organisational theory and behaviour. The literature review on corporate environmental performance will serve as a guide for the development of the corporate environmental philosophy construct that will be used to measure and compare managerial attitudes that impact upon the corporate environmental responsiveness strategies of different business firms.

Corporate environmental responsiveness is a term used with a wide array of meanings in management literature. The literature in this emerging area is limited. It consists mainly of conceptual articles and case studies across a wide variety of industries and types of businesses in an attempt to generate theoretical categories or generic typologies of organisational response to the natural environment. The common dimensions of corporate environmental responsiveness that emerge from this literature review are discussed below. Due to inadequate definitions of ecological terms in the management literature, concepts from environmental management[2] and ecology literature are used to supplement this discussion.

2.1.1. Paradigmatic models: These models are primarily derived from the ecology literature. They represent worldviews or gestalts that act as lenses or filters through which an organization sees, perceives, and interprets the world. Paradigmatic models of environmental management have developed from a continuum of "either for or against the environment" dichotomies toward richer representations that provide a greater range of descriptive categories

[2]The term "environmental management" is often loosely used to indicate corporate environmental strategies. However, Colby's (1990) definition is commonly accepted in ecological economics as "the field that seeks to balance human demands upon the Earth's natural resource base with the natural environment's ability to meet these demands on a sustainable basis" (Colby, 1990: 1).

for possible worldviews. Models developed by Buttel and Flinn (1976), Dunlap & Van Liere (1978; 1983; 1984) and Catton and Dunlap (1978; 1980) indicate that the conflict over environmental issues is described by the dichotomous distinction between the *dominant social paradigm* (DSP) and the *new ecological paradigm* (NEP). The DSP is frequently cited in early ecological literature as the dominant western worldview that is primarily Eurocentric. Capra (1992) refers to the DSP as the "old paradigm". Some of the dimensions studied in the DSP:NEP research include beliefs and values of organisations that support economic growth, faith in material abundance, support for individual rights, support for property rights, laissez-faire government, and faith in science and technology (Dunlap & Van Liere, 1984).

Robertson (1985) describes these states as the *hyper-expansionist* (HE) and *sane, humane, ecological* (SHE) paradigms. The former is urban, anthropocentric, and characterised by rational intellectual detachment, while the latter is countrywide, ecological, and experientially intuitive and emphatic. Harman (1987; 1992a; 1992b; 1992c) describes how these paradigms influence individual consciousness and affect leadership paradigms in organisations. Parallels can be seen between this description and Ackerman's (1975) and Wood's (1990; 1991) discussion about the role of individual human actors and leaders as moral actors in organisational decision-making. Thus, personal influences and backgrounds of organisational leaders are important factors in determining corporate environmental strategies.

Orr (1992) contrasts technological sustainability with ecological sustainability on ten dimensions including appropriate industrial policy, the economic behaviour of organisations and society, and the correct approach to environmental responsibility by business firms. Orr proposes

that an adherent to the technological sustainability paradigm believes that every problem has a technological or market solution that yields maximum benefit for society. This contrasts with the paradigm of ecological sustainability where every problem has appropriate solutions that maintain responsible balance within ecological ecosystems. He contrasts between humans as managers of the environment and as responsible citizens of the ecosystem.

Perhaps the most influential paradigmatic model of economic behaviour is presented by Colby (1990). At one extreme he labels the neo-classical economic belief system as the *frontier economic paradigm* (FEP). At the other extreme he redefines the *new ecological paradigm* (NEP) and simply labels it *deep ecology*. Between these two polar opposites, Colby describes three other paradigms for classifying organisational environmental behaviour, *environmental protection*, *resource management*, and *eco-development*. These represent a progression away from neo-classical economics paradigms of exploitation of nature to deep ecology viewpoints that respect nature for its intrinsic value. The paradigmatic models discussed above provide a valuable overview for developing the framework of corporate environmental philosophies presented later.

2.1.2. Phased evolution Models: Some studies discuss a phased evolution of corporate environmental responsiveness. The earliest categorisation is the dichotomous model of "resisting" or "accepting" put forth in Logsdon's (1985) study of the U.S. oil industry. This refers to distinctions between those firms that resisted and lobbied against the onset of stricter environmental regulations, and those that accepted the regulations and complied with them. Hunt and Auster (1990) view environmental response categories as "beginner", "fire fighter", "concerned citizen", "pragmatist", and "proactivist". These responses represent a shift from

reactive to a proactive stance as firms become more familiar with the consequences of environmental actions. Mathews (1991) proposes four levels of economic responses - "exploit the green fad while it lasts", "environmentalism can sometimes be good business", "environmentalism is here to stay", and "the environment is a strategic business opportunity". This represents a shift in philosophy from viewing the natural environment as a faddish social concern to be exploited, to viewing environmental responsiveness as a strategic business opportunity. Post and Altman (1992) view corporate response as a three stage model - "adjustment", "adaptation", and "innovation". Whatever labels are used for these phases of corporate environmental responsiveness, the underlying shift is from a *reactive* stance that reacts to changes in regulations to a *proactive* stance that aggressively integrates environmental concerns into strategic decision processes to gain economic and other non-tangible benefits such as improved corporate reputation. This is also accompanied by a shift from pollution control to prevention of pollution (Commoner, 1990). The *interactive* strategy phase does not seem to be reflected in these discussions.

2.1.3. Environmental philosophies: The paradigmitic models from the ecology literature presented above serve as useful guides to organisational philosophies with respect to business interactions with the natural environment. However, the treatment in the management literature has been limited to economic and management practice implications, and has not encompassed global values of economic development, social justice and equity, and deep ecology. These driving motivations underlying corporate environmental responsiveness are discussed by Vredenburg & Westley (1993) and Westley & Vredenburg (1995) who categorise environmental responsiveness

as "market driven" (exploit green market opportunities) "regulation driven" (change internally in response to increasing regulation), or "value-driven" (driven by values of conservation and restoration of the natural environment.) Rands & Marcus (1991) explain corporate response patterns in terms of individual managers' assumptions and behaviours, influenced by external and internal control mechanisms in an organization - as obedience to authority under threat of negative sanction, market exchange in search of economic reward, and voluntary action based on shared beliefs and values. Once again these philosophies represent a movement by organisations away from the neo-classical economics paradigms to a philosophy that encompasses a definite responsibility for environmental protection.

2.1.4. Organisational design - closed-loop and circular systems: Starik & Gribbon (1992) present a strategic environmental model integrating the McKinsey *7S* strategic model and the corporate social performance model developed by Wood (1991). This integrates the organisational elements that influence strategy formulation with the elements that determine corporate response on social issues. Vredenburg & Westley (1993) urge a cyclical systems and closed-loop approach to understanding industrial processes. Throop, Starik & Rands (1993) explain the impact of the natural environment on business, using principles of thermodynamics (laws of conservation of energy and the concept of entropy) which explain that current industrial systems are converting high efficiency energy to low-efficiency energy. They also urge that the concept of carrying capacity be factored into business decisions.

Shrivastava (1992) advocates the total physical systems approach to analysing the impact of the natural environment on the activities of a business firm. Similarly, Sharfman & Ellington

(1993) discuss total environmental management in terms of environmental effects throughout the physical systems lifecycle from creation of inputs to the disposal of outputs and extended to collaborative efforts with suppliers and customers of a business firm. Shrivastava (1995) discusses the inability of the current paradigms in organization theory to accommodate the natural environment, and prescribes an ecocentric orientation to facilitate the greening of organisations. All of these articles urge a fundamental change in organisational thinking from a linear to a closed-loop systems approach - a fundamental change in organisational design.

Except for Logsdon's study (1985) of the U.S. oil industry, and the Throop et al. study (1992) of the North American utility industry, the literature consists of studies that span different industry types. Generic environmental response typologies, though important beginnings in facilitating increased understanding in this area, need to be narrowed down to specific industries in order to control for the other external environmental variables (Shrivastava, 1992) such as the extent of regulation, the social visibility of the industry and the intensity of public and media scrutiny, political pressures, and the intensity of market and competitive forces. Consequently this research study is focused within a single industrial context.

The following section draws upon the foregoing discussion of literature in corporate environmental responsiveness to develop a categorization of corporate philosophies toward environmental preservation.

2.2. Environmental philosophies

Corporate environmental philosophies are divided here into four theoretical categories which refers to motivations for, and awareness of, environmental responsibility of an organization.

This term is used here to refer to a business and managerial worldview or *gestalt* about the business-natural environment interface that drives the environmental responsiveness of an organization. These states may not necessarily flow in sequence or in phases.

2.2.1. Conformity: This refers to a conformity to the neo-classical economics paradigm of the firm as a linear function for the maximization of output and economic returns with the minimum of input. It represents the traditional smokestack mentality where the government is considered responsible for cleaning up the waste generated by industrial processes through tax revenues. As regulations become stringent, firms respond through gradual conformance to regulatory and societal expectations of environmental performance.

Organizations with this state of consciousness may exhibit a wide range of actions from defensive to aggressive. These may vary along the following dimensions: (i) Regulatory - avoidance of regulation; following minimum regulatory standards; investment in pollution control; lobbying against regulations; proactive attempts at shaping regulations in accordance with the firm's technological and resource advantages (ii) Isomorphic - imitating actions of industry leaders; adopting standards set by industry associations such as the "Responsible Care" program of the Canadian Chemical Producers Association (Schmidheiny, 1992) or the Montreal Protocol on the banning of CFCs. (iii) Political - participating in initiatives such as the Energy Options debate in Canada (Kierans, 1988), (iv) Social - adopting minimum environmental protection standards in response to pressures from environmental groups and local communities. This gestalt corresponds to the DSP Paradigm in the ecological literature that believes in exploitation of nature for the benefit of mankind, as well as to Colby's (1990) frontier economics paradigm.

Most discussions in management literature focus on strategies for dealing with the business-natural environment interface and few discuss organizational philosophies. Organizational philosophies may be deduced from these discussions of different strategic positions - Hunt & Auster's (1990) "beginner" and fire-fighter", Post & Altman's (1991) "adjustment" and "adaptation", and Vredenburg & Westley's (1993) "market-driven" and "regulation-driven" organizations, to some extent represent this state of corporate environmental consciousness.

2.2.2. Economic: This philosophy involves a realisation that corporate environmental responsiveness need not just negatively impact upon economic performance due to investments in pollution and emissions control and regulatory compliance. It can even be a source of economic advantage through cost reduction and product differentiation. Firms in this stage of consciousness reap cost benefits from initial investments in energy conservation and waste reduction, and/or by selling of green products and other outward manifestations that indicate a company's green stance to its stakeholders (Vredenburg & Westley, 1993; Westley & Vredenburg, 1991). Mathew's (1991) categorisations of changing economic viewpoints towards the environment, fall within this state of consciousness, as do elements of Vredenburg & Westley's (1993) "market-driven" philosophy. In terms of paradigmatic models, this state corresponds to parts of the Environmental Protection and Resource Management paradigmatic states discussed by Colby (1990) which he dubs as "modified anthropocentric" (Colby, 1990: 8).

2.2.3. Conservation: This represents a corporate worldview that incorporates long-term commitment to: (i) Resource conservation through recycling, reducing waste, and waste-exchange with other companies, (ii) Development and use of renewable resources, (iii) Use of

sustainable resources such as timber from sustainable forests, produce from organic agriculture, etc. Companies such as Body Shop, Ben & Jerry's, Patagonia represent this state of consciousness. "Value-driven" philosophies (Vredenburg & Westley, 1993) interface with this viewpoint. However this consciousness stops far short of sustainability. Anita Roddick of Body Shop campaigns for a ban on animal testing, for the preservation of the rainforest, for the usage of renewable materials (Roddick, 1992), yet what is the percentage of renewable materials used by her company, what attempts have her companies made to avoid energy use in product distribution, to what extent are Body Shop's manufacturing operations closed-loop in resource use? The answers to these questions will stop well short of suggesting that Body Shop is on the path towards that amorphous concept of sustainability. This state falls on the cusp of the Resource Management and the Eco-Development paradigms presented by Colby (1990) that represent a transition from modified anthropocentric to ecocentric viewpoints.

2.2.4. Restorative: It is difficult to clearly determine whether the business firm as we know it can ever be truly sustainable, or whether sustainable business is an oxymoron. It is, however, obvious that a radically different *gestalt* is needed from the states of consciousness discussed above which are, at best, attempts at damage control. Even if Body Shop uses ingredients from sustainable forests, it distributes them using pollution generating means of transportation. Body Shop's Roddick flies across the world in fuel guzzling jets to talk about sustainability. This state of corporate environmental consciousness is not necessarily an utopian ideal, and is a worthy goal to strive for in view of the magnitude of the ecological crisis (MacNeill, Winsemius, & Yakushiji, 1991; Schmidheiny, 1992). While sustainable businesses may

not exist, an understanding of the initial steps to be taken towards sustainability is not unknown among business leaders (Hawken, 1994). The term used here is *restorative* (Hawken, 1994) to indicate serious attempts to restore damaged environmental systems.

This vision includes following dimensions:

(i) A fundamental questioning of existing organisational design and forms;

(ii) An understanding of the need to reduce our societal consumption patterns. This involves making products to last, and encouraging consumption reduction among consumers;

(iii) Closed-loop and cyclical systems of resource and energy use. Innovation and learning processes are driven by agendas for the elimination of non-renewable resources and energy sources and notions of minimising energy entropy (Throop et al., 1993). This includes international agreements to voluntarily restrict resource use in accordance with the eco-system's carrying capacity;

(iv) Equity - local, national, and global. Every aspect of business operations impacts upon and is impacted upon by the ten thousand or so different communities that criss-cross the two hundred or so countries (Boulding, 1989) and the millions of different species of flora and fauna. Equity involves the awareness and assessment of this impact, and attempts at achieving an equitable balance between all these peoples and species - a shift from Eurocentric and anthropocentric viewpoints to a diversified globalism, and then to heterogeneous universalism (Boulding, 1989) that equally embraces all these races and species;

(v) Inclusiveness and justice. Each of these ten thousand or so communities has its own aspirations and demand upon the eco-system. A business firm's interfaces with these societies

must be framed by considerations of social justice and inclusiveness for all these communities. Levi Strauss's refusal to do business in countries with poor records of human rights is an example. Bridgehead's insistence on paying a fair price for its purchases of handicrafts from Third World countries is another instance of this philosophy (Vredenburg & Westley, 1993). On the other hand, Wal-Mart has been accused of buying products manufactured by political prisoners in China (seen on *60 Minutes* TV program in June 1994);

(vi) Scale - bringing people in touch with their work: Ecological sustainability, social justice, and inclusiveness are also dependent upon scale. Development processes should take into consideration the need to match scale of operations to the needs of local and regional sustainability (Schumacher, 1974). Besides matching local material flows and systems to business needs, appropriate scale is also essential to bring people at all levels in the organization in touch with their work, with nature, with the consequences of their actions, with an understanding of how each impacts upon the environment in a small way. By bringing people in touch with their work and their environments, appropriate scale also leads to work satisfaction, democracy, inclusiveness, and social justice. The further removed people are from their work, the more remote the consequences of their actions, in terms of organisational performance and consequences for ecological sustainability.

This state of consciousness is squarely within the Eco-Development paradigm of Colby (1990). Colby's Deep Ecology paradigm, where managers possess a biocentric view of nature, rejects economic development and growth as we know it. This may be an utopian state and may be incompatible with business activity.

These four environmental philosophy categories may or may not evolve in stages - some companies such as Body Shop and Ben & Jerry's start operations at the conservation stage. The fourth stage is not just an utopian ideal, and considering the magnitude of our ecological crisis, it is an urgent and worthy goal to strive for. These stages are theoretical constructions, and companies may exhibit actions that fall between two stages or contain elements of two or more stages. Corporate environmental philosophy is considered a continuous variable ranging from the *conformity* state of consciousness to a *restorative* state of consciousness. It is proposed, that reactive strategies of corporate environmental responsiveness accompany the *conformity* philosophy at one end of the spectrum and *proactive* strategies accompany the *economic* philosophy in the middle, the *conservation* stage is accompanied by *interactive* strategies of environmental responsiveness at the upper end of the spectrum. For most companies, the *restorative* stage may be unrealised.

The foregoing discussion establishes the importance and need for fundamental philosophical changes in organizations that want to undertake proactive and interactive strategies of environmental responsiveness. In accordance with the thesis of this study which states that these fundamental philosophical changes lead to a questioning of conventional wisdom in organizations and can spark higher-level learning, the next section discusses relevant literature in the areas of organizational learning, innovation, and organizational change and adaptation.

2.3. Organisational learning, organisational change and adaptation.

2.3.1. The contingency view and organisational change: The contingency theory of strategy (Lawrence & Lorsch, 1967; Galbraith, 1973) indicates that, in order to yield superior

competitive performance, the strategic orientation adopted by a firm in response to changes in the business environment must be aligned or fit with the internal capabilities of a firm (Cool & Schendel, 1988; Lawrence & Dyer, 1983; McGee & Thomas, 1986; Thompson, 1967). The external business environment is changing due to an increasing societal concern for the preservation of the natural environment. These external changes have the potential to effect major internal changes within the business firm. The internal orientation of the firm, represented by management practices and systems, organisational structure, strategies, and decision-making processes, needs to be in tune with this major change in the business environment.

Consistent with the contingency view of strategy, it is important to innovate internally to reap the benefits of external innovation. Innovation is "a process in which the organization creates and defines problems and then actively develops new knowledge to solve them" (Nonaka, 1994: p.14). Internal innovation involves fluid, self-designing, internal and externally networked organisational structures, continuous experimentation with organisational processes and routines, abilities to acquire and disseminate information, create knowledge and learn, and organisational commitment to converting ideas to successful new options and new approaches (Huber, 1984; Kohli & Jaworski, 1990; Van de Ven, 1986). Successful external innovation through adaptation to rapid technological change with changes in product/ service/ process improvements, and true competitive advantage is not possible without these internal organisational innovations. These innovations lead to knowledge creation that can be a source of organisational capabilities. Thus, the organizational change literature emphasizes internal learning processes sparked by external environmental changes.

2.3.2. Organisational change and organisational learning: Organisational change leads to, and is an outcome of, organisational learning that may be either a basic learning process (Cyert & March, 1963; March & Olsen, 1976; March & Simon, 1958), that involves the updating of organisational routines as a result of experiences and activities undertaken; or leads to a higher-level learning process that changes frames of reference and norms and beliefs (Argyris & Schön, 1978). Organisational learning is defined as "the development of insights, knowledge, and associations between past actions, the effectiveness of those actions, and future actions" (Fiol & Lyles, 1985: 811). Learning within an organization indicates not only successful organisational cognitive coping with rapid environmental change (Duncan & Weiss, 1979; Hedberg, 1981; Pfeffer & Salancik, 1978; Weick, 1979), but also behavioural outcomes that reflect the patterns and/or cognitive associations that have developed (Daft & Weick, 1984).

Organisational learning processes are triggered by cultures (Beyer, 1981; Pfeffer, 1981; Mitroff & Killman, 1976), strategy (Chandler, 1962, Cyert & March, 1963; Daft & Weick, 1984), and organisational structure (Galbraith, 1973; Hrebeniak & Joyce, 1984; Meyer, 1982; Starbuck, et al., 1978), and changing environments (Hedberg, 1981; March & Olsen, 1975). At the same time, all of these three factors are also seen as outcomes of the learning process. This implies that strategies that an organization may adopt to respond to natural environmental concerns will, among other factors, impact upon the learning processes. Strategy influences learning by providing a boundary to decision-making and a context for the perception and interpretation of the environment (Chandler, 1962; Cyert & March, 1963, Daft & Weick, 1984; Fiol & Lyles,

1985). Miller & Friesen (1980) stress that the firm's strategic direction creates a momentum for learning that is pervasive and highly resistant to small adjustments.

Thus, learning is an outcome of the activities undertaken and experiences gained by an organisation's members. This is especially the case when changes in the external environment prompt changes in organisational routines and activities. Learning involves the development of different interpretations of new and existing information, through developing of new understandings of surrounding events (Fiol, 1994). Different environmental strategies lead to distinct patterns of action that can lead to learning processes in dealing with the same environmental issues within a common industrial context. Literature on higher-level learning suggests that the acquisition and processing of information about alternatives takes place in a relatively costly process of search, frequently conducted under conditions of ambiguity (March & Olsen, 1976) - not unlike the ambiguity and lack of information that characterises the business-natural environment interface.

When companies choose interactive environmental strategies, they bring in influences from external stakeholders that can effect paradigm shifts in business philosophies. Facilitation of experimentation by managers (March, 1988) can lead to the recognition of new goals and the means to achieve these goals, new ways of assembling responses to stimuli (Kelley, 1955), and occurs through the use of heuristics, skill development, and insights (Fiol & Lyles, 1985). These learning processes result in major reorientations that involve changed norms, values, or world views (Argyris & Schön, 1978; Bateson, 1972). The desired consequence of higher-order learning is not a particular behavioural outcome, but the development of new frames of reference

(Shrivastava & Mitroff, 1982), as is important when dealing with gestalt shifts and uncertain outcomes involved in incorporating environmental concerns into decision-making processes.

Contrary to discussions in the management literature that only performance below aspirations will trigger processes of higher-order learning (Cyert & March, 1963; Lant & Mezias, 1990; Milliken & Lant, 1991), it is argued that fundamental shifts in philosophy that accompany the need to incorporate environmental concerns into strategic decision processes, can create the experiential base of activities that triggers the processes of higher-order learning within organisations. A fundamental change in organisational thinking is needed to accommodate the concept that the organization itself is an integral part of the earth's ecology. This involves a shift to thinking in terms of closed systems and circular flows instead of as linear processing systems, organisational outputs are recycled back as inputs via societal consumption patterns, organisational waste streams are eliminated or recaptured as inputs, renewable energy sources are used, and (ultimately, in an ideal situation) the organisation's processes are integrated with the ecological processes of this planet.

Such a fundamental change in organisational thinking through the strategic integration of environmental responsibility has the potential for bringing about an internal-external revolution in business. Environmentally-driven external innovation has the potential of not only providing opportunities for product differentiation and cost-reduction (Porter, 1980), but can spark internal building of competencies and invisible assets (Itami, 1987). While environmental change provides an opportunity for a firm to be the first mover, the likelihood of a firm benefiting in a sustained manner from the first mover status will depend upon these internal innovation processes. Further,

in an era when the only constant that we know is change, business organisations and their employees need anchors in the form of intrinsic values that do not change with changing environments and competitive strategies. Environmental responsiveness strategies have the potential of generating these shared intrinsic values which can be melded into strong organisational cultures by organizational leadership. Cohesive corporate cultures that share a positive outlook about a firm's societal mission can be hypothesised to result in higher levels of employee satisfaction and motivation - strengthening processes of internal innovation.

The study found that proactive and interactive corporate environmental responsiveness strategies were associated with the emergence of firm-specific organizational capabilities. These capabilities are argued to be the outcomes of processes of organizational learning and innovation, which result from fundamental changes in organizational frames of reference as a result of incorporation of environmental concerns into decision-making processes. The following section describes the literature on the resource-based view of the firm that discusses the importance of firm-specific organizational capabilities as a source of competitive advantage.

2.4. The Resource-based view of the firm in strategic management

This study attempts to measure unique knowledge-based organizational capabilities that are the outcomes of the organizational learning processes discussed above. These capabilities may be sources of competitive advantage, according to the resource-based view of the firm. This section reviews the literature in the resource-based view of the firm that links the emergence of unique firm-specific organizational capabilities to product-market position of competitive advantage.

The resource-based view of the firm emphasises that sustained competitive advantage lies in firm-specific assets that are rare, inimitable, non-substitutable, and not tradable in factor markets (Barney, 1986, 1991). These assets create "isolating mechanisms" which Rumelt (1984) describes as barriers to entry and mobility that insulate a firm from imitation by competitors. These isolating mechanisms may be a result of "causal ambiguity" (Lippman & Rumelt, 1982), which describes the inability of competitors to identify the competencies or skills contributing to a competing firm's superior performance. This is similar to Polanyi's (1983) concept of tacit knowledge - knowledge which cannot be formalised, translated, or transferred outside the organization. The tacit knowledge is unique to the firm, and is present as an accumulation of its unique experience. This tacit knowledge has little, or a lower value, if separated from the unique setting of the firm in which it has been accumulated.

Organisational capabilities are not embedded in any single person, but in the links across diverse individual capabilities (Nelson & Winter, 1982). Nonaka (1994) argues that knowledge creation within organisations depends upon the critical abilities of organisations in mobilising tacit knowledge held by individuals and provide a "forum" for a "spiral of knowledge" creation through socialisation, combination, externalisation, and internalisation of information flows.

First mover advantages exist in accumulating the organisational intellectual capital, or tacit knowledge, in respect of environmental practices. Technological advances can be imitated or substituted by better technology. However, these assets are based on accumulation of collective organisational experiences in handling environmental issues, and are more in the nature of tacit knowledge (Polanyi, 1983) and invisible assets (Itami, 1987) that are difficult to identify by

competitors ("causal ambiguity" - Lippman & Rumelt, 1982), and hence not easy to imitate. This knowledge is also time-dependent, and cannot be imitated or acquired without the actual performance of certain routines and activities collectively within an organization over a period of time (Dierickx & Cool, 1989). Often this knowledge is effective only in conjunction with the other assets and organisational variables unique to a firm, and cannot be transplanted effectively to another firm.

Research into organisational paths that lead to the development of these unique firm-specific resources and capabilities is limited. As discussed in the preceding section, organisational learning and internal innovation processes sparked by environmental response strategies impacts upon organisational performance by leading to the building-up of unique resources and assets such as corporate reputation; ability to build positive problem-solving relationships with a wide variety of stakeholders; positive cohesive cultures; pride in the job and loyalty to the company; ability to innovate internally in technology, production processes, products, and management practices, etc.

These capabilities are in the nature of accumulated assets. Dierickx and Cool (1989), have distinguished between asset accumulations and asset flows that lead to such accumulations and have explained the features of asset accumulations that make these assets firm-specific and inimitable. A discussion of these factors is framed in context of corporate environmental responsiveness strategies below.

(a) Firm-specific assets: Excess profits are competed away unless firms invest in stocks of firm-specific assets that are also unique. Knowledge created in the process of learning to

incorporate environmental concerns into the decision-making process is unique, since there are no tested formulae or recipes. Firms are learning about the business-natural environment interface, and each is developing unique insights in this area depending upon its mix of unique experiences and sequence of activities and paths undertaken. This knowledge is a firm-specific asset that can not be acquired in strategic factor markets and needs to be accumulated internally (Barney, 1986). Some of this knowledge may not remain firm-specific forever, but the innovations and cost reductions sparked by environmental response provide the firm with a time cushion to enable it to build up additional strengths and resources to compete effectively in the longer term. The contributions environmental responsiveness makes to corporate reputation, cultural cohesiveness, and development of shared ideologies of employees, may be unique and firm-specific and may provide sustained competitive benefits for a longer time period.

(b) Time compression diseconomies: This means that maintaining a given rate of spending on resources over a particular time interval to build up capabilities for managing the business-natural environment interface produces a larger increment of stock of accumulated resources and capabilities, than maintaining twice this rate of resource spending over half the time interval (Dierickx & Cool, 1989). This is where the value of early mover advantages lies. These capabilities represent cumulative and collective learning by the members of the organization over time. In a business situation where firms do not know the real impact of their operations on the natural environment and the exact consequences of actions undertaken to incorporate environmental concerns into strategic processes, these capabilities have to be cultivated through investments that require substitution of short-term earnings for long-term learning and benefits.

(c) Asset mass efficiencies: Adding increments to an existing stock is facilitated by possessing high initial levels of that asset stock (Dierickx & Cool, 1989). A company that already has a well established base of innovations and capabilities for incorporating environmental protection into their strategy process, has already created a fund of experience and skills that is necessary for a momentum of second-order learning (Lant & Mezias, 1992). Momentum created by such accumulated stocks of capabilities and collective knowledge are difficult to catch up with by companies starting from initial levels. There may exist a critical mass of knowledge accumulation, beyond which higher-level learning begins, and sparks meaningful knowledge-creation and innovation. This critical mass may take a considerable period of hands-on experience and activities to reach. Thus, historical success translates into favourable initial asset stock positions which in turn facilitate further asset accumulation.

(d) Interconnectedness of asset stocks: Accumulation of stocks of certain assets is dependent upon the accumulated stocks of other assets (Dierickx & Cool, 1989) that the firm may have built up over a long period of time. These may be a reliable service network, zero defect products/services, a record of social responsibility and community development, organisational learning in reducing environmental impact of a company's operations. To illustrate, technological improvements in products are dependent on feedback from customers, which in turn depends on the existence of an extensive service network. Another instance is when trust-based relationships with environmental groups and local communities bring environmental problems into prominence and trigger appropriate responses.

(e) Preventive maintenance against asset erosion: Assets must be maintained by building and maintaining their stocks, and constantly improving their quality through innovation. Thus, an organization cannot adopt a superficial corporate environmental responsiveness strategy by selling "green" products, but must fundamentally change its philosophy toward the business-natural environment interface and change business practices to maintain these assets.

2.4.1. Measuring organisational capabilities: The research study attempts to link interactive corporate environmental responsiveness strategies with the emergence of organizational capabilities. The research design used is limited in tracing organizational higher-order learning processes and thus attempts to identify some of the outcomes of these learning processes - organizational capabilities. Capabilities are defined as complex bundles of skills and collective learning, exercised through organizational processes, that ensure superior coordination of functional activities (Day, 1994). Thus, capabilities are the coordinating mechanisms that enable the most efficient and competitive use of a firm's assets - tangible or invisible (Itami, 1987). New capabilities can be developed in periods of greater turbulence (Barney, 1991; Wernerfelt, 1984) and organizational change when higher order organizational learning processes are triggered.

Capabilities are exercised through organizational processes, which depend upon a series of activities carried out by the business. The organizational processes and some of the capabilities important for the oil industry will vary from that of other industries to the extent that the chain of business activities differs across industries. Each company may develop a different set of capabilities even as a result of similar environmental strategies, depending upon its core activity concentration, unique history, competitive context, past commitments, and future strategies.

Mapping of these activities and identification of linkages between the activities in an organization's activity value-chain can point towards capabilities in the form of: (a) collective knowledge resulting from experiences of employees in dealing with the business-natural environment interface, which can be applied across functions and levels within the organization; (b) superior organizational systems and routines that link various activities that have resulted from the process of proactive environmental responsiveness, and also enable the effective utilization of the knowledge that is generated from experience; (c) the organizational culture, reflected in shared values and norms in respect of the natural environment. These values and norms are guiding philosophies that provide frameworks of action to employees across various activities and levels. These norms and values are not only affected by the collective knowledge and experience that increases managerial exposure to natural environment issues, but also, in turn, influence the knowledge the employees seek to acquire from business activities and experiences in dealing with the natural environment.

A detailed mapping of linked capabilities across organizational activities and functions would require a qualitative study and would probably be limited to a handful of firms. This research study supplements limited case study data with survey data to identify links between corporate environmental responsiveness strategies and organizational capabilities.

2.5. Summary. This chapter draws upon the literature in the areas of corporate social and environmental responsiveness and ecology to develop a continuum of corporate environmental philosophies. This continuum ranges from the treatment of environmental degradation as an externality outside the purview of organizational action to a fundamental rethinking about organizational design and role of the firm on the business-natural environment interface. It is argued that at higher ends of the

continuum of environmental philosophy, decision frameworks change and organizations begin to question conventional wisdom. This triggers higher-order learning and internal innovation processes. Since these processes cannot be measured by the research design adopted for this study, the research concentrates on measuring some of the outcomes of these learning processes. These outcomes are in the form of knowledge-based unique firm-specific organizational capabilities. The literature in the resource-based view of the firm is discussed to highlight how these organizational capabilities can impact positively upon firm performance by adding to competitive advantage.

The literature in corporate environmental responsiveness strategies needs theoretical development and empirical research to explain and predict organizational actions and impact on performance. Consequently, a theory-building study from the exploratory perspective was undertaken in the Canadian oil and gas industry to supplement literature in this area. The theoretical framework developed based on this study was then tested through a questionnaire-based survey in the North American oil and gas industry. The next chapter discusses the research method used for the exploratory theory-building phases of the research.

CHAPTER 3 - RESEARCH METHOD - THEORY DEVELOPMENT THROUGH EXPLORATORY STUDY

This chapter describes the first phase of the research which involved exploratory theory-building study in the Canadian oil and gas industry.

3.1. The research setting. Most of the research in corporate environmental responsiveness has been cross-industry (Shrivastava, 1992; Vredenburg & Westley, 1993). Logsdon's (1985) study of the U.S. oil industry categorised organizational responses but did not discuss organizational variables impacting upon these responses. Throop, Starik, and Rands's (1993) study of the North American utility industry is a conceptual exploration of organizational responses within the frameworks of laws of thermodynamics and the concept of carrying capacity. Therefore it was decided to restrict this study to a single industry in order to control for as many external influences as possible.

The oil and gas industry was chosen as a research setting because it uses non renewable resources as inputs, and its products are a major cause of air pollution. The industry is under pressure from society due to its negative impact on the natural environment. Environmental regulations have been becoming increasingly stringent in both Canada and the U.S.

The exploratory study was carried out within the Canadian oil and gas industry. Most of the Canadian oil and gas industry is concentrated within Alberta with head offices in Calgary. This provided easier and repeated access to company executives for interviews. Location within Alberta also provided easier access to sources for data verification and triangulation. These sources included regulators, environmental groups, and the industry association. This

geographical concentration admittedly limits the diversity of organizational responses that may emerge within a more widely dispersed industry. However, the U.S. oil and gas industry also tends to be geographically concentrated in states such as Texas, Colorado, Louisiana, and Oklahoma. The trade-off involved here is between limiting of external influences and losing a diversity of perspectives.

3.2. Research method. Due to inadequate theoretical development of frameworks that inform and explain corporate environmental responsiveness strategies, a discovery oriented approach was followed. This approach adopted a comparative case study method from the grounded perspective. The grounded perspective is adopted where inquiry is directed at a social phenomenon whose dimensions and influences are unclear and insufficiently discussed in literature (Glaser & Strauss, 1967). This approach is also adopted when it is uncertain which of the existing theoretical perspectives is likely to inform an explanation and prediction of a phenomenon. Extant literature has not discussed organizational influences on corporate environmental responsiveness strategies. It is possible that theoretical frameworks from organization theory, strategic issue diagnosis, or corporate social responsiveness may inform this phenomenon. However, due to the unique systemic and holistic nature of the impact of the natural environment on business, it was uncertain which of these perspectives applied.

The comparative case study approach to theory-development (Eisenhardt, 1989; Yin, 1989) was undertaken from a grounded perspective. These comparative case studies which control for external influences, enable the identification of theoretical insights (Yin, 1989).

3.3. Sampling. Theoretical sampling (Glaser & Strauss, 1967) methods were used. While the first firm included in the case study was selected for its record of proactive environmental actions, subsequent firms were selected in order to account for theoretically important criteria such as size and range of activities.

Firms in the oil and gas industry are classified as "majors", "seniors", "intermediates", and "juniors" based on their total assets and sales revenues. The sample for the exploratory study included two "majors", two "seniors", two "intermediates", and a "junior" firm. The implicit assumption driving the use of the size criterion was that firms with greater resources may have greater organizational slack to adopt voluntary strategies of environmental responsiveness. The second criterion was the range of a firm's activities. The assumption behind this theoretical criterion was that firms forced to respond to a wider range of external stakeholders, due to involvement in a wide range of activities, may adopt different environmental strategies.

The decision to stop data collection with seven firms was taken due the fact that further interviews were not revealing any new significant themes that informed the phenomenon under study, indicating theoretical saturation according to Glaser & Strauss (1967). However, this method suffers from the limitation that even though several useful insights emerge to substantively explain the phenomenon under study, the possibility always exists that further data collection may yield some fresh theoretical insights. The objective of this study was exploratory in nature to understand broad aspects of an emerging phenomenon - corporate environmental responsiveness strategies. Hence, the grounded approach was considered appropriate.

The seven companies included in the study (with names disguised at the specific request of some of the companies) were as below:

(i) Buffalo Oil - Senior company with annual sales revenues of approximately $1 bn. and integrated activities. This company's environmental strategies were classified as interactive.

(ii) Sioux Oil - Intermediate company with annual sales revenues of approximately $ 0.5 bn. and downstream activities. This company's environmental strategies were classified as proactive.

(iii) National Petroleum - Major company with annual sales revenues of approximately $ 6 bn. and integrated activities. This company's environmental strategies were classified as reactive.

(iv) Royal Petroleum - Major company with annual sales revenues of approximately $10 bn. and integrated activities. This company's environmental strategies were classified as reactive.

(v) U.S. Oil - Senior company with annual sales revenues of approximately $ 4 bn. and upstream activities. This company's environmental strategies were classified as reactive.

(vi) Farmers Oil - Intermediate company with annual sales revenues of approximately $ 0.3 bn. and upstream activities. This company's environmental strategies were classified as reactive.

(vii) Northern Oil - Junior company with annual sales revenues of approximately $ 0.1 bn. and upstream activities. This company's environmental strategies were classified as reactive.

3.4. Data collection and analysis. The data collection methods were in keeping with an exploratory discovery-oriented approach. Unstructured interviews totaling 36 hours were conducted with seven senior executives and twelve middle-level managers in the seven companies studied. Interviews were taped and subsequently transcribed except where respondents objected, in which case detailed notes of interviews were taken and subsequently verified for accuracy by

the interviewees. One manager refused to allow his responses to be used in the study. In the smaller companies, an average of two managers (one senior executive and one middle level manager) were interviewed, while in the larger companies, an average of four managers (including at least one senior executive) were interviewed.

Interviews were unstructured and open-ended. The first interview was usually conducted with the Chief Executive Officer (or an executive designated by the C.E.O.). The initial questions were very open-ended and usually were, "Does the natural environment mean anything to your company?" "In what way does the natural environment impact your company?" These first interviews were followed-up by interviews with other key informants within the organization. These included the environment, health and safety manager (hereafter, EHS Manager), a production or resource management manager, and a marketing or development manager. In the smaller companies more than one function was handled by a single manager and hence fewer managers were interviewed.

Data analysis involved the constant comparison method (Glaser & Strauss, 1967). Each interview was transcribed and visual scans made to detect emerging themes. An interview summary form (Miles & Huberman, 1984) was prepared after each interview to highlight emergent themes, variables, and other issues of interest which would be followed up at subsequent interviews. Each interview was coded in accordance with these emerging themes and sentences relating to each theme were entered in separate computer files. The number of references and intensity of support for each theme were identified within each file before deciding

which themes to retain and which to drop as theoretically less significant. Connections between the significant themes were investigated in the data.

At the same time, literature review was undertaken to obtain a theoretical perspective on these emerging themes. If a theme did not seem to be significant and important at the completion of data collection, it was dropped. To that extent, the data analysis was biased by the researcher's perspectives about which themes seemed theoretically important.

Archival data in the form of corporate public documents such as annual reports, environmental assessment reports, company newsletters, company policy declarations, and newspaper reports on the environmental actions and strategies of the companies for the period 1980-1995, were also analyzed to verify interview data. In addition, interviews with officials from the Alberta Energy and Resources Conservation Board (the regulatory enforcement body), with officers of the Canadian Association of Petroleum Producers (the industry association), and with representatives of Alberta Greens, and Greenpeace (two environmental interest groups who have been scrutinizing the practices of the oil and gas industry) were also conducted.

The next chapter briefly describes the evolution of regulatory frameworks in the North American oil and gas industry, the research setting for this study.

CHAPTER 4 - THE EVOLUTION OF REGULATORY FRAMEWORKS IN THE NORTH AMERICAN OIL AND GAS INDUSTRY

This chapter discusses the structure of the oil and gas industry in North America, the evolution of the environmental regulatory frameworks, and the impact of the industry on the natural environment. The intention of this chapter is to provide a backdrop and appreciation of the underlying motivations that influenced the evolution of environmental regulation of the oil and gas industry in North America.

The oil and gas industry belongs to a group of industries, including the chemicals, forestry, and other extractive industries, that is viewed by many in society as damaging and harmful to the natural environment. This is not only due to the wastes and pollution generated by the industry and its products, but also due to the non-renewable and non-replenishable nature of its extracted raw material base.

4.1. Petroleum and natural gas

Petroleum is a mixture of naturally occurring hydrocarbons that can exist in a solid, liquid or gaseous state, depending upon the temperature and pressure to which it is subjected. Almost all petroleum is produced in liquid or gaseous form, and these constituents are referred to as either crude oil or natural gas, depending upon the hydrocarbon mixture (Amyx et al., 1960). Whether the substance is crude oil or natural gas is largely determined by the number of carbon atoms in its molecular structure. For both oil and gas, the greater the number of carbon atoms the higher the specific gravity. Crude oil might also contain impurities such as sulphur and minor amounts of certain metals that affect later processing at the refinery stage. Natural gas is found with oil, and

frequently on its own. Within the reservoir, gas might exist in solution with crude oil, but upon being produced to normal atmospheric conditions, it separates in the gaseous form.

Natural gas is increasingly important as a fuel in its own right - it is the cleanest burning hydrocarbon with very little carbon dioxide emissions. However, it can also be of substantial importance in the production of oil. Canadian exports of natural gas to the U.S. are based upon a rising demand for emission reduction and the increasing number of co-generation plants where heat and electricity are generated simultaneously. This demand is increasing at a rapid rate as pressures from the Environmental Protection Agency (EPA) in the U.S., state environmental regulations, consumer and environmental groups are forcing electric utilities to switch to natural gas. During 1993-94, this upsurge in demand has raised natural gas prices and prompted moves by oil companies in Alberta to explore and extract free-standing reserves (not occurring with oil) of natural gas. Severe conflicts have built up between economic interests urging immediate exploitation of reserves to meet this upsurge in U.S. demand, and the environmental groups urging responsible and detailed environmental impact assessment that many companies are unwilling to undertake. This conflict is framed within a high unemployment rate and sluggish economic growth in Canada during 1990-1994. These pressures may create potentials for further escalation of environmental regulations, and conflicts between advocates of environmental protection and of economic development.

4.2. The industry structure

The most striking characteristic of the petroleum industry in North America is its domination by a handful of corporate giants that include some of the world's most profitable

corporations. These companies known as the 'majors' integrate all four of the basic oil and gas industry activities - producing (encompassing exploration), transporting, refining, and retailing. The integrated corporation usually has co-ordinated control over every stage of the oil flow and a potential profit centre in each of the four sectors. The extraordinary profitability power of these 'majors' stems from entry barriers. In contrast to the cost of entering the production sector, the capital cost of acquiring a presence in the refining and pipeline areas is extremely high.

The second characteristic of the industry, unique to North America due to historical reasons, is the presence of a very large number of "independent" producers most of whom have no capacity to refine and transport. The independents are a sufficiently diverse group to make generalisation difficult. Some are engaged in as many as three to four of the industry's main functions and have an economic perspective that differs little from that of majors. However, most of these companies are small whose interests are concentrated in the production sector, with activities limited to a few fields or even a single "pool". Even though, as individual companies their economic power is limited, their large number and their situation have had a great effect upon the formulation of regulatory policy. This unique and critical feature of the oil industry in North America affects environmental regulation. Unlike most other parts of the world, the North American oil and gas industry cannot be regulated by monitoring a state-owned monopoly or a handful of large oil companies. The presence of large numbers of small-sized independent producers has contributed to considerable disregard for responsible environmental practices (Breen, 1993). Most of the smaller companies lack the resources for undertaking thorough

environmental assessments and internal resource commitments necessary to become environmentally responsible.

The North American oil and gas industry is layered into a hierarchy based on an unclear mix of sales revenues, assets, and oil and gas reserves. This hierarchy is dominated at the apex by 'majors' with large scale integrated operations in upstream exploration and extraction, refining and processing, and product wholesaling and retailing. Most of the 'majors' are multinational companies, often with uniform environmental action guidelines in developed countries, and have annual sales revenues of several billion dollars each. The next layer consists of 'seniors' with annual sales revenues ranging between $500 million to around $1 billion. Ranked lower down are the 'intermediates' with annual sales revenues ranging from $100 million to $500 million. At the bottom of the pyramid are hundreds of smaller companies known as the 'juniors'. The criteria for classifying companies into these categories varies depending upon the viewpoint of the firm making the classification. While industry analysts and watchers recognise who the 'majors' and 'seniors' are, the line between the 'intermediates' and 'juniors' is blurred, depending upon whether the classification is made on the basis of owned oil and gas reserves, total assets, annual sales revenues, or the number of employees.

While many of the larger companies on both sides of the U.S.-Canada border are subsidiaries or affiliates of the same companies, the smaller independents are usually different in both countries. According to the managers interviewed, there is a continuous interchange of personnel and management practices between the centres of the Canadian oil industry in Alberta and the major centres of the U.S. industry in Texas, Oklahoma, Colorado, and Louisiana.

The difference between the U.S. and Canadian industries lies in the unique ways these have evolved their environmental practices within different regulatory and societal systems. The Canadian environmental policy places greater emphasis on consensus-building and self-regulation, while the policy in the major U.S. states, while differing between states, largely emphasises regulatory sanctions. The Canadian society seems to exhibit a higher awareness and concern for environmental damage (Angus Reid, 1988-1994). At the same time, the industry on both sides of the border seems to abhor excessive government regulation, considering itself capable of enlightened self-regulation (Pasquero, 1991).

4.3. The evolution of regulatory frameworks

Regulatory approaches are not put into place as pure theoretical constructs. They are the product of conflicting historical forces. Canadian policies, at least in the last half-century, have been based on the U.S. experience (Breen, 1993). However, over the last decade, the Canadian environmental public policy process has tended to move more toward consensus-building through a network of roundtables and reliance on self-compliance by industry through creation of awareness and enlightened self-interest (Pasquero, 1991). Environmental policy in the U.S. oil producing states has increasingly moved toward detailed regulations and negative sanctions. This may be a reflection of the realities of the U.S. economy which is ten times the size of Canada's. However, this difference is often popularly ascribed to differences between Canadian and U.S. cultures. It is not clear whether the Canadian approach has been any more successful in reducing the negative environmental impacts of business.

The philosophy that dominated regulatory frameworks early in this century was an economic concept of conservation of resources which required following the principles of maximum efficiency accompanied by equity or justice in resource distribution (Breen, 1993). Similar to the current paradigm of environmental protection, this concept required trade-offs between short-term development and long-term objectives, both public and private. Oil is migratory and it was in the interests of each well operator to extract as much as possible as fast as possible before the neighbours did the same. This motivated producers in the early stages of oil development to extract as much oil as possible, and store it in open earth pits. This was accepted by the U.S. legal system under the "rule of capture" (Breen, 1993). Without proper storage this oil leached into the groundwater, flared up into fires, and the consequent market gluts led to low prices. The regulatory frameworks were set up first in U.S. states such as Ohio and Oklahoma in response to increasing public concern for the wasteful exploitation rates of oil and to curb exploding law and order problems as people operated under the "rule of capture". Oil reserves are production-rate sensitive and a too fast depletion reduces the ultimate recovery of oil (Breen, 1993). This is where the concept of equity was important, to ensure that formulae (known as "correlative" or "proration") were created to allow an equitable sharing of common oil pools by different independent well operators.

During the 19th century, oil, just like other natural resources, seemed unlimited. Around the turn of the century, the frontier of unlimited resources seemed to be vanishing as society became concerned about preservation of resources for the future (Breen, 1993). The need for efficient production to eliminate waste emerged more slowly. It was not until the importance of

exhaustible and non-renewable mineral resources to modern communities became more apparent that the idea of promoting economically efficient methods to ensure the maximum ultimate recovery of the resource was seen as appropriate. This was based on the economic definition of "conservation", which implied the maximising the present value of a resource - in other words, getting the most petroleum in the present for the least investment. The economic definition of conservation does not denote the concern for future supply that agitated the early conservationists. Thus, the emphasis shifted from a concern for the future generations to considerations of economic efficiency. The concerns in the 1990s are turning back toward preservation of oil reserves for future generations. There is also a widespread concern for the seemingly irreversible pollution effects caused by burning fossil fuels.

The first phase of exploration and production of oil from the 19th century up to the 1930s was dominated by market forces. Free enterprise and frontier resource development values dominated the industry. The markets were indifferent to natural gas and it was flared, resulting in colossal waste. The first wave of regulations for conservation were entirely concerned with external damage and pollution caused by oil production - oil leaks, contamination of groundwater by salt runoffs, interchange of fluids with ground water, surface waste and pollution, the need to adequately and safely plug abandoned wells, safe storage instead of in open earth pits where the oil leached into groundwater, reduction of fire hazards, laws to prevent the wasteful flaming of natural gas, and prevention of wasteful burning of natural gas all day in flambeau lights. The first wave of regulations were welcomed by the oil industry due to economic considerations. Restrictions on the right to drill and regulation of extraction rates led to price stability that

benefited all producers. Correlative or proration formulae that regulated the spacing of wells (reducing them from as much as 27 wells per acre to one well for 40 acres of land) removed the anxiety to extract oil before neighbours "captured" reserves from common pools (Breen, 1993).

The second phase marked a period of transition from the pioneering phase to the contemporary industry phase. Following regulatory practices adopted by individual states in the U.S. such as Oklahoma and Ohio, the Alberta Provincial Natural Gas Conservation Board (the precursor to the Energy Resources Conservation Board - ERCB) was formed in 1938. The objective was to create a regulatory authority for everyday operations of the oil industry in Alberta. At this point of time, the Alberta oil industry was restricted to one major oil pool, the Turner Valley oilfield in Alberta. The principle of conservation having gained acceptance, this phase required the practical application of the principle in the field. This phase of regulation was dominated by technical considerations, during which the Board reshaped ideas about acceptable production practice. During the first and second phases, the oil industry was dominated by entrepreneurial independent companies.

The discovery of the [illegible]ic oilfield in 1947 dramatically altered the scale of production. Alberta became a strategically important area for oil reserves from the North American point of view. The 'majors' entered Alberta bringing in influence from the political forces in the U.S. Due to the presence of international financial capital and exports to the U.S., regulations and public policy in this phase were influenced more by Washington D.C. than by Ottawa (Breen, 1993). The ERCB formulated a fresh set of objectives in 1950 in accordance with regulatory frameworks of states in the U.S.: (a) efficient use of natural resources, (b) development of these resources to

protect the interests of the future generations, (c) elimination of all economically avoidable waste, (d) protection of property rights, (e) maintaining a healthy domestic producing industry to sustain the local or regional economy, and (f) national security (this last objective was given greater importance in the U.S.)

During the next phase, market forces gained domination again as chronic oversupplies constantly flooded the market. Development within the province and the search for expanded markets led to the creation of the National Energy Board in Ottawa, and Canada's first national oil policy in 1961. The central feature of this oil policy was the allocation of markets west of the Ottawa valley to Western Canadian producers.

The ERCB has disproportionate influence in the Canadian business sector. Depending upon ranking criteria, six to eight of the Canada's 20 largest corporations are oil companies (*The Financial Post*, 1986). The operating environment and the financial well-being of these large and powerful corporations are affected directly by decisions emanating from the ERCB head office in Calgary. According to Breen (1993), the ERCB was formed in an uncritical framework contrary to the regulatory frameworks in the U.S. oil producing states that tended to foster the interests of large oil companies. It has been noted that not long after creation, a typical regulatory agency is inevitably co-opted by the industry it was designed to regulate (Bernstein, 1955). Professional regulators soon come to see and interpret the world through eyes similar to those of the regulated industry. Differences come to be more of detail than substance (MacAvoy, 1970). However, according to Breen (1993), the ERCB, confronted by individuals and an industry often

preoccupied by short-term perspectives emanating from constant focus on the yearly balance sheet, managed to promote long-range conservation policies.

Environmental considerations during the 1960s and the 1970s showed a greater concern for clean-up of solid waste and contamination and the reduction of highly visible pollution. However, concerns for habitat and species protection as well as the need for sustainable business practices are a relatively recent phenomenon in the Canadian oil and gas industry (though exceptions were found during the research study). The major federal environmental legislation was passed in 1985. In 1986 there were eight different provincial laws in Alberta regulating environmental assessment and protection. These laws were disjointed, uncoordinated, and difficult to enforce, and the industry adopted a serious posture towards environmental issues only after 1988, when the ERCB established strict environmental impact assessment guidelines. In 1993 all eight provincial laws were consolidated into one Alberta Environmental Protection and Enhancement Act that made managers of Canadian firms personally liable for environmental accidents. This catalysed increasing environmental action by the industry. Clearly, therefore, firms that were undertaking voluntary and proactive environmental actions before 1993 exhibited greater environmental responsibility and responsiveness.

In the U.S., the 1986 amendments to the Superfund legislation (The Superfund Reauthorization and Amendment Act) has been the dominant sanction driving companies towards cleanup of wastes and pollution generated by them in the past. These regulations have made companies painfully aware of the risks of inappropriate waste disposal. However, regulatory frameworks in Canada and the U.S. do not provide any positive incentives to industry to

voluntarily and proactively go beyond regulated actions. Firms have had to find their own motivations for, and benefits consequent to, proactive actions.

4.4. Pressures from other stakeholders

Additional pressures for proactive voluntary action have come from an increased public awareness about environmental issues and increasing media focus on spills, leakages and accidents. The negative publicity and huge liability payments consequent to the *Exxon Valdez* oil spill in Alaska has forced the oil and gas industry to respond to environmental concerns in terms of reducing the risk of such accidents. The high level of social concern about the long-term sustainability of the oil and gas industry prompted a Canadian national initiative in 1988, popularly known as the "Energy Options" study (Kiereans, 1988). This was a forum in which the future of Canadian energy options was debated by representatives of the government, oil and gas industry, energy producing utilities, environmental groups, consulting firms, and groups of concerned citizens. The Energy Options study recognised the growing interdependence of the natural environment and the economy, and of the costs imposed by the neglect of this relationship. It was proposed that Canada should be a world leader in establishing the principle of "sustainable development", with the energy sector playing a lead role. Full-cost pricing should be established to ensure that environmental costs are covered in all forms of energy. It called for an integration of environmental planning and management into energy decision-making at the policy level, project level, and global level (Kierans, 1988). It is debatable whether any real changes have occurred in response to the study. However, the oil industry executives acknowledge that

awareness about the impact of the industry on the natural environment increased as a result of this national debate.

Meanwhile, the industry faces increasing pressure from environmental groups (Greenpeace has vowed to shut down the industry (*Calgary Herald*, 1993)), from local communities, citizen groups, from regulators, and from consumers. Natural gas is presented by the oil and gas industry as a transition fuel between petroleum and renewable sources of energy. However, environmental groups have been vociferously opposing moves by the Canadian natural gas industry to develop and extract additional free-standing natural gas reserves for exports to the U.S. (Nelson, 1994).

Petroleum products are subject to intense competition and face buyers' markets. Oil companies are struggling to attract consumers in a declining market. In such a competitive market, companies may lack motivations for proactive environmental actions unless they perceive a lack of conflict between environmental response and economic performance objectives. On the other hand, environmental responsiveness presents opportunities for some companies to create intangible features or attributes for an essentially undifferentiated product. The major external forces that have influenced the oil industry's response on environmental issues are presented in Table 1.

4.5. Impact of the oil and gas industry on the natural environment

According to industry executives and environmental groups, the natural environment impacts on various aspects of their firms' operations in the following ways:

(i) Development and extraction activity affects natural habitats. The challenge is to leave as small a "footprint" as possible using innovative remote sensing, exploration, and horizontal drilling

Table 1: External events influencing environmental responsiveness in the Canadian oil and gas industry

SOCIAL	1960s 1970 1985-88 1988-93	Rise of ecological awareness. First U.S. environmental teach-in Increased awareness of ozone depletion and global warming. Consumer polls in developed countries reveal growing social concern for environmental degradation.
POLITICAL	1988	The Canadian Energy Options Initiative.
LEGAL	1988 1993	Alberta E.R.C.B. environmental regulations made stringent. Regulations make managers personally liable for environmental accidents.
ENVIRONMENTAL DISASTERS AND GROUPS	1989 1988-93	The Exxon Valdez oil spill & several major tanker oil spills across the world. Increasing pressure from environmental groups for greater environmental responsibility.
ISOMORPHIC	1985-88 1989	Canadian Chemical Producers Association establishes a highly visible "Responsible Care" program. Montreal Protocol on CFC reduction -proactive initiatives by industry on environmental issues.

techniques and technology. Environmental protection may also involve refraining from using modern technology in some cases - to illustrate, some firms may decide to send geophysicists on horseback with sensing equipment to scan geological formations.

(ii) Abandoned wells: after wells are abandoned, proper casing techniques, cleanup and restoration of habitat to as close to a natural state as possible, including soil cleanup. According to managers interviewed during the exploratory study, despite investment of resources to develop soil cleanup technology, it is still virtually impossible to fully restore the organic properties of the soil.

(iii) Pipelines: ensuring minimum effect on habitats and animal migrations. Controlling and preventing spills and leakages.

(iv) Refineries and processing facilities: controlling and reducing polluting air emissions, and water and solid wastes. Preventing fugitive emissions in the form of leaks and spills. Disposal of solid wastes. Minimising energy and water use.

(v) Transportation of petroleum products by road/rail/tanker: prevention of spills and leaks.

(vi) Retail operations: prevention of leaks and spills from underground tanks. Meeting provincial regulations on vapour recovery and minimising ground level ozone build-up problems in areas such as the Lower Fraser Valley, British Columbia.

(vii) Developing and selling products with reduced environmental impact: high oxygenated fuels, grain based fuel blends, recycled engine oils and lubricants. Continually exploring cleaner burning fuels and improved technologies such as natural gas fuel tanks/engines, and renewable energy sources.

The foregoing highlights the impact of the oil and gas industry on the natural environment throughout its operations cycle - from the inputs it consumes to the negative impacts of the products it produces. This discussion about the North American oil and gas industry serves as a backdrop for a discussion, in chapter five, of development of the theoretical framework based upon the exploratory research study conducted in the Canadian oil and gas industry.

CHAPTER 5 - THEORETICAL DEVELOPMENT: IDENTIFICATION OF FACTORS AFFECTING CORPORATE ENVIRONMENTAL RESPONSIVENESS STRATEGIES

This chapter integrates concepts from chapter two which discusses the fundamental literature base that inform this research, the findings emerging from the exploratory case studies, and concepts from literature in other management disciplines that are seen to inform the results of the exploratory study data analysis.

This chapter is divided into five parts. The first part describes the categorization of corporate environmental responsiveness strategies along a continuum emerging from the theory-building case studies. This continuum ranges from reactive to proactive to interactive strategies. Corporate environmental responsiveness strategies is the criterion variable that is sought to be explained by organizational and managerial variables. The second part discusses the role of managerial interpretations of environmental issues as threats or opportunities in influencing corporate environmental responsiveness strategies. The third part discusses the organizational context variables that influence managerial interpretations of environmental issues and hence indirectly influence corporate environmental responsiveness strategies. The fourth part discusses the organizational factors that directly influence corporate environmental responsiveness strategies. The last part of this chapter discusses the influence of different corporate environmental responsiveness strategies on organizational outcomes and performance. This section discusses the link between high scores on the corporate environmental responsiveness strategies construct and the emergence of unique organizational capabilities. Hypotheses that were tested in this research study are developed throughout the text.

5.1. Corporate environmental responsiveness strategies.

An analysis of the interview data and the archival data enabled identification of patterns of organizational actions that were guides to strategies (Mintzberg, 1978, 1994) followed by each of the seven firms in dealing with the business-natural environment interface. The analysis revealed a clear distinction between the environmental strategies of two firms, Buffalo and Sioux on the one hand, and five firms, Royal, National, U.S. Oil, Farmers, and Northern on the other. The former two, starting in the early 1980s, initiated proactive environmental actions that went beyond regulatory requirements and accepted industry practice. The latter five have been lobbying against escalating regulations, complying with the regulations as they evolve, and/or more recently undertaking risk reduction to reduce risk of environmental liabilities.

This distinction between the environmental strategies of these two groups also enabled a comparison of the organizational and leadership contexts that influenced these different strategies. Within this rough-cut dichotomous distinction between the proactive response of two firms and the reactive response of the five firms, lies a wider range of responses. This range of responses is discussed below.

5.2. Corporate environmental responsiveness strategies in the Canadian oil and gas industry.

Corporate environmental philosophy can be viewed on a continuum within the framework of corporate environmental philosophies developed in chapter 2 (section 2.2) - *conformity, economic, conservation,* and *restorative.* At the same time corporate environmental responsiveness can be in the form of *reactive, proactive,* and *interactive* strategies. The possible categories of corporate environmental performance emerging from the dimensions of the four

TABLE 2: Dimensions of corporate environmental responsiveness in the oil and gas industry

	Strategies for environmental responsiveness		
States of environmental consciousness (responsibility)	*Reactive (actions mandated by regulations or by industry practice to reduce liability and risk)*	*Proactive (voluntary actions for environ. protection by changing operations)*	*Interactive (voluntary actions for environmental protection by changing operations and institutional environment)*
Conformity	Avoidance of criminal sanctions; Risk & Liability reduction; Public relations.	None	None
Economic	None	Waste reduction; Energy conservation; Exploiting green product opportunities	None
Conservation	None	Changing processes, materials, products, and operations to reduce resource and energy use.	Working with stakeholders for resource conservation, waste exchange systems, closed-loop material use.
Restorative	None	None	Working with stakeholders for habitat and species protection, global equity, reducing consumption, and scale.

categories of environmental philosophies and the three types of environmental responsiveness strategies, are displayed in Table 2.

While theoretically any combination is possible, it is likely that reactive strategies of environmental responsiveness are accompanied by environmental philosophies that emphasize the neo-classical economics view (or the DSP paradigm). Interactive environmental strategies that treat environmental issues as domain problems to be resolved in collaboration with stakeholders, are likely to be accompanied by conservation/restorative environmental philosophies. Thus the combinations of philosophy and strategy that are likely, and as were revealed in the exploratory study were *reactive - conformity, proactive - economic, interactive - conservation, interactive - restorative.* These are theoretical categories and firms may exhibit some elements of corporate environmental responsiveness strategies and philosophies that fall between two categories.

5.2.1. *Reactive* environmental responsiveness strategies. A salient feature in companies seen to follow reactive corporate environmental responsiveness strategies was a perception of the existence of conflict between environmental and economic performance objectives. Thus, environmental actions were only undertaken if they were mandated by regulations or to reduce economic risk of financial liabilities consequent to environmental accidents.

5.2.1.(a) Risk and Liability Reduction. Royal and U.S. Oil were seen to follow an environmental responsiveness strategy of risk and liability reduction. Managers of both companies were universal in repeatedly emphasizing the importance of risk reduction. According to the EHS manager of Royal:

> "The lynchpin of our environmental strategy is risk reduction. Each firm tries to minimize risk.... obviously, smaller firms cannot invest in risk reduction to the extent that we can."

The Chairman of U.S. Oil made a similar statement:

> "Environmental risk cannot be insured..... we have to undertake this liability ourselves. We have to be very careful about these things, especially after the difficult time we have had with a couple of spills in the last five years."

The theme of risk reduction emerged in each interview with the managers of Royal and U.S. Oil. This theme was also present during interviews with managers of National Petroleum, but National has been classified under a different category due to its unique situation. The environmental strategy of risk reduction is labelled as reactive since the neither the managers of these companies, nor the documents/annual reports of these companies indicated a pattern of environmental actions that were voluntary and not required by regulations or accepted industry practice. Risk reduction as an environmental objective has also been expressed in the annual reports of the two companies.

Thus, for larger reactive oil and gas companies, specially the integrated 'majors', the focus of the environmental strategy is on reduction of risk and liability. Environmental lapses in the form of spills and leakages attract heavy fines and personal liabilities for managers (after the amended regulations that came into effect in 1993). Environmental accidents cannot be insured, and the entire costs of a public liability settlement have to be borne by the firm. Large companies are subject to a high level of public and media scrutiny, and the smallest of spills or leaks receives a large amount of attention and exposure by media and environmental groups. The larger companies are also subject to greater regulatory scrutiny and higher standards of enforcement by regulatory authorities. Fear of regulatory action, possibilities of large liability payments, personal liabilities, and the fear of damage to corporate reputation, has driven these companies to set up

their own stringent guidelines for reducing the risk of environmental accidents, and consequently the possibility of large liability payments. These include procedures to prevent spills/leaks/ accidents, emergency response procedures, and environmental audits.

The companies undertaking aggressive risk and liability reduction view environmental responsiveness as necessary for the prevention of severe financial disruption and a major damage to the corporate image in the event of an environmental accident. Environmental responsiveness is a necessary cost of carrying on business. Investments for pollution and emission control, emergency response procedures, costs of regulatory compliance, etc. are seen as clearly conflicting with economic performance targets. While these companies may sometimes institute their own stringent environmental response procedures, this is in response to accepted industry practice where environmental accidents are no longer underwritten by insurance companies. However, the organizational philosophy is predominantly in line with neo-classical economic view of the firm as a linear function for maximizing of output through the most efficient use of resources.

5.2.1.(b). Avoidance of criminal sanctions. While the larger companies are concerned about their corporate image and potential liability payments consequent to environmental accidents, smaller companies, such as Farmers and Northern, are more concerned about the possibility of prison sentences for senior executives for environmental regulatory infringement. Farmers and Northern admitted to hiring consultants primarily to establish an adequate paper trail to show that regulations are being met and that emergency response procedures are in place. They are unwilling, or unable, to expend resources on a thorough risk and liability assessment and want

to ensure that the minimum regulations are met. While these companies also are unable to obtain insurance against environmental accidents, they do not follow the most stringent industry practices for risk and liability reduction. Their low resources levels outweigh their perceptions of possible financial disruption consequent to the low probability of environmental accidents. These companies also clearly view environmental responsiveness as conflicting with their economic performance. According to the Chief Operating Officer of Farmers:

> "We cannot afford to have a separate environmental department..... I am also the environmental officer although I don't have time to wade through the maze of regulations. My priority is to keep the production going. I'll make no bones about it.... we hire environmental consultants to make sure that our paperwork reflects that the procedures required by law are in place."

Similar sentiments are reflected by the President of Northern:

> "The Bata case indicates that regulators will prosecute company directors for environmental lapses. No job is worth going to prison. We use consultants to make sure that our paperwork is in order. I am not saying that we don't have emergency response procedures in place..... the onus of proof is on us."

These smaller companies, mostly "independents", constitute a high density segment of the oil and gas industry. Consequently, they are less subject to public, media, and regulatory scrutiny. These companies do not view the possibility of damage to corporate reputation and liability payments consequent to an environmental accident as seriously as the larger firms do. Wartick (1992) found that the intensity of media scrutiny was one of the factors impacting upon corporate reputation. For smaller companies, reputation is not as major an issue as it is for larger companies. These companies are clearly reactive since they exhibit both the lowest state of environmental philosophy and also the lowest level of responsiveness. The environmental responsiveness strategy

for these companies is primarily to avoid personal criminal liabilities and penalties for senior executives through minimum compliance and to establish adequate paper trails to indicate that emergency response procedures are in place.

5.2.1.(c). Public relations - a transitory case of responsiveness. National, a 'major' company, is in the process of an ownership change and transition from an inefficient and unprofitable government-owned company to a competitive private company. This company responds to environmental issues through public relations, which involves the articulation of a corporate identity of environmental leadership by its senior managers, accompanied by environmental responsiveness strategies that are reactive and an environmental philosophy that seems to fall within *conformity*. While managers in this company retain old values of social responsiveness and environmental protection that were fostered when the company was government owned, the new ownership and top management emphasises a focus on reversing the losses incurred over the previous decade. Expenses, such as are involved in proactive environmental responsiveness, are perceived as unnecessary and conflicting with economic performance. Some examples of statements made by senior executives and members of the top management team of National:

> "In the past we have led the industry in formulating environmental policies."
> "We have received an award from the United Nations for our initiatives in formulating environmental guidelines for the industry."
> "We see our company as an environmental leader in the petroleum industry."

This can be contrasted with statements made by some middle level executives of National:

> "We have all these environmental policies and documents, yet we are way behind in our practices compared to many other companies."

"I don't think that even members of our top management really believe that we are an environmental leader."
"It is true that we adopted a leadership stance on environmental policies during the mid-80s.... but that has changed after the privatization."

This is considered a transitional stage. It is possible that with the stabilisation of economic performance, the corporate environmental responsiveness strategy of this company may either harden into a reactive-conformity stance, or evolve into a proactive-economic strategy. This will depend upon which of the organizational factors that are seen as impacting upon corporate environmental responsiveness are present. The quotes also indicate that a change of top management can have a substantial impact upon a company's environmental strategies.

5.2.2. *Proactive* strategies of responsiveness. Of the seven firms included in the exploratory study, two firms were found to exhibit non-reactive response patterns. These two companies differ substantially in size of their sales revenues, and their range of operating activities - the first, Buffalo, being an integrated 'senior' company with an emphasis on upstream operations, and the other, Sioux, being primarily a 'senior' downstream company with emphasis on developing and selling less environmentally-damaging products. The former is seen to exhibit *interactive* strategies and elements of both *conservation* and *restorative* consciousness, while the latter is seen as clearly falling within the *proactive-economic* dimension.

The second firm, Sioux, is discussed in this section. Sioux has adopted a leadership position in the development and marketing of less environmentally-damaging fuels. It adopted "the Alternative Energy Company" as its defining corporate mission in 1980. Its proactive actions for environmental protection in the marketplace are not supported either by similar proactive

actions in its manufacturing operations and other activities. For Sioux, environmental protection is a strategic source of market opportunities. It has contributed to air pollution reduction through its ethanol blended fuels, compressed natural gas, methanol, propane, and its research into other less environmentally-damaging fuels. It has also contributed toward raising consumer awareness about air pollution and the benefits of using alternative fuels.

Sioux was the first company to set up a commercial-level used engine oil recycling plant in North America in 1980. Despite considerable consumer indifference and resistance to using recycled engine oil, it persisted with this operation until it made its first profits in 1992 - twelve years after starting operations. Due to increased consumer awareness about environmental protection, and due to support from government agencies, Canadian crown corporations, universities and other educational institutions, this operation is now successful. Other oil companies are also now buying this company's recycled engine oils to blend with their own virgin oils to get Canadian government 'Eco-logo' certification for their products. Sioux also manufactures a range of vegetable-based engine oils. This quote from Sioux's President reflects their proactive stance:

> "Some sceptics accuse us of following these environmental policies superficially to make a quick buck. We started selling ethanol blends in 1980 when the environment was not uppermost in the minds of consumers. Sales of ethanol blends did not take off until the 1990s. Our engine oil recycling operation was in the red for twelve years, but we persisted due to our commitment to reduce environmental impact..... It has been an uphill struggle to make consumers accept our ethanol blends and recycled engine oils."

Sioux does not perceive conflicts between environmental responsiveness and economic objectives. Judging from its record of development expenditure on alternative fuels, it is seen as

having a longer time horizon for evaluating economic success. It has given considerable emphasis to managing relationships with an array of strategically important stakeholders. This has been necessary to get the support of environmental groups and local communities for its products, to get the support of institutional customers for its recycled engine oils, and to get the support of governments and farmers for its conversion of grain into ethanol for blending with petroleum. Environmental responsiveness is seen as contributing to the economic and competitive objectives of the organization. Sioux had the foresight to identify environmental concerns as strategically important issues long before 1988, when a sudden industry-wide awareness about environmental protection took place. Ethanol blends were introduced in 1980, and recycled engine oils in 1981. However, it has not gone beyond environmental responsibility in marketing operations to undertake a thorough environmental assessment in its manufacturing operations and other activities. This may also be due to the fact that Sioux is a marketing company with a very small stake in upstream operations.

5.2.3. *Interactive* environmental responsiveness strategies. The one company exhibiting this strategy, Buffalo Oil, is seen as not only making internal changes in response to environmental protection concerns, but is also seen to treat environmental protection as a domain issue. It interacts with external stakeholder groups such as environmental groups, local communities, and regulators to raise public awareness about environmental problems, pressurise the provincial government to declare ecologically sensitive areas as protected preserves, and advises the government on enhancing environmental regulation. Besides its *interactive* strategies of responsiveness, Buffalo exhibits states of *conservation* environmental consciousness that

emphasise resource conservation through a rethinking of its processes, materials used, and products. Despite the unsustainable nature of the petroleum business, it does exhibit some actions that fall into the *restorative* state of consciousness. It has closed down its drilling activities in ecologically sensitive areas and has lobbied the government to declare these areas as protected provincial preserves. It has also refrained from exploration activities in areas that are found to be ecologically sensitive upon environmental impact assessment.

Buffalo has been an industry leader in its environmental policies since 1980 when it incorporate environmental preservation into its corporate mission. In the early and mid-1980s, when environmental regulations mandated a lower recovery of sulphur dioxide emissions, its new refining and oil upgrader facilities were set up to recover over 99.5% of the sulphur dioxide emissions. Current environmental regulations mandate a 98% recovery. Buffalo undertook a thorough assessment of the environmental impact of its operations in the mid-1980s and disseminated this information to its employees. This created greater awareness about the environmental impact of the company's operations and enabled the creation of an action plan to reduce environmental impact.

Buffalo does not perceive any conflict between environmental responsiveness and economic objectives. It has a longer time horizon for evaluating economic success. In terms of its interactive actions, this company has given considerable emphasis to managing relationships with a wider array of strategically important stakeholders. Environmental responsiveness is considered as contributing to the economic and competitive objectives of the organization by (i) enhancing corporate image and goodwill, (ii) leading to differentiated products, (iii) reducing wastes and

energy use, resulting in lower costs, (iv) engendering innovation through a spirit of experimentation and learning within the organization, (v) enhancing productivity through organization-wide attention to hitherto neglected areas of operations.

Buffalo had the foresight to identify environmental concerns as strategically important issues long before 1988, when an industry-wide awareness about the environment took place. Environmental assessment and impact is integrated into all aspects of its strategic planning and decision making processes. Its future strategies include research plans to develop less environmentally-damaging technologies, processes, and products. The EHS manager of Buffalo echoed the company's President in stating, "....environmental concerns represent the next frontier for productivity improvements in the oil and gas industry."

Similar corporate strategies for managing the environment, called "voluntary response", are discussed by Galbraith (1977). As per Galbraith, these strategies are undertaken to generate goodwill among stakeholder groups in the corporate environment. This goodwill is seen to pay-back during times of scarcity or crisis. The managers of the proactive companies stress the need for building-up of goodwill reserves among regulators, environmental groups, local and native communities, and consumers as the driving force behind their proactive actions. The President of Buffalo explained the company's mission:

> "In 1980, we adopted a corporate mission of building-up reserves of goodwill with our neighbours. Since environmental protection has been increasingly important for our neighbours in Alberta, we have worked with them to find practical solutions to environmental problems."

While the environmental groups contacted view all oil companies negatively, they confirmed that companies such as Buffalo are more open and willing to engage in a dialogue to appreciate different viewpoints. The regulators also confirm that they consider some companies such as Buffalo as more "sincere" in their approach towards environmental responsibility. Regulators confirm that they watch companies with a "bad attitude" more closely. "Sincere" companies are often given the benefit-of-doubt for environmental lapses.

5.3. The influence of managerial interpretations on environmental strategies.

The opening quotes on page one of this dissertation as well as conflicting signals from the managers interviewed in the seven companies indicate substantially different interpretations of environmental issues in each of the companies. Managers of Sioux and Buffalo often mentioned environmental actions as a potential source of productivity improvements, efficiencies, cost-reductions, market opportunities, product differentiations, and competitive advantage. On the other hand, managers of the other five companies usually discussed environmental actions as necessary only to avoid financial liabilities, criminal regulatory sanctions, boycotts by societal groups, etc. The managers of the five reactive companies also indicated that environmental actions were costly and detracted from competitiveness and economic performance. This indicated that managers in each company interpreted environmental issues differently.

The influence of managerial interpretations (or sensemaking) of strategic issues in the business environment has been argued to influence organizational actions and strategies (Daft & Weick, 1984; Dutton & Duncan, 1987; Dutton, Fahey & Naraynan, 1983; Ginsberg & Venkataraman, 1992, 1995; Lyles & Mitroff, 1980). Managers in different organizations may

interpret the same issue differently (Lawrence & Dyer, 1983; Meyer, 1982). Some dimensions along which managers have been found to make sense of, or interpret, strategic issues are as threats or opportunities (Dutton & Jackson, 1987; Thomas & McDaniel, 1990). However, whether issues are considered strategic in the first place and thus labeled or classified by managers is seen to be influenced by: (a) The degree of state uncertainty (Milliken, 1987, 1990) as regards the likelihood of the occurrence of the strategic issue (Milliken, 1987, 1990); (b) The perceived urgency (Dutton & Duncan, 1987) or the effect uncertainty of such issue on the organization (Milliken, 1987,1990); and (c) The issue feasibility (Dutton & Duncan, 1987), or manageability and understandability (Ginsberg & Venkataraman, 1995), or the response uncertainty regarding the actions that should be undertaken to deal with the issue (Milliken, 1987, 1990).

This research study makes an assumption that within the current climate of regulatory, societal, and media concern and scrutiny, environmental issues will be perceived as strategic by all oil and gas companies. Thus, there will be few differences perceived by managers along dimensions of state uncertainty, effect uncertainty, and response uncertainty. Differences will be identifiable to the extent to which managers interpret environmental issues as threats or opportunities, without considering the uncertainty dimensions that may influence these managerial interpretations of the environmental issue.

Interviews were analyzed along three attribute dimensions of threat/opportunity interpretations proposed by Dutton & Jackson (1987) and Jackson & Dutton (1988). These dimensions are positive versus negative, gain versus loss, and controllable versus uncontrollable. Table 3, reproduced from Sharma & Pablo (1995), presents examples of quotes from interviews

that enabled the data to be classified along these dimensions. The data was coded along the positive/negative dimension on the basis of emotional and affective cues that indicated whether managers associated features such as a "positive glow" (Dutton, 1993) with environmental issues. The data was coded along the gain/loss dimension on the basis of indications of the perceived impact of environmental issues on competitiveness, economic performance, or financial indicators of the organization. The third dimension of controllable/uncontrollable was distinguished on the basis of cues that indicated whether or not managers felt the lack of information, resources, and/or authority necessary to deal with these issues (Sharma & Pablo, 1995).

Table 3 indicates distinct differences between reactive and proactive/interactive companies' managers interpretations of environmental issues along the three attribute dimensions. The managers of the proactive/interactive companies (Buffalo and Sioux) interpret environmental preservation as an integral part of their corporate mission; as a source of pride in their leadership stance; as contributing to competitive advantage, cost reduction, product differentiation, better relationships and corporate reputation; as something they have adequate knowledge and information about; and as something with respect to which they have discretion to undertake actions.

In contrast, the managers of the reactive companies (Royal, National, U.S. Oil, Farmers, and Northern) interpret environmental issues as a regulatory concern external to their organizations; as a threat of criminal sanctions and of financial risk and liabilities; as a source of non-productive cost and expenditure on pollution control and cleanup; as uncertain in its dimensions; and as something over which they have little discretion to undertake action.

Table 3: MANAGERIAL ISSUE ATTRIBUTE INTERPRETATIONS
(Source: Sharma & Pablo, 1995)

Issue Attributes	Buffalo	Sioux	Royal	National	U.S. Oil	Farmers	Northern
Positive/Negative							
1980-85	Consistent with company mission	Consistent with corporate mission	No impact on job	Did not think about it	Not important to operations	No pressures from outside groups	Not important
1986-87	Enhances stakeholder goodwill	Source of pride in corporate identity as a market leader in alternative fuels	*Legal* issue	Hurdle - environmental approvals more difficult for new developments	*Legal* problem; Public relations managed approval process	*Legal* issue - new projects required costly assessment	*Legal* issue
1988-92	Secure in company reputation as an environmental leader	"	Source of negative publicity due to environmental accidents	Sense of conflict and frustration	Pressures from environmental groups due to environmental spills	Hurdle - more rigorous standards for project approvals	Increasingly difficult to get project approvals
1993 on	"	"	Financial concerns aroused due to potential liabilities	Potential source of risk and liability	Detrimental to new developments	Potential source of criminal liability for managers - sense of panic	Senior managers can go to prison - sense of panic
Loss/Gain							
1980-85	Contribution of stakeholder goodwill to smooth everyday operations	Source of product differentiation	Little impact upon line operations	Did not think about these issues	External to the company's operations	Little impact upon line operations	Nothing to do with day-to-day operations
1986-87	Source of cost savings, learning & innovations	Dominant market share in alternative fuels	Losses due to delays in project approvals	Losses due to delays in project approvals	Loss of viable resource options	Losses due to delays in project approvals	Cost overruns in new projects due to approvals
1988-92	"	"	Huge liabilities due to accidents; loss of competitiveness due to investments in waste/ emission control	Loss of competitiveness due to investments in waste/ emission control	Huge liabilities due to accidents; loss of competitiveness due to investments in waste/ emission control	Cannot afford to invest in waste/ emission control equipment	Cost of production went up
1993 on	Source of competitive advantage	Source of competitive advantage	Can create severe financial disruption in event of an accident	Detracts from economic objectives of organization	Can lead to large payouts as a result of minor infringements	"	"

Table 3: MANAGERIAL ISSUE ATTRIBUTE INTERPRETATIONS (contd.)
(Source: Sharma & Pablo, 1995)

Issue Attributes	Buffalo	Sioux	Royal	National	U.S. Oil	Farmers	Northern
Controllable/ Uncontrollable							
1980-85	We were all involved in building an environmental plan for the company	Everyone was involved with generating ideas for developing & marketing altern- ative fuels	Environmental regulations were the domain of the legal department	No involvement- legal department handled environmental regulations	The legal and public relations people handled environmental regulations	The company's lawyers handled environmental regulations	Legal issue - not really important
1986-87	We had the freedom to propose and act upon solutions to reduce environmental impact	"	"	"	The environmental assessment department was set up, but line managers were not involved	We hired outside consultants to handle approvals	No involvement - outside consultants handled approvals
1988-92	We could play around with around 5% of our expense budgets for non-major modifications in materials, processes, packaging, etc.; We were rewarded as much for building up our reputation for environmental protection as meeting output and financial targets	Even though we were selling traditional fuels, we were rewarded more for promoting sales of alternative fuels	Line managers became primarily responsible for compliance and risk reduction based on information provided by the environmental assessment department	An environmental policy was formulated but we were evaluated only on economic performance as long as there was no major accident	The company wanted us to perform on environmental indicators that were not specified or quantified, and we were evaluated negatively in case of a spill or an accident	Line managers responsible for compliance but rewarded for economic performance; lack of knowledge	No one can meet all the regulations - the titles alone run into 18 pages
1993 on	We have an environmental conscience too - everything cannot be quantified	"	We really don't know what we can do to reduce environmental impact other than comply with regulations	There is no incentive to do anything but comply	Unknown impact of experimental actions on output and economic targets	Consultants hired to ensure emergency response procedures in place	Our consultants audit every two years to ensure no major loopholes in procedures

This analysis reinforces the three dimensions of threat versus opportunity interpretations of strategic issues proposed by Dutton & Jackson (1987) and Jackson & Dutton (1988). A relationship can be seen between managerial interpretations of positive/gain/controllable dimensions and proactive/interactive environmental responsiveness strategies, and between negative/loss/uncontrollable dimensions and reactive environmental responsiveness strategies. The following hypothesis is presented based on this discussion:

> *H1: The greater the degree to which its managers interpret environmental issues as threats, the greater the degree to which a company will exhibit a reactive strategy of environmental responsiveness. The greater the degree to its which managers interpret environmental issues as opportunities, the greater the degree to which a company will exhibit an interactive strategy of environmental responsiveness.*

Since proactive strategies fall along the reactive-interactive continuum, these will be accompanied by managerial interpretations of environmental issues as a mix of threats and opportunities in different aspects of the organization's operations.

Managerial interpretations of strategic issues have been found to be influenced by environmental forces (Milliken, 1990), organizational context (Daft & Weick, 1984; Huber, O'Connell & Cummings, 1975; Milliken, 1990), as well as internal cognitive processes (Sims & Gioia, 1986). This study is limited to an examination of the influence of organizational context variables on managerial interpretations of environmental issues, and thus indirectly on corporate environmental responsiveness strategies. Internal cognitive processes of the managers, while undoubtedly important influences (Sims & Gioia, 1986), have not been considered due to the limitations of the research design. Figure 1 presents an overall model of influences of organizational context on managerial interpretations of environmental issues and on corporate

Figure 1: Factors influencing corporate environmental responsiveness strategies and outcomes of responsiveness

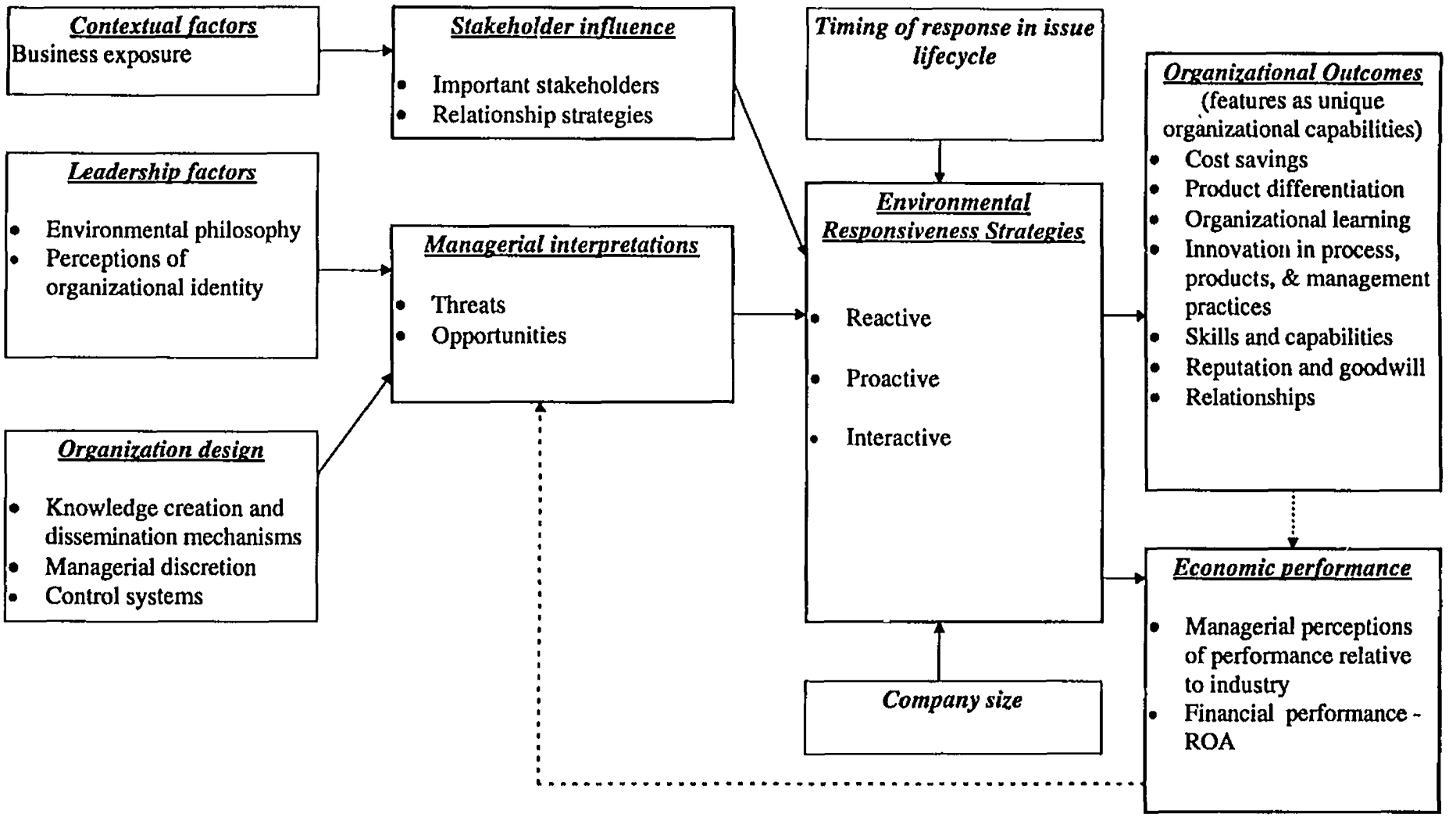
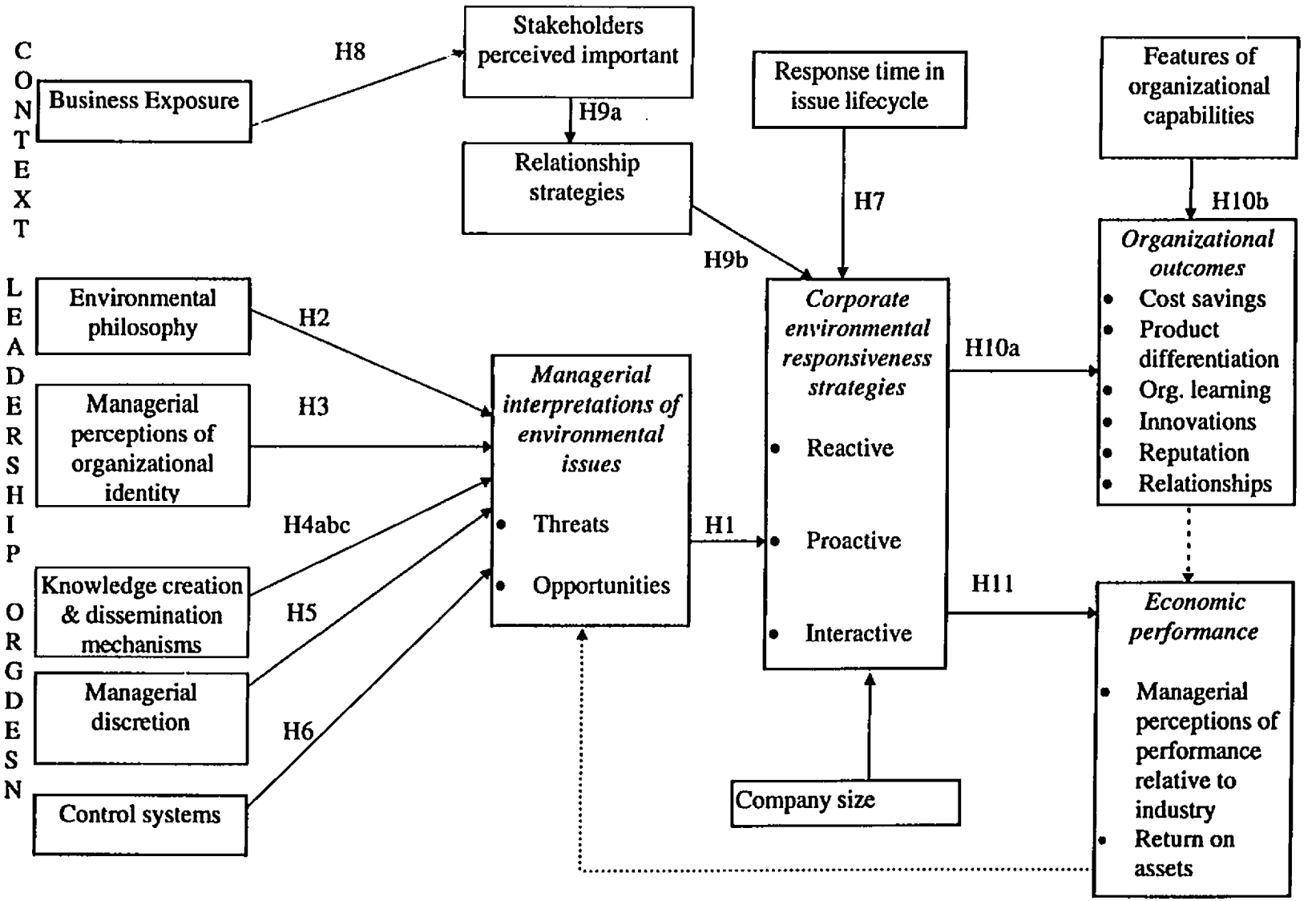


Figure 2: Factors influencing corporate environmental responsiveness strategies and organizational outcomes of responsiveness



environmental responsiveness strategies. This model also shows the relationships between corporate environmental responsiveness strategies and organizational outcome variables. Figure 2 shows the relationships hypothesized in this chapter.

5.4. The influence of organizational context on managerial interpretations.

Research on the influence of organizational context on managerial interpretations has pointed to several influences:

Environmental influences: Impact of the issue on the resource dependence of the organization (Milliken, 1990).

Organizational characteristics: (a) Organizational effectiveness (Milliken, 1990); (b) Corporate strategy (Hambrick, 1981; Thomas & McDaniel, 1990); competitive posture (Ginsberg & Venkataraman, 1992). (c) The information-processing capacity - degree of formalization and interaction - of the top management team (Thomas & McDaniel, 1990).

Leadership influences: (a) Organizational ideology (Meyer, 1982); (b) The strength (Milliken, 1990) of perceived organizational identity (Dutton & Dukerich, 1991). The rationale for classifying organizational ideology under leadership variables is based on discussions in literature that emphasize the disproportionate influence of executive leaders on organizational ideologies and strategies (Ackerman, 1975; Hambrick & Mason, 1984; Meyer, 1982; Miles, 1987; Selznick, 1957). Similarly, it is argued that organizational identity is influenced by the executive leadership.

Interviews revealed two primary aspects of organizational context as influences on managerial interpretations of environmental issues. The first influence was the role of leadership

variables in the form of organizational ideology or philosophy on environmental issues, and the perceived identity of the organization. The second influence was the role of organization design variables such as knowledge creation and dissemination systems, managerial discretion, and control systems. The current competitive postures and corporate strategies of the companies were not perceived by managers as important influences on corporate environmental responsiveness strategies. Companies exhibiting both categories of environmental strategies (reactive and proactive/interactive) included low cost producers (U.S. Oil, Farmers, Northern, National) as well as product differentiators (Sioux, Royal) (Porter, 1980).

5.4.1. Leadership influences - Organizational environmental philosophy: Organizational environmental philosophy is equated here to the ideology of the organization toward environmental issues. Ideology is defined by Beyer (1981) as "beliefs about the causal relations between courses of action and outcomes." Similarly, environmental philosophy refers to the organizational set of beliefs about the outcomes or consequences that are likely to arise as a result of actions taken to deal with the business-natural environment interface. Organizational ideology has been seen to influence managerial interpretations of strategic issues (Meyer, 1982).

Organizational environmental philosophies are the outcomes of a number of variables and processes: (a) The personal values of members of the organization, which refer to normative preferences for certain courses of action (Beyer, 1981); (b) Founding characteristics of the organization (Miles, 1987). According to Miles (1987), individual firms in an industry are influenced by the set of societal expectations about the issue in the era within which they are founded. One era may emphasize unfettered free enterprise, while another era may emphasize

environmental responsibility. Thus, oil and gas companies founded during the 1990s (an era with concern for environmental preservation) may differ in their dominant ideologies toward environmental preservation from those founded in the 1940s (an era of post-war economic development); (c) The unique history of the organization (Miles, 1987) in terms of the series of significant events that shaped the interface between the natural environment and its business. To illustrate, Exxon's ideology toward the natural environment is likely to be significantly shaped by the *Exxon Valdez* oil spill in Alaska; (d) The reaction of the organization to these series of significant events on the business-natural environment interface, i.e., the organizational actions taken to deal with these events; and (e) The personal values of the dominant coalition or leadership within an organization that has an important influence on organizational ideology (Beyer, 1981; Pettigrew, 1979).

The dominant role of the executive leader in shaping organizational environmental philosophies was marked in the Sioux and Buffalo, the proactive/interactive companies. Managers in both companies identified the role of a single individual in shaping their companies' environmental missions and ideologies. Buffalo's managers identified their President (since 1980), and Sioux's managers identified their founding Chairman, as major influences on organizational ideologies and strategies through successive changes of company top management.

Interviews with the managers and the President of Buffalo revealed similar recurring ideological themes. Buffalo's managers often framed their responses in the words of the President. To illustrate, some quotes from interviews with Buffalo's managers:

> President: "Consumers exhibit the Jeckyll and Hyde syndrome. They want to protect the environment and yet do not want to give up their cars. I could say that it's not my responsibility.... yet, I believe that our company has a role in educating consumers."

"We made all those investments in pollution prevention during the mid-80s because it was obvious that the environmental problem would only get worse."

EHS Manager: "Our president likes to call it the Jeckyll and Hyde syndrome. We feel that we have a mission to educate consumers."
"How can anyone in the industry think that the environmental problems will go away?"

Product Development Manager: "In our company, we call it the Jeckyll and Hyde syndrome..... our president wants us to take an active role in educating consumers."
"Our president wants us to constantly think ten-fifteen years ahead about the possible expectations of society regarding our role in environmental preservation."

Similar examples of convergence in philosophies on environmental protection were found among managers of Sioux. The natural environment was seen as an issue central to the corporate missions of both Buffalo and Sioux. This issue was infused by an organizational environmental philosophy that seemed to be substantially influenced by the opinions of an identifiable leader.

Managers of Farmers, Northern, Royal, and U.S. Oil exhibited considerable convergence over their environmental philosophies. Their philosophies emphasized the neo-classical view that environmental responsiveness detracted from economic performance, and that financial performance was the most important performance criterion. However, managers of National exhibited considerable divergence in their environmental philosophies. This is because the recent change of ownership has brought two sets of organizational values and philosophies into conflict. However, in the case of reactive companies, there seemed to be a lower level of identification of environmental philosophy with an individual. These companies identified their environmental philosophies with either overall organizational philosophies or with the influence of a top management team. This indicates that proactive stances on a strategic issue may be undertaken by

an individual, while reactive stances may be influenced by existing corporate strategies of a top management team.

The environmental philosophy dimensions range from conformity, to economic, to conservation, to restorative philosophies. Companies with a restorative or conservation environmental philosophy give importance to environmental protection as an important social concern and a corporate objective for which business policies and practices ought to be changed. These companies accord a high degree of legitimacy to the environmental claims of their stakeholder groups. They realise that the strategic choices that they make on corporate environmental performance often determine the status of various constituencies with respect to the company, rather than the other way around, i.e., their environmental practices are examined by these stakeholder groups and influence their relationships with the company. These companies are concerned about the legitimacy of their industry and not just the individual business.

These are clearly evident in the philosophies of Buffalo that emphasises accounting for the concerns of a wide variety of stakeholders and also as spokespersons for the natural environment. Buffalo is concerned about the non-sustainable nature of the oil industry and has invested in technology and research to find less environmentally-damaging products and processes. Buffalo's proprietary data on habitats and species is shared freely with other companies interested in environmental assessment. Buffalo's president does not view economic and environmental goals of the company as separate and conflicting. For Buffalo and Sioux's leaders, environmental responsiveness is a vital and worthy goal that is as important as economic performance. The exploratory study confirms Miles's (1982, 1987) findings that executive leaders of institution-

oriented companies avoid using their record of interactive corporate environmental performance to gain marketplace advantage. They believe that companies that use environmental proactiveness to create special market opportunities for themselves quickly lose credibility in dealings with agents of public interest.

Companies with a conformity environmental philosophy are driven by traditional economic values in North America, including economic individualism and survival of the fittest, private property rights, market competition, and the concept of limited government (except when their survival is threatened - e.g., Chrysler had no hesitation in invoking government help when faced with financial disaster and global competition). The executive leaders of all the reactive companies in the oil industry clearly expressed a philosophy that emphasises profit maximisation under competitive market conditions and within existing legal constraints as the most appropriate response for the company in its relationship with the natural environment.

While these are two ends of a continuum, most companies fall between these two extremes. Proactive companies such as Sioux seem to be mid-way as they exploit their less environmentally-damaging products for competitive gain, while avoiding any substantial actions to reduce environmental impact in their processes and other activities. In order to achieve a finer grained distinction on corporate philosophies toward environmental protection, the continuum of *conformity, economic, conservation,* and *restorative* is used as a guideline. These have been discussed in detail in section 2.2 in chapter two.

As companies travel up the continuum of states of environmental consciousness, proactive and interactive environmental actions and strategies are further legitimated. The comfort level of

managers with decisions on the business-natural environment interface increases, thus reducing negative connotations of environmental issues.

H2: The greater the extent to which the company espouses a "conformity" environmental philosophy, the greater the degree to which its managers will interpret environmental issues as threats rather than as opportunities. The greater the extent to which the company espouses "conservation" or "restorative" environmental philosophies, the greater the degree to which its managers will interpret environmental issues as opportunities rather than as threats.

It is likely that the greater the extent to which the company falls within the *economic* state of environmental consciousness that emphasizes cost-benefit analysis of environmental actions for economic gain, the greater the likelihood of its managers interpreting environmental issues somewhere on the middle of the scale that measures opportunity and threat perceptions as two ends of a continuum. Environmental actions will be considered threats if they conflict with immediate economic paybacks.

5.4.2. Leadership influences - Perceptions of organizational identity. Managerial perceptions of their organization's identity is seen to guide managerial interpretations of a strategic issues, and thus affect organizational action (Dutton & Dukerich, 1991). Milliken (1990) found a relationship between the perceived strength of organizational identity and managerial interpretations of a strategic issue. Miles (1987) sees organizational identity as directly influencing corporate strategies. Albert & Whetten's (1985) definition of identity is adopted here as what an organization's members believe to be its core, distinctive and enduring character. Albert & Whetten (1985) see an organization's identity as including ideology, management philosophy, culture, ritual, strategic predispositions, etc. While elements of organizational ideology are inseparable from organizational identity, it is assumed here that organizational environmental

philosophies are also distinct influences on managerial interpretations of environmental issues. This distinct nature of organizational environmental ideologies is argued to be due to the current societal concerns for environmental preservation, that bring environmental issues into prominence for organizations and their managers.

Managerial perceptions of organizational identity is treated as a leadership influenced variable. This is because an organization's leadership is seen as having an important role in shaping it's identity. Executive leaders enact the strategic core of an organization by emphasizing activities that are crucial to the survival and growth of the firm (Nöel, 1989). By setting personal examples and devoting more time and attention to certain issues, leaders indicate the strategic importance of these issues to corporate strategy, and infuse an issue with value beyond the technical requirements of the task at hand (Ackerman, 1975; Selznick, 1957). Marshall & Vredenburg (1992) demonstrated this effect in the case of the role of strategic leadership in the implementation of a marketing innovation in organizations.

Cues taken from interviews indicate some aspects of how managers perceived their organization's identity. Table 4 presents central features of identity that emerged from the data. The responses of National have not been included in Table 4. Due to the public relations stance taken by it's senior executives, National's managers provided conflicting statements. However, judging from statements of middle managers and it's record of environmental actions, managerial perceptions of National's organizational identity fell squarely within enterprise-orientation.

Table 4: Dimensions of corporate identity

Features of identity	*Some illustrative quotes*
Institution-oriented identity *Role in education. *Social responsibility - profit not only objective. *Environmental leadership. *Collaboration - environment as a domain issue. * Serious environmental problems.	Buffalo: ".. role in....educating consumers.". "....mission to educate consumers", "... active role in educating consumers." "We have a social conscience too", "Profits are not the only motive", "...we have an obligation to our neighbours", "We too have an obligation to speak for the environment", "We operate within the environment and need to protect it", "We see ourselves as environmental leaders", "We have always worked collaboratively with all our neighbours to reduce negative impacts upon the environment", "Our mission is to build reserves of goodwill among our neighbours" "Environmental degradation is bound to get worse." Sioux: "By selling less environmentally-damaging fuels, we play a role in educating consumers about environmental preservation", "We persisted.. (with a money losing operation for 12 years) due to our inner commitment (to reduce environmental impact)", "It was an uphill struggle to make consumers accept our ethanol blends and recycled oils.", "We had to build bridges with provincial governments and farmers...", "Our mission as an alternative energy company will guide our future strategies" "Environmental problems won't go away."
Enterprise-orientated identity *Responsibility of consumers; *Maximizing investor wealth only objective; *Regulations constrict operations; *Government responsible for environmental preservation; *Scepticism about environmental problems.	Royal: "It's impossible for anyone to wade through the maze of environmental regulations.... the titles alone run into 14 pages.", "Our primary mission is to provide a return to our investors", "Do you want us to tell our stakeholders to accept a lower return because we want to spend money to reduce pollution even though regulations don't demand it", "The petroleum industry is sustainable - as reserves go down, the prices will go up, reducing consumption." U.S. Oil: "We are in this business to make money... we generate billions in government revenues, we provide jobs, we stimulate economic development..... it is the consumers (of petroleum products) who must learn to conserve", ".... our company's responsibility is to our investors and that includes reducing environmental liability." Farmers: "We don't believe all this nonsense about global warming... there is not a shred of scientific evidence", "Our mission is to operate as efficiently as we can and make profits.... we contribute a percentage to charity each year", "The regulations are killing the industry." Northern: "Our chairman has told us that if he has to go to prison for an environmental accident, we are all out of a job. At the same time, we have to ensure that our investors get the best returns", "I can't think of one reason why our company should do anything not required by law."

This classification of institutional and enterprise-oriented organizational identities has been emphasized by Miles (1987). Miles stresses the importance of an institutionally-oriented corporate identity for proactive strategies to deal with external issues. He found that reactive external affairs strategies in the U.S. insurance industry were accompanied by an enterprise-orientation that saw the company as a maximizer of investor wealth unfettered by external regulation and control - similar to the frontier economic paradigm (Colby, 1990). This is also similar to Albert & Whetten's (1985) description of a utilitarian identity that is oriented towards economic production. The utilitarian organization is governed by values of economic rationality, profit maximization, and financial return, and is identified generally with business firms.

Managers of companies that were proactive in pursuing external socially responsible strategies saw their companies as institutionally-oriented with a social franchise to exist as a part of and for the benefit of society (Miles, 1987). Albert & Whetten (1985) contrast utilitarian identity with a description of a normative identity that is governed by cultural, educational, and expressive values. The church is cited as an example of a normative organization. The concept of normative identity as described by Albert & Whetten (1985) does not seem to describe the proactive/interactive firms in the study. Rather, these firms are seen to have a dual identity (Albert & Whetten, 1985) which mixes economic values with socially responsive values. Miles's (1987) description of institution-oriented identity that emphasizes the company as a social franchise seems to be a better fit with these companies. While Miles (1987) sees organizational identity as influencing corporate strategies, he does not see the role of managerial interpretations as

intervening variables that moderate the relationship between organizational identity and corporate strategy.

Managers of both Buffalo and Sioux stress the importance given to the institutional and social role of the company in everyday operations. They exhibit an institution-orientation and consider that social objectives are an important part of their company's mission. This contrasts with the heavy emphasis on maximizing investor wealth as the primary mission of the five reactive companies. It was found that the executive leadership of Buffalo and Sioux played an important role in shaping the influence of environmental issues into the corporate identity by labeling these issue as a legitimate focus of organization-wide action.

Buffalo's mission of goodwill generation among neighbors through environmental preservation adopted in 1981, and Sioux's mission as an alternative energy company adopted in 1980, provided such issue labels. This labeling through mission statements was central to the perceived corporate identity, providing managers with guiding reference points within which they framed their decisions and actions. Buffalo's managers began to see their company as an industry leader in environmental practices and Sioux's managers saw their company as a market leader in selling less environmentally damaging fuels. Decisions and actions that reduced the environmental impact of their companies' operations, were consequently seen as consistent with their corporate missions. Regardless of how regulations and public expectations would develop in the future, Buffalo's mission was to achieve exemplary environmental leadership and Sioux's mission was to achieve leadership in the marketplace for less environmentally damaging products. The ambiguity surrounding the eventual dimensions of the environmental issue, a major determinant of threat

association (Jackson & Dutton, 1988) or state uncertainty (Milliken, 1990), was thus removed by incorporating environmental responsiveness into the corporate mission.

The managers of the five reactive companies, lacking any such guiding reference point on environmental actions, continued (and still continue) to treat environmental issues as regulatory issues to be dealt with by the legal and compliance departments and as a risk and liability reduction problem. While Royal and National issued environmental policy statements in 1989, these statements are not considered by managers as an integral part of the corporate mission. U.S. Oil, Farmers, and Northern have still not formulated environmental policy statements. The managers of the reactive companies continue to perceive their corporate identity as maximizers of shareholder wealth and as good corporate citizens, following regulations and making philanthropic contributions. It emerges that the extent to which managers perceive their organization's identity as institutionally-orientation influences managers' interpretation of environmental issues.

H3: The greater the degree to which managers perceive institution-orientation as central to their organization's identity, the greater the degree to which they will interpret environmental issues as opportunities rather than threats. The lesser the degree to which managers perceive institution-orientation as central to their organization's identity, the greater the degree to which they will interpret environmental issues as threats rather than opportunities.

Leadership influences are seen to shape managerial interpretations of environmental issues via shaping of organizational environmental philosophy and organizational identity. A company's leadership may also have an indirect influence on managerial interpretations by changing organization design. However, this study measures leadership influence only through its influences on organizational philosophy and identity. The following sections discuss the influence of

organization design on managerial interpretations. The organization design features that emerged as important influences in managerial interpretations of environmental issues were knowledge creation and dissemination mechanisms, managerial discretion, and control systems.

5.4.3. Organization design and organizational learning. Organizations need to facilitate knowledge creation and dissemination in order to promote higher-order learning (Argyris & Schön, 1978; Galbraith, 1977). This process was found to involve three stages for the proactive/interactive firms studied in the exploratory study: (1) Mechanisms for the creation, exchange and dissemination of knowledge on the business-natural environment interface; (2) Providing managers with discretion to experiment and create knowledge about actions and practices that would reduce environmental impact within the context of economic objectives; and (3) Changing control systems to focus managerial attention on environmental actions. These three changes in organization design influenced the attention paid by managers to environmental issues and thus influenced their interpretations of these issues. These process of changing organization design to facilitate organizational learning on the business-natural environment interface was not seen in the five reactive companies in the study.

5.4.4. Organization design: Knowledge exchange and dissemination mechanisms. Understanding organizational impact upon ecosystems requires changes in conventional thinking. Managers need to shift perspectives from linear processing to closed-loop or cyclical processes, from efficient resource use to resource conservation, from maximizing sales and consumption to educating consumers in wise consumption, from short-term performance maximization to considerations of future generations and global equity. Understanding organizational impacts on

ecosystems also requires expertise and knowledge from the disciplines of biology, chemistry, geography, physics, etc. In order to become proactive/interactive in their environmental responsiveness strategies, organizations need to create mechanisms for the creation, exchange and dissemination of this new knowledge on the business-natural environment interface.

Buffalo undertook a detailed environmental audit and impact assessment of its operations in the early 1980s. Outside consultants were hired, but staff and operating managers at all levels were involved in creating knowledge about the interface between their company's operations and the natural environment. At that time, government and industry guidelines did not provide companies with sufficient information and benchmarks to enable them to assess their impact on the natural environment. Buffalo's detailed impact assessment report was circulated to all company employees and their input was solicited on ways of reducing the impact of company operations on the natural environment. Thus an emergent strategy formulation approach (Mintzberg, 1978, 1994) was adopted. A corporate environmental assessment department was set up. However, it was quite clear that this department's mission was to create knowledge on ways of reducing environmental impact in collaboration with other staff and line operating departments. The EHS manager of Buffalo explained:

> "In most companies, the environmental department's role is to interpret environmental regulations, inform operating departments about potential infringements, and undertake public relations to improve the company's environmental image. We did all this of course..... but our primary mission was to interact with all members of the company and with our neighbours to better understand environmental impact and find ways of reducing it."

At the same time, Buffalo set up devices for integrating this knowledge, exchanging information and disseminating it across the organization. During the early 1980s a board level environmental committee was set up, a top management steering committee was set up to formulate an environmental plan, and task forces of middle and junior managers were set up to provide inputs to the steering committees. Thus, both staff and line managers were involved in knowledge creation, exchange, and dissemination.

Sioux also set up a Board level environmental committee during the early 1980s. However, the company's environmental policy and plan was formulated by staff departments including the environmental affairs, research and development, and planning departments. Line manager involvement in environmental policies and plans of Sioux came at a later stage during the late 1980s. Sioux's environmental policy revolved around the identification and exploitation of less environmentally damaging fuel technologies for the marketplace. While its managers located these technologies, its research department made these technologies commercially viable.

During the early 1980s, most oil and gas companies in Canada had health and safety departments, but environmental affairs were not included in their responsibilities. In fact, environmental affairs were handled by the legal department in most companies. National set up a corporate environmental affairs department in 1987, Royal moved environmental affairs away from the legal department to the health and safety department in 1989, U.S. Oil set up an environmental affairs department in 1986, and Farmers and Northern still rely on consultants to advise them on environmental affairs. In these five reactive companies, environmental affairs are solely handled by corporate/staff departments or consultants.

Regardless of the mechanisms that may exist in the reactive companies to exchange and disseminate knowledge on product innovation, technology, or other strategic issues, there are no devices to bring staff and line managers together to over environmental affairs. The line managers are preoccupied with output and profitability concerns, and the staff managers are concerned with environmental scanning and interpretation, systems, and public relations. Detailed environmental audits have been undertaken by Royal and National during 1993 and 1992 respectively. However, these audits are the responsibility of the staff managers and line managers have very little involvement.

As a result of the different approaches taken by Buffalo on the one hand (and Sioux to a limited extent), and the five reactive companies on the other, the extent to which the respective organizations have gained an understanding of the business-natural environment interface differs. Buffalo and Sioux's managers are less uncertain about how to deal with the business-natural environment interface and consider it a part of their job to continually improve this knowledge base. The operating managers of the five reactive companies consider environmental issues a legal problem to be dealt with by the staff departments.

During the early and mid-1980s, there were uncertainties regarding the final dimensions of this issue in terms of the relationship between organizational actions and environmental outcomes, standards of enforcement, and public expectations. The managers of all companies in this study indicated that during this stage, even if they knew the right questions to ask regarding how to deal with the business-natural environment interface, the information and knowledge necessary to answer these questions was hard to come by. Without this information, the financial and technical

implications of a decision were difficult to assess. Buffalo, and to some extent Sioux, were able to overcome this uncertainty by creating mechanisms of knowledge creation and exchange between line and staff managers in their companies. The reactive companies have still not created these mechanisms. Line managers in these companies still treat environmental issues as outside the purview of their jobs and solely the domain of staff managers. For these managers, environmental issues presented risks and liabilities and regulatory hurdles that would have to be overcome through assistance by the staff functions.

The proactive companies' line managers were made responsible for reducing the environmental impact of their companies' operations at an early stage and achieved a level of comfort with these issues through information support and continual learning. Thus the involvement of line managers in creating knowledge on the business-natural environment interface influences how they interpret these issues.

> *H4a: The greater the degree of involvement of line managers in dealing with the business-natural environment interface, the greater the degree to which they will interpret environmental issues as opportunities. The lower the degree of involvement of line managers in dealing with the business-natural environment interface, the greater the degree to which they will interpret environmental issues as threats.*

Because line managers tend to emphasize economic and operational targets while staff managers tend to emphasize issue interpretation and analysis, it is important to strike a balance of influence between line and staff units in formulating external affairs strategies (Miles, 1987). The reactive companies did not achieve this balance as they kept environmental issues within the domain of staff units, and thus failed to gather information on how these issues could be operationally addressed and the economics of doing so. The proactive companies, on the other

hand, achieved this balance in dealing with environmental issues through the use of such integrative devices as board level committees, task forces, and rotation of staff officers from environmental assessment departments to the business units.

This balancing of responsibilities for information support sparked processes of learning and knowledge creation about ways of reducing the environmental impact of the companies' operations. For managers of Buffalo and Sioux, this alleviated the informational ambiguity that is an important determinant of threat perceptions of strategic issues (Jackson & Dutton, 1988). The balance of influence between line and staff functions in building information on the business-natural environment interface influences managerial interpretations of environmental issues. The balance of influence is reflected in integration devices used for dealing with the business-natural environment interface, such as task forces, rotation of managers in staff and line functions, liaison roles, board level committees, etc., as well as in the level of cooperation between line and staff managers in dealing with the business-natural environment interface.

> *H4b: The greater the degree of cooperation between line and staff managers in knowledge creation on the business-natural environment interface, the greater the degree to which managers will interpret environmental issues as opportunities. The lower the degree of cooperation between line and staff managers in knowledge creation on the business-natural environment interface, the greater the degree to which managers will interpret environmental issues as threats.*

> *H4c: The greater the use of integration devices between line and staff managers for knowledge creation and exchange on the business-natural environment interface, the greater the degree to which managers will interpret environmental issues as opportunities. The lower the use of integration devices between line and staff managers for knowledge creation and exchange on the business-natural environment interface, the greater the degree to which managers will interpret environmental issues as threats.*

5.4.5. Organization design: managerial discretion. Higher-level learning that leads to innovation consists of the search for and exploration of alternative sets of routines, rules, technologies, and goals (Argyris & Schön, 1978; Lant & Mezias, 1992), and requires managerial experimentation with the use of heuristics, skill development, and insights (Fiol & Lyles, 1985). These learning processes result in major reorientations that involve changed norms, values, or world views (Argyris & Schön, 1978; Bateson, 1972), the desired consequence of which is not particular behavioral outcomes, but rather the development of new frames of reference as becomes necessary during the evolution of new strategic issues (Shrivastava & Mitroff, 1982). However, this type of learning is frequently conducted under conditions of ambiguity (March & Olsen, 1976). Thus, the creation of an organizational context that facilitates experimentation and provides discretion to managers is essential (Hambrick & Finkelstein, 1987; Wood, 1991).

Buffalo provided this context by altering patterns of authority, responsibility and control to allow operating managers discretion in use of budgeted funds to experiment with changes in material specifications, process modifications, waste handling systems, and operating policies that would reduce the impact of the company's operations on the natural environment. From 1987 onwards, a percentage of budget allocations to each department, ranging from 2% to 7%, was allowed for alternative technologies, innovations, and approaches to reducing environmental impact of operations. Such flexible planning and budgeting systems not only led to significant cost reduction, but also resulted in a long list of patents on innovations in process modifications and waste disposal systems (refer to Appendix 2).

While Sioux provided a more limited amount of discretion to its managers (only to the extent to which alternative energy sources could be identified and exploited in the market), this has led to a preeminent market position for Sioux in alternative energy products.

The reactive companies, on the other hand, have not provided any degree of discretion to their managers in dealing with the environmental impact of their operations. Consequently, the only major innovation that could be documented among these five companies is contaminated soil restoration technologies emerging from Royal's research laboratory (see Appendix 2). The Manager, refining of Royal commented:

> "Unless I have some discretionary funds to play around with, I can't do anything on my own. The instructions from the top are clear, invest only as much as is necessary to get a clean chit from regulators."

These findings are consistent with those of Govindarajan (1984, 1986,1988) which linked flexibility in budgeting systems to improved managerial performance in high uncertainty situations. The discretion provided to managers of the proactive companies apparently increased their sense of control in dealing with environmental issues, alleviating the perception of issue uncontrollability associated with threat interpretations. Thus the degree of discretion provided to a company's managers in dealing with the business-natural environment interface influences their interpretation of environmental issues.

> *H5: The greater the degree of discretion provided to a company's managers in dealing with the business-natural environment interface, the greater the degree to which they will interpret environmental issues as opportunities. The lesser the degree of discretion provided to a company's managers in dealing with the business-natural environment interface, the greater the degree to which they will interpret environmental issues as threats.*

5.4.6. Organization design: control systems. The creation and dissemination of knowledge on the business-natural environment interface creates a level of comfort about environmental issues by reducing uncertainty. However, there would still be no incentive to risk jobs by compromising economic objectives to undertake actions to reduce environmental impact if managers are evaluated only on economic performance indicators.

In 1987, Buffalo matched its employees' authority for budgetary flexibility (discretion) with the responsibility (control) for meeting specified environmental targets. The knowledge created during the early and mid-1980s was utilized to establish environmental performance indicators for its employees. Some of these indicators were specific in laying down percentage ranges of waste reduction, emission reduction, safe disposal of wastes, etc. Some of these were less specific and qualitative in terms of better relationships with regulators, environmental groups, and local communities; faster approval processes for new developments; perceived improvement in company reputation and image as reflected in media or discussions with stakeholders, zero public complaint rates, etc. These environmental performance indicators were given considerable weighting in employee performance evaluation. Sioux too, in addition to using economic performance criteria, incorporated measures of performance reflecting activity directed toward market-oriented environmental responsiveness.

While some of the reactive companies have also included environmental performance indicators in their evaluation systems, the managers of these companies stress that these indicators are quite subjective in nature, are non-quantified, and are given very little importance. Economic performance targets are the preeminent measures of employee performance, and managers are left

uncertain about exactly what is expected from them in terms of environmental behaviors or outcomes. According to the resource manager of U.S. Oil:

> "Frankly, the environmental performance indicators count for very little in evaluation. You're all right if you meet your output targets. Environmental performance becomes important only in case of a major accident or spill, or frequent serious public complaints."

Movement away from the use of rigid economic performance criteria creates a degree of slack that managers can use to deal with emerging issues. Availability of slack in application of control systems contributes to organizational learning and strategic adaptation by enhancing managers' ability to cope with non-routine stimuli and to implement changes in planning and decision-making processes (Galbraith, 1977; March & Simon, 1958). Further, the incorporation of quantified environmental performance indicators in control systems focused on employee performance removes the subjectivity and uncertainty associated with taking actions on issues whose dimensions are not clear. This explicit valuing of environmental performance eases the pressure on a single economic performance criterion, reducing the potential threat of loss for managers who are uncertain about the impact of environmental actions on the organization's economic performance. Thus, it is proposed that the degree to which a company uses environmental performance criteria along with economic performance criteria in its control systems influences managers' interpretations of environmental issues.

> *H6: The greater the degree to which a company uses environmental performance criteria in employee control systems, the greater the degree to which its managers interpret environmental issues as opportunities. The lesser the degree to which a company uses environmental performance criteria in employee control systems, the greater the degree to which its managers interpret environmental issues as threats.*

5.4.7. Summary. Managerial interpretations of environmental issues are seen to be influenced by two sets of influences - leadership and organization design. Leadership influences are in the form of the shaping of the corporate environmental philosophy that establishes cause and effect relationships in the minds of managers (Beyer, 1981) between organizational actions and environmental impact; and in the form of shaping of the organizational identity that is perceived by managers. Whether managers see their companies as social institutions with social missions and objectives, or whether they see their companies as free enterprise systems operating to maximize economic return for investors, influences how they will interpret environmental issues.

Managers face considerable uncertainties and ambiguities in their efforts to understand and deal with environmental issues. Uncertainties about issue dimensions (Milliken, 1987, 1990) lead to an overemphasis on threat interpretations (Jackson & Dutton, 1987; Kahneman & Tversky, 1979) by managers. These uncertainties can be reduced by organization design that facilitates the creation, exchange, and dissemination of knowledge on the business-natural environment interface; provides managers with discretion to experiment and thus stimulate further learning and knowledge creation; and evaluates managers on actions taken to reduce impact on the natural environment.

In addition to the influence of managerial interpretations of environmental issues, certain other organizational context factors are seen to impact corporate environmental responsiveness strategies directly. These are discussed below.

5.5 The influence of organizational context on corporate environmental responsiveness strategies.

These factors relate to the timing of a company's response in the issue lifecycle; a company's business exposure which, in turn, affects the range of stakeholders it considers strategically important; and the relationship strategies that the company chooses to follow with these stakeholders, especially the manner in which it deals with the objectives and concerns of the stakeholders who act as spokespersons for the natural environment.

5.5.1. The timing of response in the issue lifecycle. As issues progress from limited attention by special interest groups, to widespread public interest, to regulatory prescriptions for action (Post, 1978), the zone of discretion available to a company for dealing with an issue successively decreases (Ackerman, 1975; Post, 1978). However, early adoption of an issue presents a number of uncertainties for a company and its managers: the urgency and durability of the issue are unclear, acceptable standards of behavior are constantly changing and are difficult to determine, and means of dealing with these issues are unknown and may require the development of new technologies, expertise, knowledge, and thinking frameworks (Ackerman, 1975). Thus, while early action presents opportunities for strategic flexibility, it also carries with it the potential costs of greater uncertain issue dimensions.

In this study, the five companies exhibiting reactive environmental responsiveness strategies adopted a wait-and-see attitude and following regulations as they changed. This was a reflection of the lack of urgency and importance given these issues by them. By 1993, these companies were faced with clear external demands for environmental preservation. Yet, they had

neither developed adequate organizational routines or the learning capabilities required to deal with the environmental issue in an effective way.

The two proactive and interactive companies, on the other hand, undertook long-term investments early on based on a belief in the urgency and durability (Milliken, 1987) of environmental preservation as an issue. This early action enabled these companies not only to shape the dimensions of the environmental issue and how they would deal with it without external pressure, but also provided managers with the time to gain familiarity with the issue and to generate knowledge and learning capabilities for dealing with the business-natural environment interface over the long-term. Buffalo was successful in establishing industry and regulatory standards for environmental assessment, environmental audit, drilling and production technologies, and waste handling procedures. Buffalo also patented several process modifications and waste recycling technologies that have been adopted by other oil firms in several countries. Sioux, by obtaining ecological certification for its ethanol blends and recycled engine oils established Canadian standards for these products. Now most oil companies buy Sioux's recycled engine oils to blend with their own virgin oils to be eligible to sell to government agencies and provincial governments. For both organizations, success from early initiatives spurred further creative action on the business-natural environment interface. Thus the timing of response to an environmental issue influences the development of corporate environmental responsiveness strategies along the reactive-interactive continuum.

> *H7: The earlier in the issue lifecycle the company initiates environmental responsiveness, the greater the degree to which it will exhibit interactive strategies of environmental responsiveness. The later in the issue lifecycle the company initiates environmental actions, the greater the degree to which it will exhibit reactive strategies of environmental responsiveness.*

5.5.2. The importance of business exposure and stakeholder perceptions. Business exposure has been stressed as an important factor by Ackerman (1975) and Miles (1982, 1987) in influencing external affairs strategies of companies. Business exposure is a function of the business strategies of the organization. The principal dimensions of business strategy seen to influence business exposure in the oil and gas industry are the product and activity mix. As products become viewed as necessities by the general public, traditional business decisions about such things as their availability, reliability, and safety move into the public arena where the general public and its agents bring their influence to bear on the corporation. Further, if these products, or the processes by which these products are created or distributed involve potential contingencies that might adversely affect the consuming public, the company's business exposure will automatically increase.

Petroleum is considered a necessity and is subject to regulatory and public scrutiny. An individual company's business exposure may be determined by the extent to which it sells products through retail outlets versus directly to industrial consumers such as utility companies. Companies that are selling their products in bulk directly to utility companies or to downstream operators are less subject to public scrutiny. However, they may be subject to pressures from these large customers, which in turn respond to their own stakeholder pressures for buying their materials from environmentally responsible suppliers. Pipeline companies demand minimum environmental standards from oil and gas producers wanting to transport their products. Large utilities in the U.S. put pressure on their Canadian gas suppliers to meet environmental standards demanded by the utilities' stakeholders. Thus, the wider the range of products manufactured by a

company, the wider the range of stakeholders whose objectives and interests the company has to accommodate.

The other dimension is the extent of potential contingencies involved in the process of production and distribution of the product. In the case of oil companies this is determined by the range of activities of the company. The greater the range of activities - exploration and drilling, production, transportation, refining, retail sales - the greater the environmental risks and potential contingencies due to a greater number of interfaces between the business and the environment. A wider range of activities also leads to an interface with a greater range of stakeholders whose objectives and interests have to be accommodated by the company.

It was quite clear from the exploratory study that the proactive and interactive companies perceive a wider range of stakeholders as important to business and in understanding of environmental issues. Companies that consider themselves upstream operators name strategically important stakeholder groups differently depending on whether they exhibit interactive, proactive, or reactive corporate environmental performance.

Buffalo, which considers upstream activities as its core area of concentration, exhibits interactive strategies in shaping environmental protection standards as well as regulations. It names local communities at exploration/ drilling sites, natural habitats, environmental groups, wildlife protection groups, native populations, employees, regulators, customers, suppliers and investors, as strategically important stakeholders. Sioux, which is proactive in strategic actions for research and marketing of less environmentally-damaging fuels, names customers, regulators, investors, employees, suppliers, and environmental groups as its strategically important

stakeholders. Local communities are not named by this company since this company does not consider itself an upstream company.

The reactive companies which consider themselves as upstream companies - U.S. Oil, Northern, and Farmers - name investors and customers as primary, and local communities at exploration/drilling sites as secondary strategically important stakeholders. None of these companies are proactive on environmental response - not surprisingly they do not name either the natural environment or environmental groups as important stakeholders.

The striking differences between interactive/proactive and reactive companies in terms of stakeholders considered strategically important are: (a) The interactive company names the widest range of stakeholder groups as strategically important, including the natural environment, wildlife protection groups, and environmental groups as primary strategically important stakeholders; (b) The interactive and proactive companies do not classify stakeholders into primary and secondary classes in terms of their importance. Not only do they name a wider array of strategically important stakeholders, but they rank them as equally important. The reactive companies do not mention the natural environment as a stakeholder; nor do they name suppliers, regulators, and employees as important stakeholders, or even refer to them as secondarily important strategically. For the reactive companies, the strategic emphasis is on customers and investors, in accordance with the importance attached to economic performance.

The concept of the natural environment as a stakeholder has been discussed in corporate environmental response literature (Post, 1990). However, the natural environment is considered an externality by all the reactive companies. This is not the case for the interactive/proactive

companies. For Buffalo's managers, the natural environment is a stakeholder of the company, and its spokespersons are not only environmental groups, regulators, and local communities, but also the company and its employees. Since the reactive firms do not perceive the natural environment as a stakeholder, they express little concern for the need to go beyond regulations, or risk and liability reduction - acceptable objectives for their perceived strategically important stakeholders, such as customers and investors. Buffalo's managers, by emphasising the importance of "neighbours" such as local communities, environmental groups, and the natural environment, have been able to formulate a more interactive response pattern.

As per stakeholder theory (Freeman, 1984), companies ought to respond to the objectives and concerns of all possible stakeholders groups impacted by and having an impact upon the company. However, stakeholder theory is largely prescriptive, and in practice firms are seen to respond to the concerns and objectives only of stakeholders seen as strategically important. It follows from the exploratory study that a wider range of activities and products results, not only in an interface with a wider range of stakeholders, but also with stakeholders considered spokespersons for the natural environment.

> *H8: The greater a company's business exposure (as measured by the range of its activities and products), the greater the degree to which its managers will perceive stakeholders such as environmental groups, local communities and other spokespersons for the natural environment as strategically important to the company's operations. The narrower the range of a company's business exposure, the lesser the degree to which its managers will perceive stakeholders such as environmental groups, local communities and other spokespersons for the natural environment as strategically important to the company's operations.*

5.5.3. Stakeholder relationship strategies: Miles (1987) discusses two external affair strategies that are followed by companies in dealing with their external constituents. These are collaborative/problem-solving strategies and individualistic/adversarial strategies. The former involve a recognition of external issues as domain problems that cannot be solved without collaborative/problem-solving processes that involve all affected stakeholders. The latter involves the disregard of the viewpoints of external stakeholders and a tendency to strike out an individualistic and adversarial path in dealing with environmental issues. This may involve litigation, court action, legal battles, and other adversarial strategies.

A similar tendency was found among reactive companies that chose to follow regulations but disregarded the public consultation process in environmental assessment. They chose to undertake actions that impacted upon the environment without consulting environmental groups, special action groups, local communities, and regulating bodies. The interactive company, Buffalo, chose to pre-consult with all these stakeholders before any development activity took place and withdrew whenever these groups considered the activity inadvisable. As a result, Buffalo has not had to undergo any scandals or legal challenges from local communities or environmental groups, and has managed to get approvals for new developments fairly quickly through informal processes. In contrast, U.S. Oil spent three years and $15 million fighting environmental groups and local communities over a new development in an ecologically sensitive area. At the end, U.S. Oil had to abandon the development. U.S. Oil initiated the development process without consulting environmental groups and chose to fight their objections and claims in

courts. The collaborative and problem-solving approaches are not one-time strategies, but are fundamental organisational approaches to deal with stakeholder concerns and objectives.

Wherever a mandate exists from the top management to build and manage more effective relationships with company stakeholders, the managers have acquired tolerance to the point of view of a wider variety of stakeholders. The influences exerted by individual members of these outside stakeholder groups also change managerial viewpoints and interpretations about environmental issues. Their own views about the role of their company in environmental protection tend to be more balanced and informed. The term "relationship-building" refers to collaborative/problem-solving strategies that involve information sharing and formulation of strategy after consideration of the objectives of all the stakeholders involved. It involves a willingness to listen to the various stakeholders instead of attempting to manage their concerns through aggressive corporate actions. Thus, the greater the importance attached to environmental stakeholders by the company, the greater the likelihood of the company following stakeholder relationship strategies that are collaborative/problem-solving in nature, rather than adversarial.

> *H9a: The greater the degree of importance attached by a company to stakeholders considered spokespersons for the natural environment, the greater the degree to which the company will exercise collaborative/ problem-solving relationship strategies with these stakeholders. The lower the importance attached by a company to stakeholders considered spokespersons for the natural environment, the lower the degree to which the company will exercise collaborative/ problem-solving relationship strategies with these stakeholders*

The term "neighbours" is used by the managers of Buffalo to describe local communities, concerned citizens, and environmental groups impacted upon by their operations. Buffalo's managers express considerable pride in managing their relationships with their stakeholders and

frequently refer to the need to build up "reserves of goodwill" with their "neighbours" - indicating the concept of goodwill as a sustainable competitive asset (Dierickx & Cool, 1989).

While the reactive companies talk about holding open houses at their upstream operating facilities, and setting up forums for discussion wherever local communities are present, the proactive companies' managers interact by reaching out and responding to the concerns of the communities and environmental groups. The environmental groups contacted view the entire oil and gas industry negatively. They feel, however, that Buffalo's managers are better listeners and more open to suggestions. Thus relationship-building approaches also lead to positive influences on the members of external stakeholder groups, engendering an atmosphere of collaborative non-confrontational problem-solving. The environmental groups and local communities prefer dealing with the reactive companies through litigation and court cases, or by opposing their every move.

> *H9b: The greater the degree to which managers of a company consider it important to exercise collaborative/ problem-solving relationship strategies with stakeholders such as environmental groups, wildlife protection groups, and local communities, the greater the degree to which it will exhibit interactive strategies of environmental responsiveness. The greater the degree to which managers of a company consider it important to follow adversarial/ litigation based strategies in dealing with stakeholders such as environmental groups, wildlife protection groups, and local communities, the greater the degree to which the company will exhibit reactive strategies of environmental responsiveness.*

It is likely that the stakeholder relationship strategies of proactive companies will fall somewhere in-between these two extremes of collaborative and adversarial strategies. It was found during the study of the oil industry that Sioux, the proactive company, exercised collaborative and problem-solving approaches with its stakeholders. However, it viewed a smaller range of stakeholders as strategically important as compared to the interactive company, Buffalo.

5.5.4. Summary. Early response in beginning to deal with the business-natural environment interface not only increases the zone of discretion for the company, but also allows its managers to familiarize themselves with the issues involved and generate knowledge about ways of balancing their economic and environmental performance targets. The business exposure of a company, as determined by the range of its products and activities, affects the extent of interface of a company's operations with the natural environment. This determines the range of stakeholder objectives and concerns that the company is forced to deal with. A company can choose to deal with these stakeholder concerns through adversarial/ litigation-based strategies, or it can choose to adopt collaborative/ problem-solving approaches to accommodate stakeholder concerns. The range of stakeholders and the relationship strategies influences the corporate environmental responsiveness strategy followed by a company.

5. 6 Organisational outcomes

This section discusses the linkage between different corporate environmental responsiveness strategies and organizational outcomes including firm economic performance.

5.6.1. The emergence of organizational capabilities: A change in organizational philosophy to accommodate concerns for environmental preservation brings about fundamental ideological changes about how business operations should be conducted. In accordance with the discussion in section 2.2 about environmental philosophies, as a company progresses up this continuum of environmental philosophies these changes are of the following types:

(a) A change in thinking from linear processing to cyclical processes with closed-loop material use being an ideal. This involves changes in thinking from cleanup of waste and pollution to waste

prevention at source; to waste reuse as inputs; to recycling of wastes; to exchange of wastes with other companies within and outside the industry for use as each others' process inputs;

(b) A change in thinking from efficiency of material use to the sustainability of material use. This not only involves conservation of non-sustainable inputs but also a move to using more sustainable inputs;

(c) A change in thinking from maximizing sales of non-sustainable and environmentally-damaging products to educating consumers in conserving resources and curbing wasteful consumption.

These fundamental changes require a questioning of conventional wisdom and can spark a higher-order learning process if fostered by the organizational factors that influence managerial interpretations of environmental issues as opportunities. These higher-order learning processes can lead to the emergence of knowledge-based organizational capabilities as a result of activities undertaken to deal with the on the business-natural environment interface.

The interactive company, Buffalo, lists a long list of organizational benefits as a consequence of its corporate environmental responsiveness strategies. These range from lower costs of processes, inputs, products, to better products, innovations, improved corporate reputation and relationships with a wide range of stakeholders. Sioux emphasizes product differentiation and innovation as well as improved corporate reputation and relationships with stakeholders. In contrast, the reactive companies are unable to connect their corporate environmental responsiveness strategies with any positive organizational outcomes other than reduction in risk of environmental accidents. The three main capabilities emerging from proactive and interactive strategies of corporate environmental responsiveness are:

(a) Capability of establishing relationships with stakeholders with non-economic goals: The most important capability that emerges is the ability to establish trust-based positive relationships with a wide variety of stakeholders, especially those with non-economic goals. In contrast to the reactive companies which express pride in their relationships based on mutual economic goals with customers, suppliers, and investors, Buffalo and Sioux's managers are most proud of their relationships with environmental groups, local communities, regulators and other groups motivated by non-economic goals. These relationships are based on values and ideologies for the preservation of the natural environment and not for economic gain of the interacting parties. Joint problem solving, information sharing, and negotiation (Gray, 1989) takes place here within the framework of environmental protection and not within the framework of the economic transaction.

Buffalo and Sioux, having decided to become industry leaders on environmental protection, determined that it was essential first to understand the real environmental issues by establishing positive and trust-based interactive relationships with multiple stakeholders who were concerned about, and spoke for, the natural environment. The twin goals of goodwill generation among diverse stakeholder groups and reducing environmental impact of corporate operations became primary goals for both companies. This required organizational incentives to facilitate the conscious development of the abilities of all employees to listen to, and give weight to the viewpoints of the various stakeholders interacting with the natural environment, such as environmental groups, local communities, regulators, suppliers, consumers, employees, native communities, etc. This is an outside-in process that started when employees began to interact with these stakeholders to identify and understand the important issues in the business-natural environment interface. Once these interactions started, employees became

more aware about their companies' environmental impact. They developed the ability to listen to, respond to, and thus build up mutual trust and credibility with these stakeholder groups. According to the managers of the proactive companies, this process took between five to seven years of consistent actions and behaviour to seep deeply into the organizational culture and decision-making patterns. This ensures that new employees learn quickly that developing positive relationships with a wide variety of stakeholders is as important as satisfying customers and earning an above industry average return for the investors. The proactive companies have also benefited from a battery of subtle sources of social influence derived from their employees' close relationships with the representatives of these stakeholder groups. These close interactions increase the likelihood that stakeholder representatives will also have positive and favourable influences on critical decisions made by these groups in respect of the interactive/proactive companies (Sharma, Vredenburg & Westley, 1994; Vredenburg & Marshall, 1991).

The trust and credibility developed with these stakeholder groups is a time-dependent strategy asset that can not be easily imitated by competitors (Dierickx & Cool, 1989), since this asset is based upon a decade of consistent actions by the companies to reduce their impact on the natural environment in consultation with a diversity of stakeholder groups. The representatives of environmental groups, and local communities in interaction with these companies' operations, confirm that they have positive relationships with these companies, that they are consulted on actions impacting upon the natural environment, that their opinions are given importance, and that they tend to believe the statements of these two companies. These groups have negative impressions about the reactive companies. According to the officials of the regulatory agency (A. E.R.C.B.), while no company has a

perfect record in meeting emissions and solid wastes limits, the two proactive companies make more sincere efforts than others to cut down their emissions and wastes. The regulators confirm that they give the benefit of doubt to in case of minor infractions by "sincere" companies and concentrate on companies that tend to have a "bad attitude" towards meeting environmental standards. In general, the regulators have a positive view of the larger reactive companies as well, but a negative view of the two junior companies in terms of "sincerity." This is consistent with the definition of the reactive companies as those complying with regulations. Similarly, the representative of Greenpeace, opposed to the oil industry, stated, "at least we can talk to these (interactive/proactive) companies..., they are in a dirty business but at least they try harder than the other larger companies that have greater resources."

The reactive companies think in terms of public relations or the management of the concerns of the external stakeholders. These companies feel that stakeholders such as environmental groups and local communities, unlike investors who have representation on the board, or the regulators who have coercive power, or customers who have purchasing power, need to be persuaded to understand the company's point of view. These companies feel that there is no need to establish non-economic and values-based trusting relationships with these stakeholder groups who are out to oppose their every move. These companies are still actively fighting and lobbying the government to open up ecologically sensitive areas for exploration and development. Environmental groups and local communities confirm that these companies do not involve them in consultation processes and in major decisions impacting the natural environment.

The benefits of this firm-specific capability, i.e., ability to establish positive trust-based relationships with stakeholders, lie in easing of opposition in everyday operations and development

plans. The proactive companies are able to go through public consultation hearings and approval processes for new developments much faster, and thus save time and money. The reactive companies face stiff opposition, and these hearings can go on for years without resolution. In contrast, Buffalo and Sioux always consult environmental groups and local communities before announcing new developments. If these stakeholders clearly indicate that the development is not desirable due to ecological sensitivity, these companies withdraw without spending time and money on legal battles. These groups are satisfied with the voluntary actions taken by Buffalo in voluntarily withdrawing from two ecologically sensitive areas, and in breaking ranks with the industry to lobby the government to declare these areas preserves.

While Buffalo's emphasis is on relationship-building with stakeholder groups at the upstream end of its operations, Sioux's emphasis is on relationship-building with customer groups which include farmers, government agencies, crown corporations, non-profit organizations, N.G.O.s, etc., all supportive of this company's moves towards less environmentally damaging fuel alternatives. Sioux's recycled engine oil was purchased by these groups for twelve years, keeping the pioneering operation alive. With growing awareness of environmental degradation, more consumers are buying the recycled oils and the company is making profits on this operation. While these relationships were forged mainly with customer groups, these were based more on ideology and not on economics, since the company's ethanol blends, reformulated gasolines, and vegetable based engine oils are more expensive than the conventional alternatives.

Thus the capability to establish trust-based relationships with external stakeholders with non-economic goals has benefited the proactive companies through faster approvals on new developments,

lower litigation expenses on environmental issues, a very high level of goodwill among communities which translates into sales at their retail outlets, high level of respect for the company and its employees, and a positive corporate reputation in a society concerned about environmental protection. These capabilities are based on changes in fundamental business attitudes and values and require organizational change over a period of time. Thus these capabilities are firm-specific in that they are nurtured and facilitated within organizations that have made changes in fundamental philosophies towards environmental protection and have created the organizational context to facilitate managerial discretion (Finkelstein & Hambrick, 1990). These capabilities reside in every employee by virtue of corporate culture and are not the exclusive preserve of boundary spanners, and thus span functional areas and hierarchical levels.

(b) Capability of continuous innovation: As the window for technological innovations gets shorter, even internal innovations in systems and management practices are rarely defensible against competitive actions. However, a capability for continuous innovation enables an organization to stay a step ahead of competitors who cannot develop this capability as quickly or those who may not be interested in developing such relationships. Organizational philosophies and systems in the interactive/proactive companies support experimentation and the pursuit of opportunities at the business-natural environment interface in an efficient and effective manner by facilitating managerial discretion (Finkelstein & Hambrick, 1990).

According to the managers of the reactive companies, the oil and gas industry is mature, and innovations in processes, technology, and products are likely to be rare due to lack of long-term horizons. Most managers are of the opinion that since only between fifty to seventy years of

commercially viable oil stocks remain worldwide there are no incentives in making quantum leaps in technology. The contrast in the innovation rates of the reactive and interactive/proactive companies, as determined from interviews and company documentation, is remarkable in terms of the list of innovations made by these companies before 1993 and in 1994 as listed in Appendix 2. According to the reactive companies, major innovations are unrealistic since the technological base of the industry is constant and most companies were currently using recent state-of-the art equipment with high productivities and efficiencies. In contrast, the same technological levels and state-of-the-art equipment did not constrain the interactive/proactive companies from the innovations that they listed. Only the major innovations are listed in Appendix 2 since several of the hundred or so are very minor technical changes in the processes and products. However, these minor innovations are also purported to have effects on cost reduction and/or product/ process improvement.

As can be seen from the Appendix 2, Buffalo and Sioux have developed unique innovation capabilities different from each other and from other firms in the industry. While Buffalo has concentrated on a stream of technological innovations in its operations, Sioux has concentrated on product-based innovations. However, the above list of innovations given above does not reflect the visible excitement, or "positive glow" (Dutton, 1993), of dealing with a whole new area of continuing opportunity evidenced by the managers of Buffalo and Sioux. The capability to innovate in these companies is not confined to a specific operation, functional area, or hierarchical level, but is a pervasive part of the organizational culture.

(c) Capability of facilitating higher-order learning: The innovations listed above were attributed by managers to learning processes generated as a result of the need to think about the business-natural

environment interface. According to the managers of Buffalo and Sioux, this is the one frontier in a technologically mature industry that is open to fresh learning, innovations, and productivity improvements. Having been driven by visionary leadership in both cases to accommodate the concerns and objectives of all external stakeholders and to generate and build-up goodwill for their respective companies, these managers find themselves open to a host of outside influences and thinking. As these influences sparked thinking processes that do not follow conventional industry wisdom, the two companies have come to be seen as mavericks in the industry. Both companies have not been active participants in the Canadian Association of Petroleum Producers, the bastion of conventional thinking. Managers of Buffalo and Sioux explained that once they opened their minds to ideas from stakeholders such as local communities and environmental groups, they were also able to gaze inwards and find ways of accomplishing the objectives of these groups while generating innovations and productivity improvements within their organizations.

This is a circular process where outside influences spark internal learning and innovation, which leads to demonstrated actions for environmental protection, which, in turn, leads to better relationships with external groups, which once again leads to greater outside influence and internal organizational learning. Higher order learning, in addition to leading to capability development within the companies, is also a capability in itself that opens up organizational perspectives and enables the questioning of conventional wisdom. The process of organizational learning has become a part of the organizational culture, where managers are encouraged to seek outside influences and perspectives on organizational operations, question conventional wisdom by constantly looking for ways of reducing environmental impact, and being allowed to experiment and find better ways of running their business.

Higher order organizational learning processes in these companies involve the following common dimensions: (a) Integration of knowledge; (b) Diffusion of knowledge; (c) Keeping up the momentum of learning; (d) Feedback on knowledge application. Managers are encouraged to act upon and experiment with ideas resulting from outside influences and perspectives on operations. In both companies, to encourage formal interaction, monthly meetings under the themes "Environmental leadership" (Buffalo) and "Alternative Energy Developments" (Sioux) bring together a changing mix of managers from all of the company's facilities and operations. These groups discuss advancements in knowledge on the business-natural environment interface and actions taken to reduce environmental impact in each managers' respective operations. Managers interact to determine ways in which each of these developments can be implemented in other aspects of the company's operations. Managers are also encouraged to formulate informal groups for discussion and interaction. According to the managers, they are able to freely interact on phone and on electronic mail with their colleagues whether in the head office or in the field, and that they are continually able to assist and learn from each other on effective actions for smooth handling of the business-natural environment interface.

Due to the currently low level of existing knowledge in the industry regarding effective ways of reducing environmental impact, benchmarks that are accepted industry-wide do not exist. Thus, during these monthly meetings, training programmes are also run by outside consultants and corporate environmental assessment managers who have a greater understanding of ways of assessing the impact of operations on the natural environment. The solutions for reducing these impacts are left to the managers. The organizational cultures of these companies support the process of knowledge generation through learning, and the dissemination of this knowledge to spark further knowledge

generation. This is a firm-specific capability since the same managers may not be able to adopt similar stances on experimentation, learning, and knowledge generation in other organizations that do not have a mandate for environmental protection. These capabilities have also been developed by these companies during a decade of organizational change and nurturing.

> *H10a: The greater the degree to which a company adopts interactive corporate environmental responsiveness strategies, the greater the degree of emergence of organizational benefits that are sources of competitive advantage. The greater the degree to which a company adopts reactive corporate environmental responsiveness strategies, the lower the degree of emergence of organizational benefits that are a source of competitive advantage.*

> *H10b: The greater the degree to which organizational benefits emerge in response to corporate environmental responsiveness strategies, the greater the degree to which these benefits will exhibit features of unique firm-specific capabilities that are sources of competitive advantage. The lesser the degree to which organizational benefits emerge in response to corporate environmental responsiveness strategies, the lesser the degree of these benefits exhibiting features of unique firm-specific capabilities that are sources of competitive advantage.*

5.6.2. Economic performance: It is extremely difficult, even impossible, to control for the several organisational and industry factors that may cloud the time-lagged relationship between proactive/interactive corporate environmental responsiveness strategies and economic performance. In fact, in the short-term, reactive companies may perform better due to lower investments of resources and managerial time in environmental responsiveness. In the long-term, with the emergence of higher-order learning and organizational capabilities, the interactive companies are likely to perform better. The research design does not include the time dimension to explore relationships between corporate environmental responsiveness strategies and firm economic performance.

The objective of examining the relationship of corporate environmental responsiveness strategies with an economic performance outcome variable, is to establish that even if proactive/interactive companies are not more successful than their reactive counterparts, they perform at least as well economically. The exploratory study revealed that the proactive/interactive oil companies were above industry-average performers. While it can be speculated that the causal connection works the other way, i.e. an economically successful company can afford to invest in interactive environmental strategies, this seems improbable since larger and more resource-rich companies in the oil industry exhibit reactive strategies of corporate environmental responsiveness. It is assumed, as revealed in the exploratory study, that companies in the oil and gas industry have consistently followed similar strategies for the last five years, i.e. those following reactive strategies have not switched to proactive or interactive during the last five years.

The exploratory study points to the fact that the interactive/proactive companies have been following these strategies consistently over the last decade or more. Due to the need for fundamental philosophical and design changes, a company cannot change its environmental strategies from reactive to proactive within a year or a couple of years. Similarly, organizational capabilities and a base for strong economic performance take a long-period of time to build up (Dierickx & Cool, 1989). As a result, positive relationships between interactive/proactive corporate environmental responsiveness strategies and organizational outcomes are predicted.

> *H11: The greater the degree to which a company adopts interactive strategies of corporate environmental responsiveness, the greater the degree to which it's economic performance will be above industry average.*

A converse hypothesis is not presented since without controlling for individual firm variables and industry variables, it is impossible to state the relationship between reactive corporate environmental responsiveness strategies and economic performance.

5.6.3. Chapter summary. This chapter emphasizes the role of managerial interpretations of environmental issues as opportunities rather than threats as influencing corporate environmental responsiveness strategies. In addition to managerial interpretations, collaborative/problem-solving relationship strategies with stakeholders considered spokespersons for the natural environment, and the timing of response of the company in the environmental issue lifecycle, are considered as important influences on corporate environmental responsiveness strategies.

Managerial interpretations of environmental issues are seen to be influenced by: (a) leadership influences such as the shaping of corporate environmental philosophy and the shaping of organizational identity as institution-oriented rather than enterprise-oriented; and (b) organization design variables such as knowledge creation and dissemination mechanisms, managerial discretion for experimentation, and control systems that evaluate employees on environmental performance.

Proactive/interactive corporate environmental responsiveness strategies are seen to result in organizational benefits which may be in the nature of unique firm-specific organizational capabilities. These capabilities result in above-average economic performance for these companies.

The framework of organizational factors influencing corporate environmental responsiveness strategies, which in turn influence organizational outcomes, is dynamic. Positive organizational outcomes reinforce managerial and top management commitment to interactive and proactive strategies. Therefore, Figures 1 and 2 indicate a feedback loop from organizational outcomes to managerial interpretations of environmental issues. The cross-sectional research design is unable to incorporate measures for the feedback process. However, the feedback process has been emphasized by managers of the interactive and proactive companies during the exploratory study. The positive organizational outcomes, initially in terms of reputation and relationships, and later in terms of economic benefits, kept these organizations focused on environmental preservation.

Chapter six describes the research method for the mail survey to test the hypotheses presented in this chapter.

CHAPTER SIX - RESEARCH METHOD - THEORY TESTING THROUGH THE QUESTIONNAIRE BASED MAIL SURVEY

This chapter describes the research method used for the theory testing phase of the study through a questionnaire based mail survey in the Canadian and U.S. oil and gas industries.

6.1. Overview. The objective of the mail survey was to improve the generalizability of the case studies to the North American oil and gas industry, as also the external validity of the theoretical framework developed through the exploratory and qualitative research. The model of corporate environmental responsiveness developed by integration of an exploratory study from the grounded perspective in the Canadian oil and gas industry and literature review was tested among samples of the Canadian and U.S. oil industries. The rationale for considering both U.S. and Canadian industries was twofold: (a) in case corporate environmental responsiveness strategies did not differ across the Canadian and U.S. oil and gas industries, the model would gain in generalizability; and (b) in case differences were detected, there could be possible managerial and public policy implications due to the differences in regulatory contexts in the two countries. The U.S. regulatory system emphasizes detailed guidelines and punitive penalties, the Canadian system emphasizes collaborative processes framed within broad guidelines.

It can be argued that a theoretical framework developed within the limited context of the Canadian oil and gas industry may not be applicable to the U.S. industry. However, there were resource and time constraints in undertaking similar exploratory work in the U.S. oil and gas industry. As a result, it was decided to test this framework in the two different countries in the

hope that some common variables influencing corporate environmental responsiveness strategies would emerge.

6.2. Sampling. The Canadian Association of Petroleum Producers (CAPP) estimates a total of around 2000 oil and gas companies in Canada and a total of around 3000 in the U.S. According to the association, most of these companies are very small resource owners or leasing companies with limited activities and very little interface with the natural environment.

The Compact Disclosures database for Canadian companies contains details of around 1000 Canadian oil and gas companies that fall into all SIC codes pertaining to oil and gas drilling and exploration, oil and gas services, oil and gas pipelines and transportation, petroleum and petroleum products manufacture and marketing, and petroleum refining. Most of these companies are listed on Canadian stock exchanges and are public, although a few larger private companies are contained in this database as well.

In accordance with observations made during the exploratory study, and as confirmed by CAPP, smaller companies with annual sales revenues of less than C$ 20 million were not expected to show any variation in corporate environmental responsiveness strategies other than minimum regulatory compliance. These smaller companies would also be less likely to respond to a lengthy questionnaire due to limited resources and manpower. Adopting a C$ 20 million annual sales revenues cut-off point, a population of 163 active Canadian companies emerged. An analysis of sales revenues revealed that these 163 companies constitute almost 80% of the total sales revenues of the 1000 companies in the Compact Disclosures database. After a comparison of these 163 company names with an internal proprietary list, an official of CAPP indicated that

none of the private or public Canadian oil and gas companies with annual sales revenues over C$ 20 million had been excluded.

The Compact Disclosures database for U.S. companies contains details of around 1200 public, and a few large private U.S. companies, that fall into all SIC codes pertaining to oil and gas drilling and exploration, oil and gas services, oil and gas pipelines and transportation, petroleum and petroleum products manufacture and marketing, and petroleum refining. Adopting a U.S. $20 million annual sales revenues cut-off point, a population of 225 active U.S. companies emerged. These 225 companies constituted around 78% of the total sales revenues of the 1200 U.S. companies. Thus, the initial range of companies to whom the survey would be mailed was the entire populations of Canadian and U.S. companies with annual sales revenues in excess of $20 million (Canadian or U.S. funds).

Each of these companies was contacted over the telephone to obtain names and titles of potential respondents to the questionnaire. These telephone calls led to the reduction of the total number of companies to be surveyed. Due to constant merger activity in the oil and gas industry, it was revealed that some companies had merged since the database had been updated. Some companies were managed by other companies and the same set of managers were involved in decision-making in both companies. As such, they refused to fill in two sets of questionnaires for the two companies. Some companies just owned and leased out oil and gas drilling equipment to smaller exploration companies. As such, these companies had little interface with the natural environment. As a result of the telephone calls, the total number of Canadian companies was reduced to 110, and the U.S. companies were reduced to 163.

The largest theoretical model to be tested in this research study through multiple regression analysis consists of seven independent variables. Adopting a rule of the thumb of 10 cases required for every variable to generate sufficient power for multivariate statistical analysis (Tabachnik & Fidell, 1989), a response from around 70 companies was required in each population. This constituted around 55% of the total Canadian companies and 37% of the total U.S. companies surveyed. Adopting more sophisticated statistical power tables (Cohen, 1988) after adjusting for small population size, a response size of around 70 companies in both populations will yield a statistical power of 0.80 for an effect size of 0.20 at a significance level of $p < 0.05$.

6.3. The research instrument - item reliability and validity checks: Feedback on the initial draft of the questionnaire was obtained from the doctoral advisory committee. Further feedback was obtained from seven individuals with expertise in the areas of environmental assessment, oil and gas industry, and corporate strategies. These included two management professors, one faculty member in environmental design, one faculty member in environmental engineering, a retired director of the Alberta Energy and Resources Conservation Board, an official of CAPP, and an environmental assessment manager in a 'senior' integrated oil and gas firm. Based on feedback from these expert judges, the questionnaire was modified. The modified questionnaire was pretested on 25 managers from 15 oil and gas companies who were enrolled in an environmental engineering course.

The objective of this pretest was to ensure ease of understanding, the relevance of the items included in the questionnaire, and the time taken, and ease with which the questionnaire would be completed. Based on feedback from the 25 managers, slight modifications were made in

the questionnaire to eliminate items which seemed either redundant, irrelevant, or required information which a manager may not readily have. The population for administering the questionnaire was very limited, and a larger pilot test within this population would have jeopardised the response to the final survey. In fact, at least five respondents to the mail survey called back to state that they had already filled in the questionnaire in the pretest. These five managers had to be excluded from the survey.

Some of the constructs used in the questionnaire were based on established scales. However, environmental strategies and environmental philosophies constructs, among others, had to be developed for this study. Consequently, scale reliability tests were run on the data using the Cronbach Alpha reliability measure. The scores indicate a fairly high scale reliability of between 0.70 to 0.90 for most scales. Consequently, the questionnaire was treated as final for administration to the sample population chosen. A copy of the questionnaire is enclosed in Appendix 1a. Construct validity tests were not run on the pretest data since the small number of cases in the pretest (25 respondents) would have led to biased and inconclusive effects of predictor variables on criterion variables. Ethics approval was obtained from the University of Calgary Conjoint Areas Research Ethics Committee.

6.4. Multiple Respondents. Most research studies in strategy rely upon key informants to provide information at the organisational unit of analysis by reporting on organisational properties (Seidler, 1974). The unit of analysis is the business firm, and the characteristics of a business firm may differ from the characteristics reflected in the feelings, opinions, or perceptions of managers within the organization (Phillips, 1981). The use of single respondents also prevents a

determination of the extent to which variation in measurements are due to (1) the concept or variable being measured, (2) systematic sources of error, or (3) random errors (Bagozzi, 1980). It is possible that different informants may use different information or events to form opinions or give different weights to different information.

In the present study, it was important to obtain responses from multiple respondents within each respondent company due to two reasons: (a) Corporate strategies are organizational constructs that need to be viewed from multiple viewpoints within an organization, especially in view of the fact that these strategies may often be emergent (Mintzberg, 1978) and not formalized in the top management strategic planning process; (b) The measure for environmental philosophy is likely to be biased with personal managerial values toward the environment. Averaging out of multiple responses can be argued to be closer to an organizational philosophy rather than a single response.

Separate questionnaires were sent to between two to four managers in each company. These managers included the chief executive officer or a member of the top management team, the environmental assessment manager, a senior line manager or profit centre head, and boundary spanning middle manager - preferably a marketing manager. The smaller companies often combined several of these functions with one individual and had fewer respondents. To illustrate, several upstream junior and intermediate companies had a development manager responsible for marketing, new developments, administration, environmental assessment, health and safety functions. The exploratory study revealed that these managers represented a fair mix of decision makers on the business-natural environment interface.

It is it important to obtain multiple informants, but it is also important to use the data from multiple informants to assess the reliability and validity of measurements of the organisational variables. For convergent validity to be achieved, it is necessary that correlations between informants reporting on the same trait be positive and statistically significant (Campbell & Fiske, 1959). Inter-rater reliability between multiple respondents was computed using analysis of variance across responses to all the items in the questionnaire after excluding demographic variables (Shrout & Fleiss, 1979; Tinsley & Weiss, 1975).

6.5. Survey administration - response rate. The response rate to the survey was satisfactory - 99 Canadian companies (90%) and 74 U.S. companies (45%) responded. Sixty five Canadian companies (60%) and ten U.S. companies (13.5%) provided multiple respondents. Many of these Canadian companies provided three, four, or even more respondents. While the multiple response rate among U.S. companies was not good, a high inter-rater reliability among Canadian companies is generalised to the U.S. sample in this study.

This good response rate can be attributed in large part to the following survey administration procedure:

(a) All companies were personally contacted over the phone to obtain names of the persons responsible for the functions of the president, environmental assessment, marketing, and line operations/production. Wherever possible, at least one person in these companies was contacted over the phone and the survey objectives were explained.

(b) The questionnaire mailings were made through the Canadian Association of Petroleum Producers (CAPP) which agreed to fund a portion of the research expenses. The covering letter

(sample enclosed as Appendix 1b) included the name of CAPP as a co-sponsor of the research. The first mailing resulted in responses from 71 Canadian companies and 33 U.S. companies.

(c) Three weeks after the initial mailing, faxed reminders were sent to non-responding Canadian companies. Since the database for the U.S. companies did not include fax numbers, a second mailing was made to all non-responding U.S. companies four weeks after the first mailing. Within two weeks of the faxed reminder to Canadian companies (accompanied by telephone calls to 15 companies), the total responses were up to 93. Within four weeks of the reminders, the total Canadian companies that responded reached 99. The second wave of mailings for U.S. companies was successful in bringing in 41 additional responses, taking the total up to 74.

As a result of a 90% response rate among Canadian companies, non-response bias does not seem to be a factor among the Canadian responses. Non-response bias may still be an issue with the U.S. companies and this has been dealt with in the results section.

6.6. Data analysis. The theoretical model that was developed from the exploratory study specifies the directions of the influence between predictor and criterion variables, and lends itself to ordinary least squares multiple regression. The number of responding cases for the Canadian and U.S. industry were 99 and 74 respectively. This number exceeds the 70 cases worked out as the minimum necessary for obtaining sufficient statistical power to meaningfully interpret the effects of the regression (Tabachnik & Fidell, 1989). The theoretical model was fairly well developed through the exploratory study and most variables are distinct and emergent from data relevant to the industry studied. Neither the nature of the model, nor the numbers of cases lend

themselves to structural equation modelling techniques which require large numbers and a large number of variables with underlying latent constructs (Jöreskog, 1971).

Almost all the variables have been measured using Likert-type interval scales (seven point), and hence are treated as continuous variables. In this situation, as long as the regression assumptions are met, multiple regression is the most robust statistical tool of analysis and testing of the model (Berry, 1993; Pedhazur, 1982). Data diagnostics were run to verify the linearity, normality and homoscedasticity of the distributions of the variables. These regression assumptions must be met in order to generate best unbiased linear estimates of the effects of predictor variables on criterion variables (Berry, 1993).

Significance levels: Choosing significance levels for statistical tests based on sample distributions such as *t*- values is based on the purpose for which such measures are used (Skipper, Guenther, & Nass, 1967). In exploratory research, where the variables are preliminary newly developed constructs which have not been tested in a variety of situations, a significance level of $p < 0.10$ is acceptable as a cut-off criterion to judge statistical significance. This is more often, than not, the case in social sciences (Lutz, 1983). In sophisticated studies, especially in the natural sciences, where several replications have been made and the constructs have been refined, a level of significance of $p < .01$ is acceptable. In most social science research that uses a mix of established and preliminary constructs to measure complex phenomena subject to a wide variety of social and psychological influences, a level of significance of $p < .05$ is deemed as acceptable. Due to the exploratory nature of the present study, and also due to the preliminary nature of the constructs intended to represent complex phenomena, a significance level of $p < 0.10$ would

normally be acceptable. However, the significance levels that emerged for most of the statistically significant relationships in this study were below $p < .01$ (most being below $p < .001$). This shows strong support for the underlying hypotheses, in spite of the preliminary nature of the constructs used and the complex social and organizational phenomena that are sought to be measured.

Scale reliability: Scale reliability tests were run for each variable using Cronbach Alpha. Scale reliability is undertaken to determine the internal consistency between the items constituting the scale and also the stability of these items in different measurement situations. The reliability helps decide whether or not to include all the indicators or items used to measure a variable into the construct. The coefficient alpha is a measure based upon the average correlation among items within a construct to indicate internal consistency between the individual items. Coefficient alpha sets an upper limit to the reliability of tests constructed using the variables or measures. Even though coefficient alpha does not consider some sources of measurement error, it is never substantially higher than other measures of reliability (Nunnally, 1978).

A satisfactory level of reliability depends upon the use of the measure. In the early stages of research (as in the case of exploratory studies to test social sciences models) instruments with reliabilities of 0.70 are sufficient. If the resultant correlations with these measures are significant, then it will be worthwhile to work on these measures to increase items and otherwise reduce measurement error (Nunnally, 1978). Alpha values are also shown for each indicator or item indicating the overall alpha for the scale if the indicator or item were to be deleted from the scale. Normally, items that substantially improve the overall alpha reliability if they are excluded, should be deleted. However, such decisions must be theoretically justifiable.

Factor analysis: Factor analysis is a name given to a broad category of approaches to conceptualize groupings of variables. These are data reduction methods which are often used to develop the structure and assess the fit between the data and the hypothetical structure (Tabachnik & Fidell, 1989). Factor analysis is applied to a single set of variables where the researcher is interested in discovering which variables in the set form coherent subsets that are relatively independent of one another. Variables that are correlated with one another but largely independent of other subsets of variables are combined into factors. The criterion for combining such variables is ultimately theoretical justification (Tabachnik & Fidell, 1989).

The method for data reduction used was principal component analysis wherein all the variance is distributed to components, including error and unique variance for each observed variable. Thus, if all components are retained, principal components analysis duplicates exactly the observed correlation matrix and the standard scores of the observed variables. Each principal-components factor explains more variance than would the loadings obtained from other methods of factoring (e.g., principal axis factoring) (Nunnally, 1978).

The results of factor extraction are rotated to improve the interpretability and scientific utility of the solution. Oblique rotation assumes that the factors are correlated, as is more likely in social science phenomena. Oblique rotation offers a continuous range of correlations between factors and when the value of correlation is less than zero, the solutions are increasingly orthogonal. Orthogonal rotation methods such as varimax and quartimax were also used in the analysis. The results were not significantly different from the results obtained from oblimin rotation. While orthogonal rotation methods are mathematically more elegant, oblique rotation is

conceptually more sound (Nunnally, 1978; Tabachnik & Fidell, 1989). There are ultimately very little significant difference in the factors that emerge or even the factor loadings as a result of using different methods of rotation (Nunnally, 1978; Tabachnik & Fidell (1989)).

A factor loading cut-off of 0.70 was adopted (Nunnally, 1978) as generally acceptable to make a decision on whether or not to accept a particular configuration of indicators as constituting a separate factor. There is no hard and fast rule for a cut-off criterion, but a correlation of less than 0.70 between an item and a factor is generally considered to have a high measurement error (Nunnally, 1978). However, in the ultimate analysis, theoretical justification drives these decisions, and loadings higher than 0.30 may be acceptable in certain cases. Any loading lower than 0.30 explains less than 9% of the variance in a factor and is not acceptable (Nunnally, 1978).

Differences between the U.S. and Canadian datasets: Differences between the U.S. and Canadian datasets were compared for differences by following three methods. (a) Absolute mean values were compared for substantial absolute differences. (b) Since the U.S. response rate was 45% and substantially lower than the entire population, it constitutes a form of self-selected sample. Thus the *t*-values of the U.S. data means were compared with absolute mean values in the Canadian data. This was due to the fact that Canadian responses approached population values. (c) Chow tests were run on the residual sums of squares generated by each regression model in the Canadian, U.S., and combined datasets to determine whether the two datasets could be pooled. While the Chow test for some regression model indicated that the datasets could be pooled, the tests for some other regression models indicated that the assumption of equal

parameters for the two datasets was unrealistic. Regression models for which the Chow tests indicated statistically significant differences between the two datasets, were rerun with interaction terms for the country and the variables in the equation. This was done to examine which of the individual coefficients was statistically significantly different between the two countries.

While most variables seemed to differ little in terms of statistical significance in the two datasets, it was decided to run the two datasets separately on theoretical grounds. It was assumed that the Canadian and U.S. oil and gas industries operate in different regulatory and social environments. The U.S. regulatory environment emphasizes specific detailed guidelines and punitive penalties. The Canadian regulatory environment emphasizes collaborative public consultation processes.

6.7. External validity. The high response rates, specially from the Canadian population, eliminates validity concerns due to non-response bias. The non-response bias tests based on company demographics of the responding and non-responding groups of U.S. companies shows no statistically significant differences between the two groups (see section 8.3). Concerns can be expressed that only companies with annual sales revenues in excess of $20 million are included in the study. However, the exploratory study and the opinions of industry experts are in agreement that the very small companies with sales of less than $ 20 million will show little variation in environmental strategies beyond minimum regulatory compliance due to lack of resources for proactive action. Further, the population of the U.S. and Canadian oil and gas industry included in the study represents almost 80% of the total annual sales revenues of the industry. This argues for representativeness in terms of the economic concentration of the sample.

Chapter seven discusses the operationalization of the constructs used in the mail survey, and presents the measure and scale development statistics.

CHAPTER 7 - MEASURE AND SCALE DEVELOPMENT

This chapter describes the operationalization of the variables into measurable constructs used in the questionnaire. The first part of the chapter describes the operationalization of organizational factors impacting upon corporate environmental responsiveness strategies. The second part of this chapter discusses the development of the corporate environmental responsiveness strategies construct. The third part of discusses the operationalization of the organizational outcome variables - organizational capabilities and firm economic performance. The discussion on measure development also includes scale reliability measures for the pretested data, and the main datasets for the Canadian and U.S. companies.

The rationale for using these statistical analysis methods and significance levels have been discussed in chapter six on data analysis methods used for the mail survey data.

7.1. Measure development for managerial interpretations of environmental issues.

The three major dimensions of threat and opportunity perceptions that need to be measured are positive/negative, controllable/uncontrollable, and gain/loss. These dimensions and their measures are adapted from Jackson & Dutton (1988). To illustrate, threat perceptions may be accompanied by feelings of loss without gain, low control because others constrain actions, feelings of being underqualified to deal with issues, lack of technical knowledge on the business-natural environment interface. Opportunity perceptions may be accompanied by a high potential of gain without loss, likelihood of successful resolution with economic goals, feelings of high control because resources and information are available for resolution, ability to act autonomously, and feelings of being qualified to deal with the issue. The measures have been

adapted from some of the items used by Jackson & Dutton (1988) and are represented in interval scaled items in question number 2 of the questionnaire enclosed as Appendix 1a. The total scores yield a threat versus opportunity interpretation of environmental issues as two ends of a continuum. A low score indicates a high opportunity - low threat interpretation and a high score indicates a high threat - low opportunity interpretation.

This measure is correlated with the measure for corporate environmental responsiveness strategies, which is also an interval scale continuous variable. It is hypothesized that the lower the threat interpretations (indicated by a low score on the THREAT variable), the higher the score on corporate environmental responsiveness strategies variable (ENVSTRGY).

Table 5.1 below presents scale reliability measures for this construct using Cronbach Alpha with the dataset from the pretest, as also for the main dataset, separately for the Canadian companies and the U.S. companies.

Table 5.1: Scale reliability for managerial interpretations measure (THREAT)

Items	*Pretest*	*Canada*	*U.S.*
Cronbach Alpha	.9173	.8332	.7797
Alpha- if individual item deleted			
1. No benefits to company of environmental actions	.8850	.7962	.6964
2. Environmental actions constrained by others	.8953	.8060	.7575
3. Likely to lose rather than gain by environmental action	.9041	.8041	.7810
4. No possibility of resolution of environmental problems	.8961	.7872	.7033
5. Lack of technical knowledge	.9112	.8064	.7461

As can be seen from the table, the overall scale reliability measure (Alpha) ranges from .78 to .92 in the various datasets. The Alpha measure for the pretest data is higher than the Alpha measures for the survey datasets. This is expected since the pretest was administered to 25 industry executives enrolled in the same environmental engineering course. These executives were likely to have a greater convergence of response and thinking as compared to those in heterogeneous companies who responded to the survey.

Table 5.1 also shows the value of alpha if each of the individual items or indicators constituting the scale were deleted from the scale. This shows that the removal of none of these items makes an improvement in the overall alpha measure. Hence the five items constituting the scale are considered internally consistent and stable indicators of the managerial interpretations construct.

Table 6.1 presents results of principal components factor analysis among the items constituting this construct to examine whether the items constituting this scale seem elements of the same construct. Oblimin rotation was used to obtain a simple structure among the items constituting the scale. This analysis was run separately on the Canadian and U.S. datasets. The analysis was not run on the pretest dataset due to a small number of cases (Hayduk, 1987; Kim, 1978). A factor loading cut-off of 0.70 was adopted (Nunnally, 1978) as generally acceptable to make a decision on whether or not to accept a particular configuration of indicators as constituting a separate factor. However, in the ultimate analysis, theoretical justification drove these decisions.

The Canadian dataset confirms that all the items load on one factor. The total variance in the variable explained by this factor is around 61%. In the US dataset, two factors emerge - one explains 54% of the variance and the other explains around 21% of the variance in the variable. There does not seem to be any theoretical justification for breaking up this variable into two factors. The two items constituting the second factor do not seem to be theoretically different from the other three. Furthermore, these two items have factor loading scores of around 0.50 on the first factor. Hence, in the absence of theoretical rationale for having two factors in the US data and only one factor in the Canadian data, the five items constituting this construct are retained as indicators of one variable.

Table 6.1: Factor scores for managerial interpretations measure (THREAT)

Items	*Canada*	*U.S.*	
Factors extracted - P.C. oblimin rotation (percentage of variance explained)	1 (60.6)	2 (53.7)	(21.4)
Factor loadings			
1. No benefits to company of environmental actions	**.7842**	**.7123**	.4712
2. Environmental actions constrained by others	**.7614**	.5184	**.8301**
3. Likely to lose rather than gain by environmental action	**.7714**	.4886	**.8908**
4. No possibility of resolution of environmental problems	**.8214**	**.9060**	.1123
5. Lack of technical knowledge	**.7504**	**.8877**	.2166

7.2 Measure development for leadership influences on managerial interpretations.

7.2.1. Managerial perceptions of organisational identity. This construct is intended to measure the extent to which managers perceive their corporate identity as institution-oriented rather than enterprise-oriented. Corporate institutional identity dimensions are measured in items

in question number 3 of the questionnaire attached as Appendix 1a. The items included to measure institution-orientation include the extent to which the company is perceived as involved with social/community problems, the extent to which it collaborates with stakeholders for environmental preservation, the extent of support for the arts and charities, the extent to which it sees itself as an environmental leader, etc. The total scores will indicate institution-orientation versus enterprise-orientation in the corporate identity perception by the employees as two ends of a continuum.

The hypothesized relationship is that higher scores on the seven-point interval scale measuring perceptions of corporate identity as institution-oriented will be accompanied by lower scores on threat interpretations of environmental issues by managers.

Table 5.2 presents scale reliability measures for this construct using Cronbach Alpha with the dataset from the pretest, and also for the main dataset, separately for the Canadian and U.S. companies. The overall scale reliabilities are satisfactory and range between .80 to .84 for the various datasets. The alpha coefficients for the construct if each item were to be deleted are also all above .74 in the two datasets. This indicates that all the five items that constitute this measure are stable and internally consistent.

Table 6.2 presents results of principal components exploratory factor analysis among the items constituting this construct. This factor analysis has been run separately for Canadian and U.S. companies.

As can be seen, all items intended to measure institution-orientation of a company load onto one factor in both the datasets with factor loadings of 0.70 or higher. The single factor

explains 56% of the variance in the variable in the Canadian data and around 62% of the variance in the U.S. data. Hence, all of these items have been aggregated into a measure of institution-oriented identity of the company.

Table 5.2: Scale reliability for institutional identity measure (IDTYINST)

Items	*Pretest*	*Canada*	*U.S.*
Cronbach Alpha	.8210	.7979	.8404
Alpha- if individual item deleted			
1. Identity as a patron of arts and charities	.8413	.7491	.8229
2. Identity as collaborating with stakeholders	.7589	.7897	.8115
3. Identity as a good corporate citizen	.8373	.7543	.8309
4. Identity as an environmental leader	.7216	.7534	.8026
5. Identity as involved in social/community issues	.7238	.7458	.7626

Table 6.2: Factor scores for institutional identity measure (IDTYINST)

Items	*Canada*	*U.S.*
Factors extracted - P.C. Oblimin rotation (Percentage of variance explained)	1 (56.4)	1 (61.5)
Factor loadings		
1. Identity as a patron of arts and charities	**.7191**	**.7398**
2. Identity as collaborating with stakeholders	**.6975**	**.7740**
3. Identity as a good corporate citizen	**.7412**	**.7090**
4. Identity as an environmental leader	**.7917**	**.8017**
5. Identity as involved in social/community issues	**.8016**	**.8854**

7.2.2. Environmental philosophy. This scale relates to section 2.2 in chapter 2 which develops a detailed discussion of organizational environmental philosophy. Based on this discussion, a set of items have been generated to measure the continuum of environmental

philosophies that range from *conformity, economic, conservation,* to *restorative.* The items are included in question number 1 in the questionnaire attached as Appendix 1a. These items are measured along a seven-point likert-type scale. The total score of a respondent on these items is intended to indicate a position along the continuum. A low total score is intended to indicate a conformity philosophy, while a high score is intended to indicate a restorative/conservation philosophy.

Since it is likely that the strategic leadership of a company will have a disproportionate influence on the organizational environmental philosophy, it was important to obtain responses from at least one member of the top management team. Responses from all of the companies that responded to the survey included a response from either a member of the top management team or a person designated to respond by the C.E.O. of the company. Even though the data from multiple respondents in each firm were averaged, it is argued that leadership philosophies influence environmental philosophies of managers in the organization (Ackerman, 1975; Miles, 1987; Selznick, 1957). Consequently, it is hypothesized that a high score on the environmental philosophy scale will be accompanied by a lower score on the threat interpretations of environmental issues.

Table 5.3 presents scale reliability measures for this construct using Cronbach Alpha with data from the pretest and for the main dataset separately for Canadian and U.S. companies. As can be seen, the reliability of the overall scale ranges between .71 and .90 in the separate datasets. The alpha coefficients if each individual item were deleted from the construct also are either close to 0.70 or higher. As expected, the greater homogeneity of respondents in the pretest led to a

higher reliability of the items used in the measure. Further, the main datasets for Canadian and U.S. companies have been constructed after aggregating multiple respondents for these companies. The inter-rater reliability for these multiple respondents averaged above 0.80 (the computation of inter-rater reliability is discussed in chapter eight). However, environmental philosophy is a very personal and individual construct and need not be cohesive across the organization. The objective here is to get a representation of the top management viewpoint as reflected through executive leaders and middle managers.

Table 5.3: Scale reliability for the environmental philosophy measure (ENVPHILO)

Items	*Pretest*	*Canada*	*U.S.*
Cronbach Alpha	.8998	.7131	.7901
Alpha- if individual item deleted			
1. Preservation of species biodiversity is not business responsibility	.8796	.6711	.7605
2. Wait for clarity in regulations before any environmental action	.8886	.6981	.7963
3. Companies can only respond to demand	.8991	.7140	.8017
4. Redesign of businesses necessary	.8902	.6777	.7624
5. Equity for all of world's communities	.8997	.6964	.7686
6. Society's environmental concerns offer market opportunities for business	.8896	.6834	.7703
7. Profit should not be sacrificed at all	.8928	.7046	.7836
8. Industry faces excessive regulation	.8936	.7411	.7846
9. Business responsibility to preserve resources for future generations	.8925	.6854	.7570
10. Scale of businesses must be altered	.8907	.6937	.7762
11. Sustainable development desirable ideal	.8962	.6869	.7639
12. Business should reach zero discharges of wastes	.8855	.6750	.7729

Table 6.3 presents results of exploratory factor analysis among the items constituting this construct. This factor analysis has been run separately on the Canadian and U.S. datasets.

Table 6.3: Factor scores for the environmental philosophy measure (ENVPHILO)

Items	*Canada*			*U.S.*		
Factors extracted - P.C. oblimin rotation	3			3		
(percentage of variance explained)	26.5	15.4	10.0	33.3	12.2	10.9
Factor loadings						
1. Preservation of species biodiversity is not business responsibility	**.7179**	.3323	.1135	**.6118**	.3399	.0923
2. Wait for clarity in regulations before any environmental action	.3332	**.6780**	.3214	.4555	**.7637**	.1199
3. Companies can only respond to demand	.4835	**.6148**	.2234	.4334	.4231	.3774
4. Redesign of businesses necessary	.1156	.3123	.4139	.4400	.1134	**.5732**
5. Equity for all of world's communities	.4115	.2034	**.6466**	.3223	.2998	.4776
6. Society's environmental concerns offer market opportunities for business	**.6793**	.3456	.4765	.4113	.3345	.4654
7. Profit should not be sacrificed at all	.2675	**.7482**	.1978	.4432	.4789	**.5823**
8. Industry faces excessive regulation	.3345	.4134	.5792	.3234	**.6809**	.3114
9. Business responsibility to preserve resources for future generations	**.4788**	.1143	.1765	**.7819**	.2336	.3983
10. Scale of businesses must be altered	.1176	.2134	**.8043**	.2276	.3439	**.9158**
11. Sustainable development desirable ideal	**.5422**	.3334	.1433	**.8165**	.2118	.0345
12. Business should reach zero discharges of wastes	**.7666**	.2345	.2789	**.8470**	.3765	.1456

It can be observed that items 1, 9, 11, and 12 load onto factor 1 in the U.S. dataset with factor loadings close to 0.70 or higher. In the Canadian dataset, the factor loadings for item 9 on factor 1 is around 0.48 and for item 11 it is around 0.54. Items 1 and 12 load at a coefficient value higher than 0.70 on factor 1 in the Canadian dataset. It is theoretically justifiable to combine an item that reflects concerns for resource conservation with concerns for biodiversity preservation. Therefore, items 1, 9, 11, and 12 have been aggregated to constitute a measure of organizational environmental philosophy and named as ENVPHILS (to distinguish it from the aggregate measure ENVPHILO). The overall alpha reliability measure for the ENVPHILS construct is 0.69 for the Canadian data and 0.79 for the U.S. data. A separate principal components analysis undertaken

for these five indicators shows a factor loading of 0.70 of higher for each of the items on the single factor ENVPHILS in the two datasets.

7.3. Measure development for the influence of organization design on managerial interpretations.

7.3.1. Knowledge exchange and dissemination mechanisms. Three dimensions are sought to be measured here:

(a) The extent of involvement of line managers in decisions on the business-natural environment interface. This is measured by items 22 (a) and 22 (c) in the questionnaire attached as Appendix 1a. As per the hypothesis, higher scores on the seven point scale indicating higher involvement of line managers will be accompanied by lower threat perceptions of environmental issues.

(b) The level of co-operation between staff and line managers in generating knowledge on the business-natural environment interface. This is measured by item 22(e) in the questionnaire. Thus, the higher the score on the seven point scale, the greater the co-operation between line and staff managers. It is hypothesized that the higher the score on co-operation, the lower the threat interpretations of environmental issues.

(c) The extent to which integration devices are used to co-ordinate actions of line and staff managers on the business-natural environment interface. The integration devices are measured in items 22 (a), (b), (f), (g), (h) of the questionnaire, as liaison roles, top management steering committees, job rotation, task forces, and board committees on environmental issues. A high total score on integration devices along the seven point scale is hypothesized to be associated with lower threat interpretations of environmental issues.

Table 5.4 presents scale reliability measures for these constructs using Cronbach Alpha with the dataset from the pretest and the main dataset, separately for Canadian and U.S. companies. It can be seen that the constructs for both the integration measure and the line manager influence measure show high alphas between 0.78 and 0.97. Deletion of none of the individual items in the integration devices construct leads to any significant improvement in the overall reliability. Hence all the five items are included in the construct as internally consistent and stable.

Table 5.4: Scale reliability for the integration and line manager influence constructs

Items	*Pretest*	*Canada*	*U.S.*
INFLINE			
Cronbach Alpha	.9618	.8194	.8749
Alpha if individual item deleted			
1. The importance of line managers as a source of information and knowledge on environmental issues	was not computed due to only two items	was not computed due to only two items	was not computed due to only two items
2. The influence of line managers on environmental decisions			
INTEGRTN			
Cronbach Alpha	.8818	.7779	.8569
Alpha- if individual item deleted			
1. Board level committees	.9014	.7627	.8477
2. Liaison roles for managers	.8390	.7327	.8442
3. Rotation of managers between line and staff functions	.8510	.7609	.8220
4. Task forces on environmental assessment	.8528	.7245	.8011
Top management steering committees	.8305	.7001	.8197

Table 6.4 presents results of exploratory factor analysis among the items constituting these constructs. This factor analysis has been run separately on the Canadian and U.S. datasets. Only one factor was extracted for the items intended to measure the integration and line manager

influence constructs. All five items loaded on the single factor at coefficient values close to 0.70 or higher. This single factor explains 54% of the variance in the Canadian data and 64% of the variance in the U.S. data.

Table 6.4: Factor scores for integration and line manager influence constructs

Items	*Canada*	*U.S.*
INTEGRTN		
Factors extracted (percentage of variance)	1 (53.8)	1 (64.3)
Factor loadings		
1. Board level committees	**.6731**	**.7473**
2. Liaison roles for managers	**.7517**	**.7404**
3. Rotation of managers between line and staff functions	**.6516**	**.8136**
4. Task forces on environmental assessment	**.7698**	**.8740**
5. Top management steering committees	**.8093**	**.8256**
INFLINE		
Factors extracted (percentage of variance)	1 (84.7)	1 (89.0)
1. The importance of line managers as a source of information and knowledge on environmental issues	**.9203**	**.8898**
2. The influence of line managers on environmental decisions	**.9203**	**.8898**

7.3.2. Managerial discretion. Item 22 (f) (i) and (ii) of the questionnaire inquire about the extent to which managers have discretion to make decisions to modify business practices and make investment decisions for reducing environmental impact of corporate operations. The higher the total score on the seven point scale measuring the discretion items, the lower the score on threat interpretations of environmental issues is likely to be.

Table 5.5 presents scale reliability measures for this construct using Cronbach Alpha with the dataset from the pretest and from the main dataset, separately for the Canadian and the U.S.

companies. The overall reliability for the two items is high and ranges between an alpha value of between 0.90 to 0.99 for the datasets.

Table 6.5 presents results of exploratory factor analysis among the items constituting this construct. This factor analysis has been run separately on the Canadian, and U.S. datasets. Since there are only two items for this construct, the factor loadings are not interpreted.

Table 5.5: Scale reliability for managerial discretion construct(DISCRETN)

Items	*Pretest*	*Canada*	*U.S.*
Cronbach Alpha	.9885	.9562	.8970
Alpha- if individual item deleted			
1. Extent of discretion in investment of resources for environmental decisions	was not computed due to only two items	was not computed due to only two items	was not computed due to only two items
2. Extent of discretion in modification of practices for reducing environmental impact			

Table 6.5: Factor scores for the managerial discretion construct (DISCRETN)

Items	*Canada*	*U.S.*
Factors extracted (percentage of variance)	1 (95.8)	1 (90.7)
Factor loadings		
1. Extent of discretion in investment of resources for environmental decisions	**.9788**	**.9522**
2. Extent of discretion in modification of practices for reducing environmental impact	**.9788**	**.9522**

7.3.3. Control systems. Items 21(c), (d), and (e) in the questionnaire enclosed as Appendix 1a are intended to measure the extent to which environmental performance indicators are included in planning systems, in performance evaluation systems, and the extent to which they are weighted equally with economic performance indicators. The total score of these items on the

seven point scale is intended to indicate a high level of importance of environmental performance in the control systems, and is expected to be associated with low scores on threat interpretations of environmental issues.

Table 5.6 presents scale reliability measures for this construct using Cronbach Alpha with the dataset from the pretest and for the main dataset separately for Canadian and U.S. companies. As can be seen, the alpha is very high in all datasets and ranges between .86 to .94. Deletion of none of the three items improves the overall scale reliability substantially in any of the datasets. Removing item number two reduces overall scale reliability for the Canadian dataset to .77 from .86. This indicates that item number two has a greater stability as compared to the other two items in this construct, at least in the Canadian dataset.

Table 5.6: Scale reliability for performance evaluation/control systems construct

Items	*Pretest*	*Canada*	*U.S.*
Cronbach Alpha	.9215	.8624	.9426
Alpha- if individual item deleted			
1. The extent to which environmental indicators important in reward systems	.8969	.8123	.8828
2. The extent to which environmental performance objectives included in planning systems	.8759	.7752	.9315
3. The extent to which environmental performance indicators weighted on par with economic performance indicators	.8868	.8312	.9322

Table 6.6 presents results of exploratory factor analysis among the items constituting this construct. This factor analysis has been run separately on the Canadian and the U.S. datasets. All three items load at coefficient values of 0.87 or higher on the single factor that is extracted,

indicating a high level of cohesiveness among the items. The single factor explains around 79% of the variance in the Canadian data and around 90% of the variance in the U.S. data.

Table 6.6: Factor scores for the performance evaluation construct

Items	*Canada*	*U.S.*
Factors extracted (percentage of variance)	1 (78.5)	1 (89.7)
Factor loadings		
1. The extent to which environmental indicators important in reward systems	.8832	.9671
2. The extent to which environmental performance objectives included in planning systems	.9039	.9371
3. The extent to which environmental performance indicators weighted on par with economic performance indicators	.8706	.9368

7.4. Measure development for organizational factors influencing corporate environmental responsiveness strategies.

7.4.1. Timing of response. Environmental issues became important for the Canadian oil and gas industry only after 1988-89, and vitally urgent only after the 1993 amendments in regulations making managers personally liable for infringements. For oil and gas companies in the U.S., the enactment of the Superfund legislation brought environmental issues into prominence for the industry in the mid-1980s. However, the focus was the clean-up of hazardous wastes and emissions. The stringency of environmental regulations have alternately escalated up and rolled back as governments change in Washington. Greater current uncertainty for political support for environmental preservation in the U.S. creates greater importance for consistent long-term and early corporate environmental responsiveness strategies in the U.S.

The measure for this variable is in terms of the earliest years in which the companies modified their business operations *voluntarily* in different areas to accommodate environmental preservation concerns. Items in question number 15 in the questionnaire attached at Appendix 1a are intended to measure this variable. The responses are in terms of calendar years which are recoded into interval scaled numbers from 1 to 7. These numbers on the scale represent periods of time which are considered important milestones that should affect environmental responsiveness in the oil and gas industry. 7 indicates response before 1980 when environmental issues were given little importance by the oil and gas industry as well as by an average individual in North America. 6 indicates response between 1980-1985, a period during which some of the proactive and interactive companies responded to stakeholder pressure to assess and reduce environmental impact. 5 indicates response between 1986-1988, a period during which environmental laws were enacted and escalated up in both Canada and the U.S. 4 indicates response between 1989-1990, a period during which environmental disasters such as the *Exxon Valdez* oil spill, and indications of climate change galvanised public attention on environmental issues. 3 indicates response between 1991-1992, a period of increasing environmental concern in North America. 2 indicates response in 1993 and after, a period that has special significance among Canadian companies when managers became personally liable for environmental accidents and contamination. 1 indicates no voluntary response on a particular item on the scale.

The relationship hypothesized is that the earlier the timing of response, i.e., the higher the score on the interval scale, the higher the company will score on the corporate environmental responsiveness strategies construct.

Table 5.7: Scale reliability for timing of response measure (YEAR)

Items	*Pretest*	*Canadian*	*U.S.*
Cronbach Alpha	Cronbach	.8935	.9135
Alpha- if individual item deleted	Alpha could		
1. Year of first environmental assessment	not be run	.8700	.9081
2. Year of first environmental audit	due to few	.9114	.8983
3. Year of first modification in practices in exploration	number of cases without	.8697	.8987
4. Year of first modification in product	missing	.8581	.8960
5. Year of first modifications in production	values	.8715	.8980
6. Year first public environmental report released		.9099	.9105
7. Year of first modification of purchase practices		.8642	.9131
Year refining practices first modified		.8658	.8940

Table 6.7: Factor scores for timing of response measure(YEAR)

Items	*Canada*		*U.S.*	
Factors extracted - P.C. oblimin rotation (Percentage of variance explained)	2 (58.6)	(15.7)	2 (63.8)	(15.6)
Factor loadings				
1. Year of first environmental assessment	**.8430**	.0765	.4987	**-.9813**
2. Year of first environmental audit	.3342	**.8459**	.3768	**-.8811**
3. Year of first modification in practices in exploration	**.9001**	.1211	**.7970**	.2993
4. Year of first modification in product	**.8779**	.1765	**.8651**	.3322
5. Year of first modifications in production	**.8796**	.2339	**.7575**	.1768
6. Year first public environmental report released	.4311	**.6333**	.3678	**-.8439**
7. Year of first modification of purchase practices	**.8722**	.0995	**.9606**	.0888
8. Year refining practices first modified	**.8572**	.2766	**.5408**	.2776

Table 5.7 presents scale reliability measures for this construct using Cronbach Alpha with the dataset from the pretest, and also for the main dataset, separately for the Canadian companies

and the U.S. companies. The Alpha ranges from .89 to .91 for the various datasets indicating high reliability. The deletion of any of the eight items does not improve the overall alpha value significantly in the two datasets. This shows a high level of stability for the items constituting this measure.

Table 6.7 presents results of principal components factor analysis among the items constituting this construct. This factor analysis has been run separately on the Canadian and U.S. datasets. It can be seen that items related to environmental assessment, audit, and public environmental report load on to a separate factor. Most firms are just beginning to undertake environmental assessment and audit in response to regulatory and risk reduction pressures. However, even the proactive and interactive firms may not undertake environmental assessment and audit unless recently required to do so by regulations. This does not mean that these companies are not environmentally responsive. In fact, among the firms studied in the exploratory study, Sioux still does not conduct environmental assessment and audit. However, this firm follows proactive strategies of environmental responsiveness in the marketplace and in product development. There may be similar instances of companies which are environmentally responsible and yet may not undertake detailed audit and assessment until very recently (or not at all). Buffalo, a company found to follow interactive strategies of environmental responsiveness during the exploratory study, does not release a public environmental report. On the other hand, Royal, a reactive company, released a public environmental report in 1992. Therefore, the three items for year in which environmental assessment, audit, and release of public environmental report were

first undertaken have been dropped while developing the construct for timing of environmental response in issue lifecycle.

A principal components analysis run on the remaining five items in this scale reveals factor loadings of between 0.70 and 0.90 for all the five items on a single factor in both the Canadian and the U.S. datasets. Similarly, coefficient alpha for these five items is greater than 0.90 in both the datasets.

The factor on which the other five items load explains 59% of the variance in the Canadian data and 64% of the variance in the U.S. data. The second factor explains around 15% of the variance in both datasets. The factor loadings for the three items intended to elicit information about the year of first environmental assessment, audit, and public report, have negative loadings on the second factor in the U.S. data. In describing factor loadings, the direction of the coefficient is difficult to interpret and only indicates a loading at an angle greater than 90 degrees on the factor axis (Kim & Mueller, 1978).

7.4.2. Business exposure and stakeholder perceptions. Business exposure is measured on the basis of the range of a company's products (Item 25 (a) in the questionnaire attached as Appendix 1a) and its range of activities (Item 25 (b) in the questionnaire attached as Appendix 1a). The various products and activities are measured dichotomously, with 1 representing the presence of the product/activity in a company's repertoire and 0 representing its absence from the company's range of products/activities. The higher the total score on the number of activities and products, it is expected that the greater are the range of stakeholders considered strategically important to the company.

Items 23 (e), (g), and (h) measure the extent to which the company considers local communities, environmental groups, and wildlife protection groups as strategically important. These three stakeholder groups are the principal spokespersons for the interface of the natural environment with the oil and gas industry.

Table 5.8 presents scale reliability measures for managerial perceptions of importance of stakeholders representing the natural environment using Cronbach Alpha with the dataset from the pretest and also from the main dataset separately for the Canadian and U.S. companies. The overall alpha for the scale ranges between .81 and .89 in the three datasets. Deletion of any of the individual items do not improve the overall scale alpha substantially. At the same time, it appears that in all the datasets, removal of wildlife protection groups as stakeholders, leads to a substantial reduction in the overall alpha measure to around 0.70. This indicates the greater stability and high correlation of this item with other items in the construct.

Table 5.8: Scale reliability for important environmental stakeholders (STAKENVL)

Items	*Pretest*	*Canada*	*U.S.*
Cronbach Alpha	.8896	.8071	.8367
Alpha- if individual item deleted			
1. Wildlife, fisheries, and forestry protection groups	.7873	.6819	.6993
2. Local communities	.7948	.7259	.8869
3. Environmental groups	.9174	.7881	.7012

Table 6.8 presents results of exploratory factor analysis among the items constituting the stakeholder perceptions construct. The individual items load on to a single factor with coefficients over 0.81. This single factor explains around 73% variance in the Canadian data and around 75% variance in the U.S. data.

Table 6.8: Factor scores for environmental stakeholders construct items (STAKENVL)

Items	*Canada*	*U.S.*
Factors extracted (percentage of variance)	1 (72.5)	1 (75.4)
Factor loadings		
1. Wildlife, fisheries, and forestry protection groups	**.8181**	**.9095**
2. Local communities	**.8580**	**.7806**
3. Environmental groups	**.8774**	**.9086**

No such analysis has been run on range of products and activities since these are firm demographics and not a representation of a construct.

7.4.3. Stakeholder relationship strategies. Question 24 in the questionnaire, attached as Appendix 1a, seeks managerial opinions about the relationship strategies followed by each company in dealing with stakeholders perceived as spokespersons for the natural environment. The question seeks to ascertain whether the company follows collaborative/ problem-solving strategies or adversarial/ individualistic strategies. This measure is adapted from the measure for stakeholder relationship strategies used by Miles (1987). High total scores on these items indicate a collaborative/ problem-solving approach to stakeholder relationships versus an adversarial approach. A high score on this construct is expected to be associated with high scores on the corporate environmental responsiveness strategies construct.

Table 5.9 presents scale reliability measures for stakeholder relationship strategies using Cronbach Alpha with the dataset from the pretest and also for the main dataset separately for the Canadian companies and U.S. companies dataset.

As is observed from the Table 5.9 above, two reliability measures have been computed. The second one, titled RELATION consists of only three items that indicate the extent to which

relationship strategies adopted to deal with stakeholders who speak for the natural environment are marked by collaboration, problem-solving, and negotiation. This is because Table 5.9 clearly shows two factors emerging from these five items. The reliability of the RELATION construct is substantially better than the reliability of the five items originally in question 24. These three items are theoretically cohesive, even though Miles (1987) used all five items to measure stakeholder relationships strategies. A high score on these three items indicates collaborative/ problem solving strategies and a low score indicates adversarial strategies.

Table 5.9: Scale reliability for stakeholder relationship strategies construct

Items	*Pretest*	*Canada*	*U.S.*
STAKRELN			
Cronbach Alpha	.8419	.6910	.7582
Alpha- if individual item deleted			
1. Collaborative	.7739	.5476	.6707
2. Wait for communication from stakeholders before taking any action	.8878	.6898	.7402
3. Litigation	.8174	.7718	.7843
4. Negotiations	.7922	.5942	.7182
5. Problem-solving	.7612	.5421	.6375
RELATION			
Cronbach Alpha		.8809	.8703
Alpha- individual item deleted			
1. Collaborative	Not run	.8069	.8390
2. Negotiations		.8221	.7969
3. Problem-solving		.8583	.8169

Table 6.9 presents results of exploratory factor analysis among the items constituting the stakeholder relationship strategies construct. This factor analysis has been run separately on the Canadian and U.S. datasets. The three items, 1,3, and 4 load on to one factor in both datasets with individual coefficient over 0.70. This factor explains 51% of the variance in the Canadian

dataset and 52% of the variance in the U.S. dataset. The second factor is composed of items 2 and 3 which do not seem to represent the dimensions of relationship strategies sought to be measured. The second factor is ignored for the purposes of further analysis.

Table 6.9: Factor scores for the stakeholder relationship strategies construct

Items	*Canada*		*U.S.*	
STAKRELN	2 (50.5)	(26.3)	2 (52.1)	(29.7)
Factors extracted (percentage of variance)				
Factor loadings				
1. Collaborative	**.8976**	.2345	**.8406**	.1067
2. Wait for communication from stakeholders before taking any action	.3345	**.6914**	.3399	**.7057**
3. Litigation	.4112	**.8629**	.2987	**.8031**
4. Negotiations	**.8809**	.2997	**.7212**	.2243
5. Problem-solving	**.8874**	.1176	**.8882**	.1003

7.4.4. Size of company: Due to the limited number of case studies in the exploratory study, no conclusion could be drawn regarding a connection between the size of a company or its total resource availability and corporate environmental responsiveness strategies. It has been suggested in management literature that greater resources lead to greater organizational slack, permitting managerial discretion and experimentation on emerging issues (Cyert & March, 1963). Slack may be defined as those resources in an organization that are in excess of the minimum necessary to produce the desired level of performance or output. These may include under-utilised employees, capacity, or equipment, untapped customer goodwill, and unexploited research and development achievements, etc. While no satisfactory measures for organizational slack exist in the management literature (Bourgeois, 1981), comparative organizational resource levels or

company size are often used as proxies in the strategy literature and are operationalized as total assets or total sales.

Due to the availability of comparative data for total sales revenues for the Canadian and U.S. dataset (the asset figures are not available for some of the large private companies), company size is measured by an average of five years annual sales revenues. In the absence of any hypothesis driving the influence of size of a company on corporate environmental responsiveness strategies, this measure is introduced as a control variable. Item 27(d) of the questionnaire attached as Appendix 1a asks for the total sales revenues of the responding firms. This figure is cross-verified with the figure for sales revenues included in the Compact Disclosures dataset.

The sales revenues have then been coded on a seven point scale based on categorical intervals of sales as 7 = greater than 5 bn., 6 = between 1 bn. and 5 bn., 5 = between 500 mn. and 1 bn., 4 = between 250 mn. and 500 mn., 3 = between 100 mn. and 250 mn., 2 = between 50 mn. and 100 mn., and 1 = less than 50 million. These size gradations are based upon the rough classification in the industry between the very large integrated majors, the majors, the seniors (sales revenues between 500 mn. and 1 bn.), the intermediates (sales between $ 250-500 million), the junior companies (with sales below $ 250 million). This last category has been split into three levels to obtain a finer distinction between the larger, medium sized, and smaller junior companies, since these companies are represented in the industry in large numbers.

7.5. Measure development for corporate environmental responsiveness strategies.

The broad categories of corporate environmental responsiveness strategies revealed in the exploratory study - reactive, proactive, and interactive - have been discussed in section 5.2. In

addition, several types of responsiveness strategies are revealed within the *reactive* strategies - risk and liability reduction, avoidance of criminal sanctions, minimum compliance, and public relations. Within *reactive* strategies, a further sub-division may be made in the form of defensive strategies that involve litigation and lobbying against environmental regulations and stakeholder concerns. Since the survey data may reveal a wider range of strategies, the corporate environmental responsiveness strategies construct is not restricted to these three categories, but is designed as a continuous variable so that a company's position on the scale may reveal any categories that fall in between the reactive - interactive continuum. This continuous variable is based upon certain corporate environmental actions that determine the dimensions of the responsiveness construct.

The corporate social responsiveness literature defines certain dimensions of responsiveness that are difficult to determine by surveying company managers. The responsiveness has to be determined through responses by outside constituencies of the company. These dimensions, as culled from the corporate social responsiveness literature, are: reliability of company executives; attentiveness of company executives; preparedness of company executives; credibility of company statements; accessibility of company executives; perceived legitimacy of outsiders; communicating with public; and clarity of company interests (Miles, 1987; Wood, 1991). The research design is limited in its ability to obtain responses from the representative members of different outside stakeholder groups for each and every company included in the survey. Regulators and members of environmental groups in Alberta were approached, but they expressed their inability to rank almost a 100 companies on their environmental record. At best, these stakeholders had enough

information to comment on between 15 to 20 Canadian companies. Hence, corporate environmental responsiveness strategies are examined through managerial perceptions of the extent to which operations in different aspects of their operations have been modified and actions taken reduce the impact of the company's operations on the natural environment.

7.5.1. The dimensions of the corporate environmental responsiveness strategies. It is a difficult enough task to evaluate the ecological impact of a single product due to the hidden processes, ingredients, and motivations that culminate into the product that the consumer sees. Judging the environmental performance of a multi-division and multi-product company seems like a Herculean task. Arguably, a business firm alone is incapable of assessing the complex sequence and array of impacts it has on its natural environment and their ecological consequences. A firm's impact on the natural environment is in many ways indirect, and routed through its various stakeholders. It may purchase materials from suppliers that damage the natural environment, or it may supply goods that consume high levels of energy in their usage and have serious ecological consequences in disposal. Thus, a corporate environmental responsiveness strategies construct needs to be multi-dimensional to accommodate the environmental concerns of multiple stakeholders. Just as ecology is a holistic concept that can not be fragmented into compartments, a corporate actions to reduce negative impacts on the ecology are interlinked and a company cannot be proactive in one aspect of its operations while neglecting negative impacts in other aspects.

This section integrates discussions on the reactive, proactive, and interactive environmental responsiveness strategies described in section 5.2, with existing guidelines for

assessing environmental responsiveness and performance adopted by socially responsible investment funds (Kinder, Lydenberg, & Domini, 1993), environmental group charters (e.g. the CERES principles), environmental regulations, and the exploratory study that looks at environmental response in the Canadian oil and gas industry to generate a list of items to measure corporate environmental responsiveness. These dimensions are based on a multi-stakeholder perspective - environmental groups, local communities, citizen groups, regulators, and industry executives - that are sought to be integrated by a business firm.

An important criterion for corporate environmental responsiveness is evidence shown by the company of improvements made in reducing environmental impacts. Companies with products and technologies that are environmentally benign are accorded weight in this measure. However, companies that have operated historically with technologies and products that impact negatively on the environment are given credit for reduced pollution and waste generation, improved energy conservation, changes in technologies, processes, and products to reduce environmental impact. The dimensions of corporate environmental responsiveness strategies measured are described below.

7.5.2. Species biodiversity and habitat preservation: This dimension is particularly relevant to upstream oil companies that are actively involved in exploration, prospecting, drilling, and wellhead production activities. The items are intended to measure actions taken to reduce negative impacts on species biodiversity and habitats. Wherever species or habitats are to be preserved, the government usually earmarks certain areas as preserves that are off-limits for exploration and drilling activities. In some cases, firms are required to make detailed

environmental assessments of all new projects and developments, for submission to the regulatory authorities. Reactive companies usually litigate against the government's initiatives to protect certain areas. They also feel that, by remaining outside the areas already declared as protected, they are doing what they can for environmental protection. They are unlikely to take any voluntary actions to make environmental assessments of the impact of their operations, other than those mandated by the government. Interactive companies are likely to show positive initiatives for environmental assessment of sensitive areas and voluntary actions for preservation of species biodiversity and habitats. Items measured on seven-point interval scales included in question number 5 of the questionnaire (attached as Appendix 1a) are intended to obtain an assessment of the extent to which a company has modified different aspects of its operations to reduce impact upon habitats and species.

7.5.3. Wise use of natural resources: This dimension reflects corporate actions taken for reducing use of natural resources and substitution of non-renewable resources by renewable resources. The actions taken include changes in specifications of materials purchased by the company, involving: (i) Shifts to renewable materials or environmentally-benign materials, (ii) Reduced use of environmentally damaging or non-renewable materials; and (iii) Use of recycled and reclaimed waste materials. The reactive companies will show fewer actions taken in this regard. The proactive companies will show actions that are designed to reduce costs by reducing material use and material substitution. The interactive companies will show greater efforts in reducing use of non-sustainable and non-renewable materials, even if the impact upon costs is minimal or negative. Items measured along seven-point scales included in question number 8 of

the questionnaire (attached as Appendix 1a) are intended to gauge the extent to which the company has tried to conserve material use.

7.5.4. Waste reduction: Waste becomes pollution when it exceeds the carrying capacity of the environment. Most industrial wastes fall into this category. Waste is a sign of inefficiency and it represents raw materials not sold as a final product. Waste reduction has been driven by the cost of waste disposal and "polluter pays" policies like the Superfund in the U.S. The U.S.E.P.A. defines wastes as hazardous if, because of their quantity, concentration, or physical, chemical, or infectious characteristics, they cause or significantly contribute to an increase in mortality or serious illness, or if they pose a threat to human health and the environment when improperly managed. Toxic wastes are hazardous wastes that are directly poisonous for humans (including asbestos, lead, mercury, radioactive materials and 70,000 other designated chemicals).

The company should endeavor to reduce, and where possible, eliminate wastes through source reduction and recycling. It should also minimize and safely and responsibly dispose of hazardous wastes. The crucial element in this dimension is source reduction or pollution prevention versus pollution control through end-of-pipe technologies (Commoner, 1990). The methods of waste reduction used indicate whether companies have turned opportunities for waste reduction at source into avenues of cost reduction and innovation (Porter, 1991; Sharma & Vredenburg, 1993, 1994). Companies such as Dow Chemicals, Chevron, and 3M have responded to environmental regulations by systematically incorporating source reduction of wastes into their product design and manufacturing processes and saving substantial sums of money (Schmidheiny, 1992). Movements from waste control, to waste source reduction, to closed-loop systems will

indicate moves up the states of corporate environmental consciousness. While reactive companies are expected to show few actions for waste prevention and are likely to invest in pollution control as required by law, proactive companies are likely to show positive actions for reducing and eliminating wastes by changing processes and products. The interactive companies are likely to undertake waste prevention through substantial changes in processes and products and also closed-loop material use. Items in question 7 of the questionnaire attached as Appendix 1a are intended to measure the range of waste prevention activities of a company.

7.5.5. Energy conservation: This involves a shift to energy-efficient products and processes. The company must make every effort to use environmentally safe, renewable, and sustainable energy sources. A fuel has environmental advantages when the sum of its harvesting, conversion, and waste products have minimal impact on the environment.

Energy efficiency can be of the following types: (a) Corporate use of, and research in, renewable energy sources such as photovoltaic conversion (solar) and wind power. This is the most desirable; (b) The usage of alternative energy sources, which have a lower environmental impact as compared to fossil fuels. Natural gas is considered a transition fuel from fossils to renewables - its emissions of sulphur dioxide are almost zero, carbon emissions are low and particulates are minuscule, transportation through pipelines poses lower environmental risks and does not use polluting transportation devices. While selling natural gas is clearly an economic response, consumption of natural gas is a conservation action. Other alternative sources of energy are the usage of geothermal energy (problems: well blowouts), hydroelectric power (problems: disruptions of fish migration, plant growth, and dislocation of local people), biofuels from living

organisms such as methane from landfills and sewage as a clean burning gas, and ethanol from corn (problem: emits more nitrous oxides than gasoline, causing smog), waste-to-energy facilities (problems: toxicity of air emissions; disposal of ash byproducts; impossibility of separating the jumbled trash; no incentive to reduce consumption patterns of our throw-away society; competes with recycling because of its fuel demands; generation of dioxins); (c) Cogeneration, which is a process that produces simultaneously heat and electricity or another form of energy from a single source; (d) The setting up of compensatory carbon sinks or offsets, and buying of pollution permits; (e) Fuel usage improvements in transportation - newer and more efficient tankers, using trucks run on natural gas, trains, or pipelines, instead of ocean going tankers and road tankers.

There are three phases in the above moves towards greater energy efficiency, (a) Housekeeping - maximizing the efficiency of existing technologies and process; (b) Retrofitting of old high energy-use equipment; and (c) Process technology improvements and changing of material and product specifications. In the case of energy use, reactive companies have discovered that it pays to cut down on energy use. Thus, both reactive and proactive companies are likely to show actions for energy efficiency and co-generation. However, the proactive companies, in accordance with their philosophy of cost reduction, are likely to show a greater range of actions for energy conservation. On the other hand, interactive companies are not only likely to indicate greater investments and actions toward energy efficiency, but are also likely to indicate positive actions for usage of, or research into, renewable energy sources. The exploratory study revealed that while the reactive companies clearly ridiculed the possibility of commercial use of renewable

energy sources in the next fifty years, the interactive/proactive companies expressed great faith in overcoming obstacles toward commercial development of these energy sources.

Items in question 9 of the questionnaire are intended to measure a company's move into renewable energy sources, while items in question 10 of the questionnaire are intended to measure a company's actions for energy conservation.

7.5.6. Risk reduction: This involves reducing environmental and safety risks to employees and the communities in which the company operates. It includes using safe technologies, facilities, and operating procedures, and preparation for accidents and emergencies. This is the aspect of corporate environmental responsiveness strategies that has been eagerly seized upon by most highly regulated companies. The smallest of environmental accidents receives negative publicity and attention by the media and environmental groups, and can result in huge liability payments. The *Exxon Valdez* oil spill in Alaska caused a severe financial disruption to Exxon which a smaller company with less resources may not have survived. There may be little to discriminate the different strategic types on this dimension, since the interactive, proactive, as well as the larger reactive companies have adopted an approach of stringent risk and liability reduction. Items in question number 11 of the questionnaire (attached as Appendix 1a) measure the actions taken by a company for risk reduction, emergency response, training of employees and communities, and other organizational changes to reduce environmental risk.

7.5.7. Environmentally-benign products and services: Some of the dimensions of an environmentally-benign product/service are: (a) Designed to meet essential human needs without being frivolous; (b) Does not endanger the health of the consumer or others; (c) Causes no

significant environmental damage during production, use, and disposal; (d) Conserves energy and resources during production, use, and disposal; (e) Not made from materials derived from threatened species or environments; (f) Did not require in its development or production the unnecessary use of, or cruelty to, animals; (g) Made from recycled materials or renewables processed in a way that preserves the environment; (h) Durable and reusable first, and recyclable or truly biodegradable next; (i) Minimally or responsible packaged; (j) During and after use it is degradable, ozone-safe and environmentally-friendly, recyclable and compostable.

Petroleum products are far from coming close to these requirements. However, companies can take certain actions to sell less environmentally damaging fuels, which may include reduced packaging on engine oils and chemicals sold, among other things. In order to achieve these dimensions, a company may undertake the following actions: (a) Adoption of product life cycle stewardship to assess environmental impact of the product during and after use; (b) Obtain certification by a credible green seal such as the Eco-logo in Canada (e.g. Sioux Oil's recycled engine oils and ethanol blended gasolines); (c) Eliminate or replace product; (d) Eliminate or reduce harmful ingredients and substitute environmentally preferred materials; (e) Decrease weight or reduce volume, produce concentrated product, or produce in bulk; (f) Combine the functions of more than one product, produce fewer models or styles, redesign for more efficient use, increase product life span, reduce wasteful packaging, improve repairability, redesign for consumer use, remanufacture the product; (g) Undertake closed-loop recycling for engine oils or chemicals as is done for glass and aluminum; (h) Undertake non-true closed-loop recycling such

as is done for plastic bottles; (i) Build channels for collection of materials for closed-loop recycling.

While the reactive companies are likely to show no indications of changing their traditional products to reduce environmental impact, proactive companies are likely to make aggressive attempts to gain market advantage through products that are less environmentally damaging. In addition to the actions shown by proactive companies, the interactive companies are likely to undertake actions to reduce product consumption through greater consumption efficiency and substantial investments in research on less environmentally-damaging products.

Items in question 12 of the questionnaire (attached as Appendix 1a) are intended to bring out these dimensions of environmental responsibility in products.

7.5.8. Ecological restoration: Companies should undertake a prompt and responsible restoration of damaged environments and conditions that cause health and safety problems and provide compensation for human injury. Compensation is often mandated by regulation. However, regulation falls short on restoration. While the reactive and proactive companies may show differences of degree in voluntary actions for ecological restoration, the interactive companies are likely to undertake considerable voluntary actions that are not mandated by law or industry practice. Items in question number 6 of the questionnaire (attached as Appendix 1a) are intended to measure voluntary efforts at soil restoration, abandoned well clean-up, withdrawal from ecologically sensitive sites, etc.

7.5.9. Disclosure: This involves: (i) Disclosure of accidents and hazards; (ii) Protection of employees who report these to management or appropriate authorities; (iii) Informing in a timely

manner everyone who may be affected by conditions that might endanger health, safety, or the environment; (iv) Assessment and annual audit of environmental impact through self-evaluation of worldwide operations. An environmental audit should be a systematic, documented, periodic, and objective evaluation of how well environmental organization, management, and equipment are performing with the purpose of helping to safeguard the environment. It should facilitate management control of environmental practices and assess compliance with company policies including meeting regulatory requirements; (v) Making the environmental audit report public. Once again interactive companies are likely to show greater concern for meeting the environmental disclosure needs of their stakeholders. This item is measured by items included in question 14 of the questionnaire attached as Appendix 1a - specifically, items 14 (a), (b), (c), (e), and (f).

Item 14 (d) looks at a company's investment in training programs; item 14 (g) looks at a company's environmental practices in developing countries with less stringent environmental regulations; item 14 (h) looks at a company's investment in, and commitment to, research for environmental preservation.

7.5.10. Stakeholder partnerships: Environmentally responsible companies must add value for all stakeholders and not only for customers and investors. Stakeholders play multiple roles - e.g., regulators are also investors, customers, and members of the local communities, etc. Companies need to recognize this role of stakeholders and gain their approval for corporate activities as well as enter into partnerships for reducing environmental damage. These partnerships can include: (i) Technology co-operations; (ii) Regional ecological networks of resource use such

as the one created by Novo Nordisk in Denmark with eight other organizations to exchange wastes (Schmidheiny, 1992); (iii) Industry partnerships and associations such as the "Responsible Care" program of the chemical industry (Schmidheiny, 1992) to establish industry standards and benchmarks; (iv) Consultations and councils with local communities and environmental groups; (v) Partnerships with environmental groups for product certification and for product improvement on environmental dimensions (Westley & Vredenburg, 1991); (vi) Value-chain analysis to examine the suppliers' environmental record and activities; (vii) Partnerships with retail outlets as gatekeepers for consumer awareness and education of environmental issues; (viii) Outreach and education programs for communities and schools on environmental protection and reduction of wasteful consumption.

Reactive companies are unlikely to undertake stakeholder partnerships for environmental protection. Proactive companies are likely to undertake a few partnerships for cost reduction in the form of using waste materials of other companies, cogeneration plants in collaboration with other companies, joint recycling of materials for commercial viability, etc. Interactive companies are likely to have partnerships with environmental groups and other stakeholders for the protection of species and habitats. These companies are also likely to have partnerships in developing countries or industrially backward areas that contribute to social justice, equity, and global offsets of greenhouse gases, etc. Interactive companies are likely to be in the forefront of alliances for establishing industry and global standards for environmental protection.

Items included in question number 13 of the questionnaire (attached as Appendix 1a) are intended to measure the extent to which these various partnerships for environmental preservation are undertaken by companies.

Table 5.10: Scale reliability for the environmental strategies construct (ENVSTRGY)

Items	*Pretest*	*Canada*	*U.S.*
Cronbach alpha	.8974	.8441	.8970
Overall alpha for individual dimensions			
1. Species and habitat protection	.9045	.8501	.9025
2. Voluntary actions for environmental preservation	.8894	.8283	.8819
3. Waste reduction	.8754	.8108	.8781
4. Material use reduction	.8907	.8353	.8915
5. Alternative fuels usage	.8894	.8265	.8829
6. Energy efficiency	.8817	.8224	.8839
7. Risk reduction	.8786	.8253	.8836
8. Less environmentally damaging products	.9206	.9714	.9043
9. Partnerships for environmental preservation	.8682	.8004	.8769
10. Disclosure	.8871	.8395	.8894
11. Research and training commitment for environmental preservation	.8840	.8292	.8883

Scale reliability measures were run by computing coefficient alpha for the items constituting each of the eleven different dimensions of the corporate environmental responsiveness strategies construct. The overall alpha for each of these dimensions is greater than 0.80 and range between 0.82 to 0.97. All the items used to measure each dimension show high stability and internal consistency. Table 5.10 presents scale reliability measures for the eleven different dimensions used to measure corporate environmental responsiveness strategies using Cronbach Alpha with the dataset from the pretest and also for the main dataset separately for

Canadian and U.S. companies. These are figures for overall reliability measures for each of these eleven dimensions. The deletion of any individual item does not significantly improve or lower the overall alpha measure for the construct in the three datasets.

Table 6.10 presents results of exploratory factor analysis among the items constituting the eleven dimensions of corporate environmental responsiveness strategies construct. This factor analysis has been run separately on the Canadian and U.S. datasets.

Table 6.10: Factor scores for the environmental strategies construct (ENVSTRGY)

Items	*Canada*		*U.S.*	
Factors extracted (percentage of variation)	2 (51.5)	(10.3)	2 (60.7)	(9.5)
Factor loadings				
1. Species and habitat protection	.5444	**.7576**	**.9701**	.0999
2. Voluntary actions for environmental preservation	**.6644**	.2356	**.6652**	.3578
3. Waste reduction	**.8093**	.1776	**.8841**	.2365
4. Material use reduction	**.6779**	.3355	**.7523**	.2455
5. Alternative fuels usage	**.6695**	.2987	.4887	.5619
6. Energy efficiency	**.8266**	.1789	**.8195**	.3243
7. Risk reduction	**.7292**	.3576	**.8169**	.2134
8. Less environmentally damaging products	**.7499**	.4453	.4655	**.9256**
9. Partnerships for environmental preservation	**.9207**	.0876	.4580	.3341
10. Disclosure	.4331	.4227	**.6452**	.2495
11. Research and training commitment for environmental preservation	**.7573**	.2334	**.6479**	.1987

As will be seen from Table 6.10, there is no clear pattern that emerges in the two datasets. Whereas only habitats and species preservation dimension loads onto a different factor in the Canadian data, in the U.S. data less environmentally damaging products and alternative fuels load onto another factor. In the absence of a clear pattern in the two datasets and in the absence of a

theoretical justification, the corporate environmental strategies construct is retained by including all the eleven different dimensions.

7.6. Organisational outcome variables

7.6.1. Organizational benefits and capabilities: Based on the findings of the exploratory study, organizational benefits related to and emergent from corporate environmental responsiveness strategies are measured along the following dimensions: (a) cost benefits; (b) improved operations; (c) improved management practices; (d) improved product quality; (e) innovations; (f) organizational learning; (g) employee morale; (h) corporate reputation and goodwill; (i) relationships with stakeholders; (j) faster regulatory approvals. Items in question number 17 of the questionnaire (attached as Appendix 1a) are intended to bring out these benefits and capabilities.

The extent to which these organizational benefits have the characteristics of organizational capabilities and are not transitory short-term advantages for the company are measured by question 18 of the questionnaire. These items look at the following dimensions of these benefits based on the literature in the resource-based view of strategy: (a) the length of time taken to build up these capabilities; (b) the extent to which competitors can build up these capabilities through a greater application of resources; (c) the ease of identification and imitation by competitors; (d) the extent to which these benefits span different levels and functions in a company; (e) the extent to which they lack a clearly identified owner; (f) the extent to which these benefits trigger further organizational learning and innovation processes within the company; (g) the extent to which there are synergies between these benefits - i.e. the ability to combine with other company assets

to generate benefits; to illustrate, improved corporate reputation can combine with an established retail network to improve company sales.

It is hypothesized that the higher the company scores on the corporate environmental responsiveness strategies construct, the greater the total score on total organizational benefits resulting from corporate environmental responsiveness. Further, the greater the score for organizational benefits resulting from corporate environmental responsiveness strategies, the greater the score of their characteristics as organizational capabilities, i.e. companies with high scores on corporate environmental responsiveness will generate more organizational benefits that are in the nature of organizational capabilities rather than short-term advantages.

Table 5.11: Scale reliability for the organizational benefits construct (BENEFITS)

Items	*Pretest*	*Canada*	*U.S.*
Cronbach alpha	.9718	.9559	.9635
Alpha - if individual item deleted			
1. Product innovations	.9696	.9523	.9621
2. Increased process efficiency	.9681	.9543	.9593
3. Organization-wide learning	.9713	.9549	.9644
4. Reduction in material costs	.9678	.9507	.9594
5. Knowledge about better ways of managing operations	.9693	.9517	.9597
6. Improved employee morale	.9712	.9534	.9608
7. Process innovations	.9730	.9514	.9582
8. Reduced process costs	.9694	.9523	.9590
9. Increases in productivity	.9678	.9513	.9590
10. Improved product quality	.9687	.9521	.9616
11. Reduced costs of regulatory compliance	.9691	.9542	.9632
12. Faster regulatory approvals	.9728	.9560	.9633
13. Better relationships with stakeholders	.9690	.9532	.9599
14. Improved corporate reputation	.9679	.9521	.9603

Table 5.11 presents scale reliability measures for measures for organizational benefits construct using Cronbach Alpha with data from the pretest and from the main dataset separately for the Canadian and U.S. companies. The alpha values for the various datasets range between 0.96 to 0.97. Deletion of individual items will not significantly alter the alpha values, which remain around 0.95 for all items, indicating high stability and internal consistency.

Table 6.11 presents results of exploratory factor analysis among the items constituting the organizational benefits constructs.

Table 6.11: Factor scores for the organizational benefits construct (BENEFITS)

Items	*Canada*			*U.S.*	
Factors extracted (percentage of variance)	64.1	8.7	7.4	68.2	7.8
Factor loadings					
1. Product innovations	.603	.256	.003	**.927**	.000
2. Increased process efficiency	**.932**	.012	.000	**.802**	.003
3. Organization-wide learning	.513	**.861**	.011	.489	**.697**
4. Reduction in material costs	**.816**	.121	.001	**.709**	.111
5. Knowledge about better ways of managing operations	.610	.234	.134	.516	.299
6. Improved employee morale	.433	**.899**	.123	.418	**.739**
7. Process innovations	.398	.365	.222	**.678**	.335
8. Reduced process costs	**.916**	.056	.000	**.721**	.312
9. Increases in productivity	**.870**	.113	.007	**.852**	.000
10. Improved product quality	**.746**	.221	.067	**1.01**	.211
11. Reduced costs of regulatory compliance	**.894**	.176	.101	.332	**.849**
12. Faster regulatory approvals	.500	.234	**.604**	.476	**.889**
13. Better relationships with stakeholders	.452	**.723**	.245	.401	**.823**
14. Improved corporate reputation	.339	**.880**	.009	.501	**.736**

While the reliability of the organizational benefits scale is very high, the factor analysis reveals a separation along two dimensions. It appears as if these two dimensions relate to tangible benefits such as reduced costs, innovations, quality, productivity; and intangible benefits such as

reputation, relationships, morale, learning, etc. Since this is a dependent variable for the model that measures the impact of corporate environmental strategies on organizational benefits, a decision has to be made whether to retain the construct as is, to retain the items indicating the tangible benefits dimension, or to retain the items indicating the intangible benefits dimensions. The separation of the two factors along the two dimensions are not very clear and the factor loadings of all items on factor one is above 0.30. This is not the case for the other two factors. Moreover, the first factor explains over 64% of the variance in the Canadian data and over 68% of the variance in the U.S. data. The other factors explain less than 8% of the variance each. Since both these dimensions are important for organizational performance, the construct is retained as a by including all 14 items used to measure this construct.

Table 5.12: Scale reliability for organizational capability features (CAPABLTY)

Items	*Pretest*	*Canada*	*U.S.*
Cronbach alpha	.9783	.9355	.9417
Alpha - if individual item deleted			
1. Can be combined with other corporate assets to generate benefits	.9754	.9289	.9327
2. Cannot be easily identified and imitated by competitors	.9753	.9308	.9383
3. Triggers innovations within the company	.9735	.9270	.9331
4. Triggers collective learning within company	.9791	.9322	.9358
5. Take a long period of time to build-up	.9747	.9245	.9329
6. Lack a clearly defined owner within company	.9785	.9285	.9421
7. Competitors cannot build up similar capabilities through greater application of resources	.9765	.9280	.9394
8. Span functional areas within company	.9740	.9243	.9305
9. Span levels within company	.9734	.9252	.9289

Table 5.12 presents the reliability analysis using Cronbach Alpha for the construct designed to elicit a measure for the features and characteristics of these benefits that are related to the emergence of unique firm-specific organizational capabilities separately for each dataset. The scale reliabilities are very high and range between 0.94 and 0.98 for the three datasets. Deletion of any individual item does not alter the overall alpha measure significantly.

Table 6.12 shows that only one factor is extracted with individual items loading on the factor at coefficient values greater than 0.70. The single factor explains around 66% of the variance in this variable in the Canadian data and around 69% of the variance in the U.S. data.

Table 6.12: Factor scores for organizational capability features (CAPABLTY)

Items	*Canada*	*U.S.*
Factors extracted (percentage of variance)	1 (66.1)	1 (68.9)
Factor loadings		
1. Can be combined with other corporate assets to generate benefits	**.7966**	**.8639**
2. Cannot be easily identified and imitated by competitors	**.7633**	**.7768**
3. Triggers innovations within the company	**.8245**	**.8646**
4. Triggers collective learning within company	**.7448**	**.8184**
5. Take a long period of time to build-up	**.8551**	**.8517**
6. Lack a clearly defined owner within company	**.8015**	**.7195**
7. Competitors cannot build up similar capabilities through greater application of resources	**.8088**	**.7558**
8. Span functional areas within company	**.8622**	**.8889**
9. Span levels within company	**.8514**	**.9102**

7.6.2. Economic performance: Two separate measures of economic performance are used in this research study. The first is a perceptual measure that gauges managerial perceptions

of their company's performance relative to competitors. This measure used by Gupta (1987) and Govindarajan (1984) has often been used in strategy research. Perceptual measures of firm performance require managers to rate the performance of their firm relative to industry average. This is not as fine grained a measure as using exact financial figures. However, in the present study, such measures are relevant since it is basically argued that a high score on the corporate environmental responsiveness strategies construct will not affect competitiveness of a firm negatively, i.e., these firms will perform above industry average even though they invest in proactive and interactive corporate environmental responsiveness strategies. It would be a stretch to conclude that a high association between corporate environmental responsiveness strategies and firm performance indicates any causality.

The items included in this measure (question 19 of the questionnaire attached as Appendix 1a) inquire about managerial perceptions of company performance relative to competitors on product cost, product quality, new product development, production technology, sales growth, market share, profit margins, and personnel development. While it is difficult to hypothesize any relationships between corporate environmental responsiveness strategies and economic performance, a positive relationship between scores on corporate environmental responsiveness strategies and scores on managerial perceptions of performance are expected.

Another measure of economic performance used in this study is the 'return on assets' of the companies taken from the Compact Disclosures database for Canadian and U.S. companies. According to industry experts and the industry association, return on assets is a fair measure to enable comparisons among companies in the oil and gas sector. On the other hand, return on

investment is not considered a comparable measure since companies are capitalised differently depending upon their mix of activities. Similarly, return on sales is not comparable since downstream retailers have higher sales volumes but lower margins as compared to bulk sellers. Some companies only sell to pipeline companies at low margins. For Canadian companies, five years of data on return on assets are available. For U.S. companies, three years of data are available. Consequently, the return on assets taken as a measure is a five-year average for Canadian companies and a three-year average for the U.S. companies. Once again, while there is no theoretical justification for proposing a causality, a positive relationship between return on assets and corporate environmental responsiveness strategies scores is expected.

Table 5.13: Scale reliability for the firm performance construct (PERFMNC)

Items	*Pretest*	*Canada*	*U.S.*
Cronbach alpha	.7943	.7145	.8187
Alpha for individual items			
1. Product cost	.8086	.7485	.8180
2. New product and market development	.8611	.7036	.7634
3. Sales growth and market share	.7356	.6314	.7854
4. Personnel development	.7369	.6821	.7934
5. Profit margins	.7225	.6804	.8084
6. Product quality, features and performance	.7462	.6832	.7974
7. Production technology	.7417	.6248	.7935

Table 5.13 presents scale reliability measures for the perceptual measure for firm performance using Cronbach Alpha with the dataset from the pretest and also for the main dataset, separately for the Canadian and the U.S. companies. The overall alpha coefficient for the seven item scale ranges satisfactorily between 0.71 to 0.82 in the three datasets. Deletion of any

of the seven items does not lead to any significant differences in the overall alpha value in the datasets, indicating high stability of the items constituting the scale.

Table 6.13 presents results of exploratory factor analysis among the items constituting the firm performance construct. This factor analysis has been run separately on Canadian and U.S. datasets.

Table 6.13: Factor scores for the firm performance construct (PERFMNC)

Items	*Canada*		*U.S.*
Factors extracted (percentage of variance)	2 (39.8)	(19.0)	1 (49.2)
Factor loadings			
1. Product cost	.4887	**.7786**	.5553
2. New product and market development	.3675	.6054	**.8465**
3. Sales growth and market share	**.7338**	.1145	**.7368**
4. Personnel development	**.5321**	.2653	**.6896**
5. Profit margins	**.9106**	.1132	.6333
6. Product quality, features and performance	.3999	**.6750**	**.7017**
7. Production technology	**.8514**	.1100	**.7121**

Only one factor is extracted in the U.S. dataset. However, in the Canadian data, certain product related dimensions load on a second factor. These are product cost, quality and performance, and new product development. However, it is not clear what the first factor represents - the items range from an economic performance indicator (profit margins), to a growth indicator, to personnel development, to a technological indicator. There are no theoretically justifiable distinctions among the two factors. This is an established scale frequently used in strategy research across several different datasets. Hence, this scale is retained as is and is not modified due to lack of theoretical reasons for breaking it up or reducing the number of items.

The next chapter presents the results of multivariate statistical analysis to test the hypotheses presented in chapter five, and using the constructs discussed in chapter seven.

CHAPTER 8 - RESULTS

This chapter describes the results of the statistical analysis of the survey data for the Canadian and U.S. companies. The first part of this chapter describes data diagnostics, tests for non-response bias, computation of inter-respondent reliability, and the tests for equality of means in the Canadian and U.S. datasets. The second part describes the tests for multicollinearity among sets of independent variables in each regression model, and discusses possible remedies for the observed multicollinearity in one of the models. The third part of this chapter describes the results of multiple regression analyses undertaken to test the hypotheses designed to predict and explain corporate environmental responsiveness strategies and their impact on organizational outcomes.

8.1. Data diagnostics.

All the variables (except business exposure, values of which can range from 0 to 10) have been operationalized on seven point likert-type interval scales and closely approximate continuous variables to enable the use of ordinary least squares regression. In order to obtain the best linear unbiased estimator the variables must meet the regression parameters or assumptions (Berry, 1993). The assumption of homoscedasticity, based on the Gauss-Markov theorem, states that the dependent variable is a random variable with equal variances around the fixed values of the independent variables (Pedhazur, 1982). In other words, the variance of error values is the same at all levels of the independent variable, or that the variability of scores for the dependent variable is roughly the same at all values of the independent variables.

The assumption of normality states that if the independent variables are normally distributed, the least squares estimators will be identical to the maximum likelihood estimators

(Chou, 1975). The assumption of multivariate normality implies that there is linearity between all pairs of variables. Significance tests are based on this assumption. Homescedasticity is related to the assumption of normality because once the assumption of normality is met, the relationships between variables are homoscedastic. In the Canadian data, with response rates approaching 90% of the population surveyed, the assumption of normality becomes less important in drawing inferences from the data to the population. At the same time, it can be argued that even though populations tend to be normally distributed (Pedhazur, 1982), a dataset of just 99 companies selected on the basis of a sales revenue cut-off criterion is not likely to be normally distributed considering the 2000 companies representing the Canadian oil and industry. In any case, the normality assumption is important for the U.S. data where the response rate is 45%.

The assumption of linearity states that given the linear dependence between the dependent variable (Y) and the independent predictor variables ($X's$) and the n pairs of observations (y_i, x_i), this method produces parameter estimates a (the constant) and b (the effect of X on Y or B as the standardised effect) in such a way that the error in estimation is the minimum (Chou, 1975). The assumption of linearity is fundamental to multivariate statistics because the solutions are based on the general linear model.

Thus, if the three assumptions of homoscedasticity, normality, and linearity are met, then ordinary least squares regression yields the best linear unbiased estimators.

These assumptions were tested by visually scanning histograms and scatterplots which are attached as Appendices 3 to 5. Appendix 3 contains the scatter diagrams for all of the regression models indicating average linear dependencies of the dependent variables upon the independent

variables. These scatter diagrams with a trend line fitted indicate an approximate linear relationship (and a clear lack of curvilinear relationship) between the dependent variable and the independent variable(s) for each of the regression model. Appendix 5 contains scatterplots for the standardised residuals over values of the dependent variable. These scatterplots are intended to show the distribution of values of the dependent variable around values of the independent variables. The scatterplots show roughly equal or random scatters of datapoints around values of the independent variable(s). No visible fan shaped increasing or decreasing trend of values is observed indicating a serious violation of homoscedasticity. The histograms of the standardised residuals of the dependent variables over values of the independent variables (in Appendix 4) indicate normality of distributions for the dependent variables. While none of the variable distributions in the data are expected to be normally distributed, a pronounced or marked skewness requires special treatment of the variable values. No serious skewness or other form of frequency distribution limits the use of ordinary least squares regression. Compared to the number of cases in the data, the number of outliers are very few in all the distributions.

As the regression assumptions have been substantially met, the multiple regression is expected to be a robust method of testing the effects of predictor variables on the dependent variables in the present case (Pedhazur, 1982). The resultant effects of multivariate regression are expected to be the best linear unbiased estimators.

8.2. Inter-respondent reliability.

The data for Canadian companies contains data for 64 companies out of an N = 99 that responded with multiple responses. In the case of US companies, only 10 provided multiple responses out of a total N = 74. The distribution of multiple respondents is as below:

Response data

	Canada	*U.S.*
Total companies responding	99	74
Multiple responses	64	10
Percentage of multiple responses (%)	64.6	13.5
Number of companies with:		
4 or more respondents	3	0
3 respondents	10	2
2 respondents	51	8

Getting multiple responses in strategy research is important to obtain perspectives from different levels and functional areas within a company. According to Mintzberg (1978,1994), strategy is often emergent and the top management viewpoint need not necessarily reflect the pattern of actions that constitutes strategy within an organization. Consequently, a 65% multiple response from top and middle managers in the Canadian dataset is a healthy measure for triangulating different viewpoints within Canadian companies for measuring strategy. The same cannot be said for the U.S. dataset. However, if the Canadian dataset indicates a high inter-respondent reliability, then the same inference can be extended to the U.S. dataset.

Further, if the inter-respondent reliability is high, then the multiple responses within a company can be averaged in order to arrive at a representation of variable values that are representative of the company as a whole.

The inter-respondent reliability was computed using two methods. The first was the Spearman-Brown Inter Class Correlation Coefficient (Shrout & Fleiss, 1979), and the second was a more conservative measure of inter-class correlation proposed by Tinsley & Weiss (1975). Both methods use analysis of variance using mean sums of squares to compute the inter-respondent reliability. The latter measure adjusts the coefficient for the number of respondents to generate a conservative coefficient measure.

The Spearman-Brown Coefficient (Shrout & Fleiss, 1979): $Ms_p - MS_e / MS_p$
Inter-class correlation (Tinsley & Weiss, 1975): $MS_p - MS_e / Ms_p + MS_e (k-1)$
MS_p = Mean sums of squares for the variance between respondents
MS_e = Mean sums of squares for error
k = number of respondents.

The average inter-respondent reliability for the Canadian companies according to both measures is satisfactorily high as indicated below:

Average inter-respondent reliability statistics for Canadian responses

	Spearman-Brown Co-efficient	*IRR (Tinsley & Weiss, 1975)*
Mean inter-respondent reliability	0.82	0.69
Standard deviation	0.09	0.15
Minimum	0.55	0.36
Maximum	0.99	0.98
Mode	0.81	0.70
N	64	64

The figures indicate a high average inter-respondent reliability measure. Responses from only two companies revealed an inter-respondent reliability below 0.70 with the Spearman-Brown measure and below 0.60 with the IRR measure. Hence, the multiple responses for both Canadian

and U.S. companies were averaged to arrive at values of measures intended to represent the variables being measured.

8.3. Non-response bias.

The response rate from the Canadian companies surveyed was 90% and hence does not indicate the possibility of any apparent non-response bias in the data. Moreover, a scan of the 11 companies out of 110 that did not respond indicates 1 senior company, 2 intermediates, and 7 junior companies. This is roughly in proportion to the company population surveyed. The situation is different in the U.S. data where 45% of the companies surveyed responded. Although, 45% is a good response rate, it needs to be tested for representativeness. Among the most common approaches followed for estimating non-response bias are the following two (Emory & Cooper, 1991): (a) A few companies from the non-respondent group are selected at random, and contacted in order to get them to respond to the survey instrument. Their responses are compared to the responses of the existing respondents, and any statistically significant differences between responses may indicate a possible non-response bias. In the present study, ten U.S. companies were contacted over telephone. However, all ten of them refused to co-operate in filling in a 13 page questionnaire which would require a minimum of 45 minutes over the telephone; or (b) Certain company demographic indicators are compared for the groups of the responding and non-responding companies. Although company demographics such as sales revenues, profits, and earnings per share may not reflect behavioural and other organizational variables measured in the companies, this test provides a rough indicator of the presence or absence of differences between responding and non-responding groups of companies in terms of size, resources, etc.

In the present study, the latter approach was followed and some of the available company financial indicators were compared for the responding and non-responding groups of companies. Table 7 describes the results of the *t*-tests for the statistical significance of the difference between the means of company financial data in the responding and non-responding groups of companies. As can be seen, none of the mean differences are statistically significant. Although, this test is not conclusive, it provides some evidence to state that the two groups of companies do not differ in terms of average sales revenues, average net profits, or average earnings per shares. It seems that there are no fundamental differences between the responding and non-responding groups of companies.

Table 7: Tests for significance of differences in mean financial indicators of responding and non-responding groups of companies in the U.S. population

	Responding companies			*Non-responding companies*		
	Sales revenues (5 yrs avg.) millions	*Net income (5 yrs avg.) millions*	*EPS (3 yrs avg.)*	*Sales revenues (5 yrs avg.) millions*	*Net income (5 yrs avg.) millions*	*EPS (3 yrs avg.)*
Mean	44.15	5.43	.60	30.89	1.23	.26
S.D.	107.52	34.08	1.99	133.69	5.90	3.20
Minimum	14.28	-1.111	-3.25	6.49	-1.73	-22.61
Maximum	6477.98	2847.85	12.12	11558.88	5152.00	12.12
Difference in means	13.16	4.20	.34			
T-values	.67	1.14	.73			
Significance of *t* value (two tailed test)	.503	.256	.463			

8.4. Analysis of variable means and frequency distributions.

Table 8: Means and standard deviations for the Canadian and U.S. datasets

Variables	*Canada means*	*Canada S.D.s*	*U.S. means*	*U.S. S.D.s*
Environmental strategy	3.12	0.86	2.95	1.14
-Species and habitat protection	4.94	0.89	4.60	1.33
-Voluntary actions for restoration	3.32	0.97	3.14	1.24
-Waste reduction	5.51	1.33	5.27	2.04
-Material reduction	1.67	0.53	1.55	0.67
-Use of alternative fuels	2.55	1.08	2.92	1.60
-Energy efficiency	2.70	0.88	2.95	1.27
-Risk reduction	5.25	0.94	5.24	1.20
-Products - less harmful	3.90	2.62	3.81	2.60
-Partnerships- environmental protection	5.16	2.02	4.48	2.66
-Disclosure	3.58	0.83	3.18	1.20
-Research and training	2.15	0.77	1.90	0.94
Threat perceptions of environmental issues	2.90	1.04	3.13	1.17
Competitive Benefits	3.54	1.27	3.49	1.48
Capability features of benefits	3.90	1.22	4.00	1.32
Performance	4.67	0.62	4.41	0.74
ROA (%)	2.41	5.79	2.00	5.00
Importance of environmental stakeholders	4.75	1.32	4.14	1.53
Perceived institutional identity	5.07	0.85	4.79	1.13
Environmental philosophy	4.83	0.96	4.78	1.09
Line manager influence	5.31	1.04	4.14	1.47
Integration	4.11	1.28	5.15	1.58
Managerial discretion	4.96	1.24	3.51	1.62
Environmental indicators weighting	3.19	1.65	4.80	1.84
Performance evaluation on env. indicators	3.79	1.52	3.37	1.77
Timing of response in issue lifecycle	3.10	1.32	3.68	1.64
Stakeholder relation strategies	4.29	1.47	3.34	1.76
Company size (control)	3.64	1.76	4.00	2.03
Business exposure	4.68	1.90	4.75	2.36

Appendix 4 contains histograms showing frequency distributions of all the variables to be tested, separately for the Canadian and U.S. datasets. The general trend in these histograms is that while the average values for the U.S. data are lower for almost all variables, the variance is higher

with a greater spread of frequencies. These differences occur despite the fact that both Canadian and U.S. data show a similar number of companies with responses at the higher end of the seven-point scale for most variables. The main reason is that a larger proportion of U.S. companies than Canadian companies have responses at lower end of the seven-point scales. The Canadian companies' data tend to have higher modes (which implies a higher number of companies that are concentrated at a higher value on the seven point scale) and have smaller dispersion as compared to the U.S. companies data. This implies that even though the variable means are not absolutely very different for the two datasets, the spread of responses is higher for the U.S. companies. A greater number of Canadian companies are concentrated at higher variable values, even though outlying lower values drag averages down close to U.S. levels. It can be speculated that this may be due to a greater overall concern for environmental preservation, a greater familiarity with environmental issues, and lower threat perceptions on the part of Canadian managers.

Table 8 contains out the descriptives in terms of absolute values of means and standard deviations of the variables for the two datasets. A comparison of the mean values of the variables in the two datasets shows some interesting differences.

Corporate environmental responsiveness strategies. On a seven-point scale ranging from extreme reactiveness (1) to high interactiveness (7), Canadian companies scored an average of 3.12 as compared to an average of 2.95 for U.S. companies. This indicates a slightly higher level of proactiveness on an average. The standard deviation for U.S. companies was also higher indicating a wider variance. The frequency distribution for this variable shows 16% of the Canadian companies scoring above 4 on the seven-point scale and 2% of the companies scoring

above 5 out of 7. In the case of U.S. companies, 19% scored above 4 and 1.4% scored above 5 on the 7 point scale. However, there were a large number of U.S. companies which scored below 3 out of 7 (51%) as compared to Canadian companies (43%), which dragged the U.S. average down.

On the eleven individual dimensions used to measure environmental strategies, Canadian firms scored higher on nine dimensions and U.S. firms scored higher on two dimensions, i.e., use of alternative fuels and energy efficiency. This indicates a greater emphasis in the U.S. to switching away from traditional fossil fuels and also greater emphasis on greater energy efficiency.

Managerial interpretations of environmental issues. Canadian managers perceived environmental issues as lower threats (mean = 2.90) as compared to their U.S. counterparts (mean = 3.13). The standard deviation was also higher for U.S. companies indicating a wider variation in perceptions.

Competitive benefits of environmental strategies. Canadian companies perceived a slightly higher average connection between environmental responsiveness strategies and the emergence of organizational benefits (3.54) as compared to U.S. companies (3.49). The range of variation for U.S. companies was higher.

Features of organizational benefits as unique organizational capabilities. While Canadian companies perceived a higher average value of benefits as a consequence of environmental strategies, U.S. companies perceived a higher average connection between these benefits and the emergence of unique organizational capabilities (4.00) as compared to Canadian companies (3.90). The standard deviation for U.S. companies was higher.

Firm performance. The perceptual measure of firm performance reflected a higher average score for Canadian companies (4.67) as compared to U.S. companies (4.41). The standard deviation for U.S. companies was higher. The financial measure of return on assets for Canadian companies was also higher on an average at 2.41% as compared to 2.00% for U.S. companies. Unlike all other variables, the standard deviation for the return on assets data for Canadian companies was higher.

Importance of environmental stakeholders and stakeholder relationship strategies. Not only were stakeholders considered as spokespersons for the natural environment given greater importance by Canadian companies (mean = 4.75) as compared to U.S. companies (mean = 4.14), but the relationships strategies with these stakeholders were perceived as more collaborative and problem-solving by Canadian companies (mean = 4.29) as compared to U.S. companies (mean = 4.02). The standard deviation for both measures was higher for the U.S. companies.

Perceived organizational identity. On average, Canadian firms perceive their identity as more institutionally-oriented as compared to U.S. firms. This may imply that a relationship between managerial perceptions of institutional identity and threat interpretations of environmental issues should be a little stronger among Canadian companies. The standard deviation for U.S. firms is higher.

Environmental philosophy. This is intended to be a measure of organizational philosophy toward environmental preservation as reflected in perceptions of top and middle managers in an organization. It is impossible to separate out individual environmental philosophies and ideologies from organizational and top management philosophies. It is hoped that averaging out multiple

responses within an organization will reflect an organizational philosophy driven by top management ideologies (Hambrick & Mason, 1984). The average value of managerial concern for environmental preservation is a little higher for Canadian companies at 4.83 on the seven point scale as compared to a value of 4.78 for the U.S. companies. The standard deviation is a little higher for the U.S. companies indicating a wider variance of philosophies.

Line manager influence in environmental decisions. Once again, the Canadian dataset shows a higher average value and lower standard deviation for line manager influence in environmental decisions at 5.31 versus 5.15 for the U.S.

Integration. On average, Canadian companies appear to use devices for integrating line and staff functions on environmental issues to a greater extent than do U.S. companies (mean value of 4.11 versus a mean value of 3.51 on a seven point scale). The standard deviation for U.S. companies is higher indicating greater variance.

Managerial discretion. On average, Canadian companies appear to provide greater discretion to managers for dealing with decisions on the business-natural environment interface and allow them greater flexibility in modifying business practices and making resource allocations for reducing environmental impact (mean value of 4.96 for Canadian companies versus a mean value of 4.80 for U.S. companies). The standard deviation for U.S. companies is higher indicating greater variance.

Weighting of environmental performance indicators in employee control systems. On average U.S. companies seem to weigh environmental performance indicators higher in employee control systems (mean value 3.37 for U.S. companies as compared to 3.19 for Canadian

companies). This may be due to punitive penalties under U.S. environmental laws such as the Superfund legislation. The standard deviation for U.S. companies is higher indicating a greater variance.

Overall performance evaluation of employees on environmental performance. In the case of overall devices to include environmental indicators in employee evaluation systems and in planning and budgeting systems, Canadian companies score higher on an average as compared to U.S. companies (mean value of 3.79 as compared to 3.68 for U.S. companies). The standard deviation for U.S. companies is higher indicating greater variance.

Timing of response in the issue lifecycle: A higher mean value for the U.S. data suggests that, on an average, U.S. firms responded in modifying their practices in response to environmental issues earlier than Canadian firms. This may be due to the enactment of the Superfund legislation in the U.S. in the mid-1980s and the punitive penalties for improper disposal of toxic and hazardous wastes. The standard deviation for timing of response is also higher in the U.S. dataset indicating a wider range of response times. For Canadian companies, a mean of 3.10 indicates a response time averaging around 1990-91. The average year of response is around 1989-90 for the U.S. companies.

Company size (control variable). On average, in terms of annual sales revenues, U.S. companies that responded to the survey were larger as compared to Canadian companies that responded. The standard deviation of sales revenues was higher for the U.S. companies indicating a wider variation in company size.

Business exposure. Business exposure as measured by the range of products and activities of a company was higher on an average (mean = 4.75) for U.S. companies as compared to Canadian companies (mean = 4.68). This is consistent with a higher average size of U.S. companies that responded implying that larger sales revenues reflected a wider range of products and activities. The standard deviation was also higher for the U.S. companies.

Summary. Canadian companies scored on an average higher than U.S. companies on all variables (and lower on managerial threat interpretations of environmental issues) except for timing of response, weighting of environmental indicators in performance evaluation, use of alternative fuels and energy efficiency, and the features with organizational benefits as organizational capabilities. The standard deviations for all variables other than the return on assets measure were higher for U.S. companies. This reflects a wider variation in organizational factors, strategies, and outcomes in the more geographically dispersed U.S. oil and gas industry. The Canadian industry seems a little more homogeneous, which may be partly due to its location primarily in Alberta.

8.5. Differences between the two population samples.

It was decided to treat the two datasets as separate for analysis due to conceptual reasons. This enables the theoretical model proposed to be tested in two different countries, even though the industry is the same. This replicates the model in two different regulatory, social, and cultural contexts. The analysis of the two separate datasets also enables a comparison between two regulatory contexts and helps point to possible reasons for greater or lower environmental responsiveness in the oil and gas industry in a particular country.

Table 9: *t*-Tests for equality of means in the Canadian and U.S. datasets

Variables	*Mean difference*	*T- value*	*Two-tailed significance*	
Environmental strategy	.1687	1.110	.269	N.S.
-Species and habitat protection	.3432	1.990	.048	Different
-Voluntary actions for restoration	1.2784	1.080	.284	N.S.
-Waste reduction	1.6516	.910	.362	N.S.
-Material reduction	.8120	1.250	.214	N.S.
-Use of alternative fuels	-2.571	-1.770	.079	Different
-Energy efficiency	-1.775	-1.550	.124	N.S.
-Risk reduction	.1420	.120	.901	N.S.
-Products - less harmful	.5437	.170	.862	N.S.
-Partnerships- environmental protection	4.7809	1.85	.066	Different
-Disclosure	2.820	2.590	.010	Different
-Research and training	1.5642	1.67	.096	Different
Threat perceptions	-.2307	-1.360	.174	N.S.
Competitive Benefits	.0508	.240	.812	N.S.
Capability features of benefits	-.0929	-.460	.645	N.S.
Performance	.2570	2.450	.015	Different
ROA (%)	2.3917	3.550	.000	Different
Importance of environmental stakeholders	.6077	2.780	.006	Different
Perceived institutional identity	.2772	1.83	.069	Different
Environmental philosophy	.2516	2.190	.030	Different
Line manager influence	.1626	.840	.400	N.S.
Integration	.6045	2.740	.007	Different
Managerial discretion	.1600	.730	.219	N.S.
Environmental indicators weighting	-.1757	-.650	.518	N.S.
Performance evaluation on env.indicators	.1072	.420	.675	N.S.
Timing of response in issue lifecycle	-.2433	-1.030	.306	N.S.
Stakeholder relation strategies	.2732	1.090	.279	N.S.
Company size (control)	-.3594	-1.21	.226	N.S.
Business exposure	-.0767	-.240	.814	N.S.

N.S. = Not significantly different

A scan of the mean and standard deviation values of the variables in the two datasets indicates that the differences between the values in the Canadian and U.S. datasets are not

absolutely substantial. However, it is difficult to make judgements in the absence of statistical benchmarks for significance of differences between means.

Even though the response rate from the Canadian companies approached close to the total population, the response rate for the U.S. companies was 45%. Although no sampling methods were used, a 45% response rate indicates a form of a self-selected sample from the population. As a result, *t*-tests for equality of means of the Canadian and U.S. companies datasets were run in order to identify statistically significant differences between the variable means in the two datasets. The means for the Canadian variables taken as fixed with no dispersion (due to the proximity of Canadian response data to population values), while the means for the U.S. data are taken as sample means with standard deviations. Table 9 presents the results of the two-tailed T-tests on differences between variable means in the two datasets.

Although the mean value of the corporate environmental responsiveness strategies construct is not statistically significantly different between the two datasets, some of the individual dimensions are significantly different. These dimensions are species and habitat preservation ($p < .05$), disclosure ($p < .05$), stakeholder partnerships ($p <. 10$), research and training ($p <.10$), and use of alternative fuels ($p < .10$). In all the above dimensions, except for use of alternative fuels, Canadian companies have higher average scores.

Among the factors seen as impacting upon managerial interpretations of environmental issues, statistically significant differences are seen between the means for environmental philosophy variable ($p < 0.05$), perceived institutional corporate identity ($p < .10$), and use of integration devices ($p < 0.01$). In all these variables, the Canadian companies had higher mean

scores. This implies that multivariate analysis may reveal differences in the relationships of these three variables with managerial interpretations of environmental issues. As will be seen later on this chapter, environmental philosophy is a statistically significant predictor of managerial interpretations in the U.S. data and not in the Canadian data. Institutional corporate identity perceptions is a statistically significant predictor of managerial interpretations in the Canadian data and not in the U.S. data. Use of integration devices is not statistically significant as a predictor in both datasets.

The difference between the mean values of the variable, importance attached to environmental stakeholders, is statistically different at $p < .01$ in the two datasets (i.e., it is higher for the Canadian companies). This indicates, as is subsequently found, that the relationship of business exposure with importance given to environmental stakeholders will vary between the two datasets. In the Canadian dataset, the relationship is statistically significant, while it is not statistically significant in the U.S. data. The means of the performance variables are both statistically significantly different at ($p < .01$) in the two datasets. However, the relationships between corporate environmental responsiveness strategies and performance is found to be statistically significant in both the Canadian and U.S. datasets.

The above analysis reveals mixed results, with some variables appearing to be statistically significantly in the two datasets and many others appearing to be statistically significantly equal. This reinforces the original theoretical decision to keep the two datasets as separate.

Tests for the equality of coefficients in different regressions: Chow tests were also run to test for equality of coefficients in the different regression models. These tests gave mixed results,

with some models appearing to have statistically significantly unequal sets of coefficients, and some models having statistically significantly equal sets of coefficients.

Each regression model in the Canadian dataset was equated to its counterpart model in the U.S. dataset, and a null hypothesis formulated to test whether the regressions are identical. If the null hypothesis is accepted, then all coefficients in the regression model are deemed essentially equal in the two datasets. This implies that the two datasets can be pooled for analysis. If the null hypothesis is rejected, then it is implied that the datasets are different and cannot be pooled. A *F*-statistic is computed using the residual sums of squares (ESS_1 and ESS_2) of the regression model run separately with the two datasets and with the combined dataset. The formula for the *F*-statistic is (Pindyck & Rubinfeld, 1981):

$$F_{k,\,N+M-2k} = \quad (ESS_R - ESS_{UR})/k \;\; / \;\; ESS_{UR}/(N+M-2k)$$

$ESS_{UR} = ESS_1 + ESS_2$ (residual sums of squares of the regression equations for the two datasets);

ESS_R = the residual sum of squares for the combined regression equation;
k = number of independent variables
N = number of cases in the first dataset; M = number of cases in the second dataset

The null hypothesis is accepted or rejected depending on whether the *F*-statistic is smaller or larger than the critical value of the *F* distribution for the degrees of freedom indicated. The level of significance is taken at $p<.05$ for this test.

The first model regresses Environmental Philosophy (ENVPHILS), Managerial Discretion (DISCRETN), perceptions of corporate institutional identity (IDTYINST), inclusion of environmental indicators in performance evaluation systems (PERFEVAL), influence of line managers (INFLINE), co-operation between line and staff managers (INFLCOOP), and use of

integration devices between line and staff managers (INTEGRTN), on managerial interpretations of environmental issues as threats versus opportunities (THREAT). The null hypothesis is accepted since the *F* -statistic is 1.681 and lower than the critical value of *F* which is 2.01. This indicates that the coefficients of the variables in this regression model can be equated.

The second model regresses timing of response in issue lifecycle (EPYEAR), stakeholder relationship strategies (RELATION), managerial interpretations of environmental issues (THREAT), and company size (COSIZE) on corporate environmental responsiveness strategies (ENVSTRGY). In this case, the null hypothesis is rejected since the *F*-statistic is 5.00 and is larger than the critical value of *F* of 2.37. This indicates that the parameters of some or all of the coefficients of the two equations are different.

The third model regresses business exposure (EXPOSRE) on importance attached to environmental stakeholders (STAKENVL). The null hypothesis is rejected in this case as well. The *F*-statistic is 8.45 and larger than the critical *F* value of 3.84. This indicates that the parameters of the business exposure variable are different in the two datasets.

The fourth model regresses importance attached to stakeholders considered spokespersons for the natural environment (STAKENVL) on relationship strategies adopted with such stakeholders. The *F* - statistic is 1.056, which is lower then the critical value of *F* (3.84). This indicates that the STAKENVL coefficient is equated in the two datasets.

The fifth model that uses multiple predictors regresses capability features of benefits arising from corporate environmental responsiveness (CAPABLTY) and corporate environmental responsiveness strategies (ENVSTRGY), on competitive benefits arising from corporate

environmental responsiveness (COMPBNFT). The null hypothesis is accepted in this case: *F*-statistic = 1.76 and the critical *F* value = 3.00. Once again, one or both of the coefficients in this equation are equal in the two datasets.

In the case of the sixth and seventh models regressing corporate environmental responsiveness strategies (ENVSTRGY) on firm performance (PERFMNC) and on return on assets (ROA), the null hypothesis is rejected. The *F*-statistic for the model regressed on performance is 6.76 and greater than the critical *F* value of 3.84. The *F*- statistic for the model regressed on ROA is 18.23 and greater than the critical *F* value of 3.84. Thus, the null hypothesis (that the datasets are similar) is rejected.

The results of the Chow tests are mixed and it is unclear whether the two datasets can be combined. Due to theoretical reasons, the two datasets are treated separately. However, regression models with interaction terms between the country of response and variable values were run to identify the variable coefficients that were different in the models where Chow tests enabled the rejection of the null hypothesis. The results of the regression model with interaction terms are presented in Table 10.

The regression equation that was run was as follows:

$$\text{ENVSTRGY} = a_0 + b_{01}\,\text{THREAT} + b_{02}\,\text{YEAR} + b_{03}\,\text{COSIZE} + b_{04}\,\text{RELATION} + b_{05}\,\text{COUNTRY} + b_{06}\,\text{COUNTRY x THREAT} + b_{07}\,\text{COUNTRY x YEAR} + b_{08}\,\text{COSIZE} + b_{09}\,\text{RELATION} + e_0$$

In this equation, country is entered as a dummy variable with USA = -1 and Canada = 1. All the four variables in this equation are multiplied by country to obtain interaction terms. The regression results show that besides the main effects of the four variables, only the interaction

term for stakeholder relationship strategies is statistically significant between the two countries. There is no main effect of the country of response.

Table 10: Regression results of the impact of managerial threat perceptions of environmental issues and other organizational variables on corporate environmental responsiveness strategies (dependent variable) with country interaction terms.

d.v.=corporate environmental responsiveness strategies	Unstd *b*	Beta *B*	*t* value	*p* one tailed
THREAT	-.209	-.248	-3.95	**.0001**
RELATIONS	.172	.281	4.437	**.0000**
YEAR	.187	.280	4.230	**.0000**
COSIZE	.173	.335	5.479	**.0000**
COUNTRY	.379	.381	1.267	.2072
COUNTRY x THREAT	-.004	-..014	-.079	.9370
COUNTRY x RELATIONS	-.244	-.256	- 2.83	**.0060**
COUNTRY x YEAR	-.017	-.060	-.383	.7025
COUNTRY x SIZE	-.020	-.086	-.619	.5369
Constant (a_0)	1.745		5.840	**.0000**
R^2	.5915			
Adjusted R^2	.5645			
F Statistic	21.882			
Probability of F	**.0000**			
N	173			

Thus, the origin of the difference between the two models is the differing relationship strategies adopted to deal with stakeholders considered spokespersons for the natural environment. From the mean values of this variable, on an average, the Canadian companies adopt relationship strategies that are more collaborative/problem-solving in nature. This may be partly due to the differing regulatory contexts between the two countries. In Canada, public consultation processes are used within broad guidelines for environmental preservation. Canadian companies are forced to adopt more conciliatory stances with stakeholder groups, as compared to U.S. companies which operate under specific guidelines, punitive penalties, and a litigious environment.

In the models regressing corporate environmental responsiveness strategies on economic performance measures, the Chow test indicates differences in coefficients in the two datasets. Since only one variable, environmental strategies, is entered in both equations, it appears that the corporate environmental responsiveness strategies differ between the two datasets.

8.6. Multicollinearity.

The estimates of the Beta values and the sum of squares attributable to each variable are dependent on the other variables in the equation. Variances of the estimators also increase when independent variables are interrelated. This may result in a regression equation with a significant R^2, although virtually none of the coefficients is statistically significant. Although it is possible that one variable may be a perfect linear combination of other independent variables (yielding a singular correlation matrix), in most cases a perfect linear combination is rare. Cases of near-singularities, or high correlations between independent variables, are called multicollinearity. Multicollinearity can be detected in several ways. Large coefficients in the correlation matrix always signal the presence of multicollinearity. However, multicollinearity can exist without any of the correlation coefficients being very large. One of the most frequently used indicators of interdependency between variables is the tolerance. If the variable has a large R^2 (or a small tolerance) when it is predicted from other independent variables, multicollinearity exists. The variances of the estimators are inflated and effects are biased. The tolerance is the proportion of the variability in an independent variable not explained by other independent variables (Tabachnik & Fidell, 1989). It is calculated as 1- R_i^2 , where R_i^2 is the squared multiple correlation when the

*i*th independent variable is considered the dependent variable and the regression equation between it and the other independent variables is calculated.

Variance inflation factors (VIF) are computed as the square roots of the inverse of the tolerances. A variance inflation factor greater than 2 can mildly affect the computation of the regression equation and bias the effects. However, in measuring social phenomena, a variance inflation factor greater than 3 indicates that multicollinearity can bias the effects of the variables in the equation (Pedhazur, 1982). The variance inflation factors were computed for each set of independent variables entering the various regression models.

The first model regresses Environmental Philosophy (ENVPHILS), Managerial Discretion (DISCRETN), perceptions of corporate institutional identity (IDTYINST), inclusion of environmental indicators in performance evaluation systems (PERFEVAL), influence of line managers (INFLINE), co-operation between line and staff managers (INFLCOOP), and use of integration devices between line and staff managers (INTEGRTN), on managerial interpretations of environmental issues as threats versus opportunities (THREAT). The VIFs computed for the six variables in this equation are as below for the two datasets.

V.I.F.s for variables entered in model 1

	Canada	USA
ENVPHILS	1.375	1.719
DISCRETN	1.961	**3.632**
IDTYINST	1.694	2.551
PERFEVAL	2.234	**3.529**
INFLINE	2.502	**3.004**
INFLCOOP	2.963	2.747
INTEGRTN	2.488	**3.283**

The VIFs marked in bold indicate a high level of multicollinearity. To that extent the effects of these variables will be biased. This is specially the case in the variables in the U.S. dataset. The remedies for multicollinearity will be discussed later on in this section.

The second model regresses timing of response in issue lifecycle (EPYEAR), stakeholder relationship strategies (RELATION), managerial interpretations of environmental issues (THREAT), and company size (COSIZE) on corporate environmental responsiveness strategies (ENVSTRGY). The VIFs for the four independent variables in this equation are presented below.

V.I.F.s for variables entered in model 2

	Canada	USA
EPYEAR	1.397	1.511
RELATION	1.293	1.352
THREAT	1.299	1.269
COSIZE	1.285	1.162

The VIFs are well below 2 and indicate that multicollinearity is not a problem in this regression equation.

The third model that uses multiple predictors regresses capability features of benefits arising from corporate environmental responsiveness (CAPABLTY) and corporate environmental responsiveness strategies (ENVSTRGY), on competitive benefits arising from corporate environmental responsiveness (COMPBNFT). The VIFs for the independent variables are presented below.

V.I.F.s for variables entered in model 4.

	Canada	USA
CAPABLTY	1.267	1.445
ENVSTRGY	1.267	1.445

Once again, multicollinearity is not a problem in this regression equation.

Some of the independent variables in the first model with managerial interpretations as a dependent variable are likely to have biased effects due to the multicollinearity. This problem is more serious in the U.S. data. The other models do not have any problem of multicollinearity. Several remedies are used to deal with multicollinearity. However, none of them is considered satisfactory in the present circumstances.

Some of the remedies and their applicability in the present study are discussed. (a) One remedy is to delete the variables with high VIFs. However, it is assumed that model has been properly specified before multicollinearity is tested. Deletion of the variables will lead to specification error. In the present case, there is no theoretical justification for deleting any of the variables with high VIFs. (b) Variables may be grouped either on the basis of a priori judgements or on the basis of principal components analysis. This approach must be theoretically justifiable. In the present case, it is unclear as to which variables should be grouped. Moreover, when blocks of variables are used in regression analysis, it is not possible to obtain a regression coefficient for a block unless one has first arrived at combinations of variables so that each block is represented by a single vector. Such summary statistics which refer to blocks of variables are difficult to interpret (Pedhazur, 1982). (c) Ridge regression or other forms of regression not based on ordinary least squares may be used. Ridge regression coefficients suffer from problems of interpretability (Pedhazur, 1982). (d) Additional data may be collected in the hope that the multicollinearity is ameliorated with a greater database. However, this is a shot in the dark.

Ultimately, none of these remedies is a cure for multicollinearity. The best that can be done is to understand the causes and to try to develop better measures of the variables exhibiting multicollinearity, and to replicate the tests for the model with the better measures. It is recognized that high multicollinearity exists among independent variables in the first model, especially in the U.S. data. This will bias the effects and lead to lack of statistical significance. Encouragingly, the other regression models appear to be free of multicollinearity.

8.7. Testing of hypotheses.

Testing of hypotheses was done using multiple regression. This is the most robust method for testing associations as predicted between variables provided the regression assumptions have been met (Berry, 1993; Pedhazur, 1982). As discussed in section 8.1 above, the regression assumptions have been largely met for the variables in both datasets. In interpreting the regression results, tests of significance using *t*-values were used. A discussion of the levels of significance used is discussed earlier in section 6.6.

8.7.1. Model 1: The impact of strategic leadership and organization design on managerial threat interpretations of environmental issues. The first model to be tested is as below:

$$THREAT = a_1 + b_{11}\ IDTYINST + b_{21}\ ENVPHILS + b_{31}\ INFLINE + b_{41}\ INFLCOOP + b_{51}\ INTEGRETN + b_{61}\ DISCRETN + b_{71}\ PERFEVAL + e_1 \quad (1)$$

This model predicts that **higher** levels of managerial perceptions of their corporate identity as institutionally-oriented (*IDTYINST*), higher concerns for environmental preservation reflected in the organisation's environmental philosophy (*ENVPHILS*), higher levels of line

manager influence in decisions on the business-natural environment interface (*INFLINE*), higher levels of co-operation between line and staff managers in dealing with the business-natural environment interface (*INFLCOOP*), higher use of integration devices between line and staff managers to deal with the business-natural environment interface (*INTEGRETN*), higher levels of managerial discretion to deal with the business-natural environment interface (*DISCRETN*), and higher levels of controls that emphasize employee evaluation on environmental performance (*PERFEVAL*), will lead to **lower** managerial threat interpretations of environmental issues (*THREAT*). The results of the multiple regression for this equation are presented below in Table 11.

The model to explain and predict managerial threat interpretations of environmental issues is statistically significant in both Canadian and U.S. databases at $p < .00001$. The variables in the model explain over 45% of the variance in managerial threat interpretations in the Canadian data and around 50% of the variance in the managerial threat interpretations variable in the U.S. data. The fit of the model is very good. However, some of the individual effects are non-significant. One reason could be the multicollinearity among the variables in the U.S. data.

Among the strategic leadership variables, the effect of perceptions of institutional identity on managerial interpretations (H3) is in the predicted direction and is statistically significant in the Canadian data at $p < 0.001$ and statistically significant at $p < 0.10$ in the U.S. data. Environmental philosophy toward environmental preservation has an effect (H2) in the predicted direction and is statistically significant ($p < 0.01$) only in the U.S. dataset.

Table 11: Regression results of the impact of strategic leadership and organization design factors on managerial threat interpretations of environmental issues (dependent variable)

Independent variables	*Canada*				*U.S.*			
d.v.= interpretations	Unstd *b* (Std. errors)	Beta *B*	*t* value	*p* one tailed	Unstd *b*	Beta *B*	*t* value	*p* one tailed
IDTYINST (H3)	-.4344 (.120)	-.360	-3.61	**.0005**	-.2346 (.140)	-.228	-1.67	**.0997**
ENVPHILS (H2)	.0217 (.096)	.0198	.225	.8229	-.3462 (.121)	-.319	-2.85	**.0060**
INFLINE (H4a)	.1190 (.124)	.1165	.961	.3391	-.1259 (.116)	-.160	-1.08	.2852
INFLCOOP (H4b)	-.2428 (.126)	-.253	-1.92	**.0583**	-.0805 (.112)	-.101	-.716	.4769
INTEGRTN (H4c)	.0446 (.100)	.0538	.446	.6571	.0110 (.117)	.0145	.094	.9256
DISCRETN (H5)	-.2747 (.091)	-.325	-3.03	**.0033**	.0160 (.117)	.0222	.136	.8921
PERFEVAL (H6)	-.0546 (.079)	-.078	-.685	.4950	-.1157 (.107)	-.173	-1.08	.2857
Constant (a_1)	7.0717 (.603)		11.71	**.0000**	7.2847 (.547)		13.30	**.0000**
R^2	.4954				.5471			
Adjusted R^2	**.4543**				**.4960**			
F Statistic	12.062				10.700			
Probability of F	**.0000**				**.0000**			
N	99				74			

Among organization design variables, managerial discretion in dealing with the business-natural environment interface has an effect (H5) in the predicted direction and is statistically significant ($p < 0.01$) only in the Canadian data. Co-operation between line and staff managers in dealing with the business-natural environment interface has the predicted effect (H4b) and is statistically significant at $p < 0.06$ only in the Canadian data. All other variables do not have effects that are statistically significant. H3 (effect of managerial perceptions of institutional

identity) is accepted in both datasets. H2 (effect of organizational environmental philosophy) is accepted in the U.S. dataset. H4a (effect of influence of line managers in environmental decisions) is rejected in both datasets. H4b (effect of level of co-operation between line and staff managers) is accepted in the Canadian dataset. H4c (effect of the use of integration devices) is rejected in both datasets. H5 (the effect of managerial discretion) is accepted in the Canadian dataset. H6 (the effect of environmental performance indicators in employee control systems) is rejected in both datasets.

In comparing the beta estimates, it is seen that variables such as institutional identity, managerial discretion, and co-operation between line and staff managers in the Canadian data, and environmental philosophy in the U.S. data, have the highest comparative effects on lower managerial interpretations of environmental issues as threats.

Hence, managerial perceptions of corporate identity is the common variable in both datasets that impacts upon managerial threat interpretations of environmental issues. Other variables that are statistically significant are managerial discretion and co-operation between line and staff managers in the Canadian data and environmental philosophy for environmental preservation in the U.S. data.

On the whole, the model is statistically significant in both datasets and explains almost half the variance in the dependent variable. It can be seen that predictors with high variance inflation factors (i.e., above 3) do not have statistically significant effects upon managerial interpretations. Thus multicollinearity may be a factor. On the other hand, the exploratory study revealed strong connections between these variables and managerial interpretations of environmental issues. The

lack of statistical significance may not necessarily mean that variables such as performance evaluation systems, use of integration devices, and influence of line managers do not influence managerial interpretations of environmental issues. It may mean that that the measures for the organization design variables need to be improved to remove multicollinearity, and to include a larger number of, and more representative, indicators as measures (Pedhazur, 1982).

8.7.2. Model 2: The impact of managerial threat interpretations and other organizational variables on corporate environmental responsiveness strategies. The model being tested here is as below:

$$ENVSTRGY = a_2 + b_{12}\,THREAT + b_{22}\,RELATIONS + b_{32}\,YEAR + b_{42}\,SIZE + e_2 \qquad (2)$$

This model predicts that **lower** managerial threat interpretations of environmental issues (*THREAT*), higher levels of relationship strategies that emphasize collaboration and problem solving with stakeholders representing the natural environment (*RELATION*), early response in the environmental issue lifecycle(*YEAR*), will lead to **higher** scores on corporate environmental responsiveness (*ENVSTRGY*), i.e. companies will move toward the proactive-interactive end of the seven point continuum. Company size, as a proxy measure of organizational slack, has been entered as a control variable in absence of any hypothesized relationship. The results of the multiple regression are presented in Table 12.

Model 2 is statistically significant at $p < 0.00001$ in both datasets and explains around 47% of the variance in corporate environmental responsiveness strategies in the Canadian dataset and around 66% of the variance in the U.S. dataset. The fit of the model is very good.

Table 12: Regression results of the impact of managerial threat perceptions and other organizational variables on corporate environmental responsiveness strategies (dependent variable)

Independent variables	*Canada*				*U.S.*			
d.v.=corporate environmental responsiveness strategies	Unstd *b* (Std. error)	Beta *B*	*t* value	*p* one tailed	Unstd *b* (Std. error)	Beta *B*	*t* value	*p* one tailed
THREAT (H1)	-.2048 (.071)	-.252	-2.87	**.0051**	-.2132 (.078)	-.240	-2.70	**.0094**
RELATIONS (H9b)	.1280 (.051)	.216	2.47	**.0095**	.2157 (.058)	.340	3.71	**.0005**
YEAR (H7)	.1705 (.061)	.254	2.79	**.0064**	.2044 (.064)	.306	3.15	**.0028**
COSIZE	.1531 (.043)	.306	3.50	**.0007**	.1921 (.045)	.357	4.19	**.0001**
Constant (a_2)	2.1244 (.397)		5.34	**.0000**	1.3667 (.452)		3.02	**.0040**
R^2	.4893				.6878			
Adjusted R^2	.4655				.6629			
F Statistic	20.599				27.541			
Probability of F	**.0000**				**.0000**			
N	99				74			

All the variables entered in the equation have effects in the predicted direction and are statistically significant at $p < 0.001$ in both the datasets. Company size, the control variable, is also statistically significant at $p < 0.001$ in both the datasets. The confirmation of all four of these variables as important predictors of a significant proportion of the variance in corporate environmental strategies is highlighted in both datasets. In comparing the betas, it can be seen that company size has a comparatively high effect on environmental strategies in both the datasets. The effects of the other three variables are about equal to each other and are substantial and absolutely and statistically significant.

A hierarchical sensitivity analysis reveals that even if company size is taken out from the regression equation, the effects of the other three variables do not change significantly. Neither does their statistical significance decrease (they are still statistically significant at $p < .001$). However, the adjusted R^2 (reduced for the R^2 shrinkage factor) decreases from 47% to 39% in the Canadian data and from 66% to 56% in the U.S. data. This indicates that company size explains between 8 to 10% of the variance in explaining the variance in corporate environmental responsiveness strategies.

This can be speculated as being due to several reasons: (a) Company size, as measured by average annual sales revenues, can be argued to be a proxy for organizational slack (Bourgeois, 1981) and indicates that companies with greater quantities of idle resources can afford to allow managers to experiment with uncertainty on the business-natural environment interface. These companies can also probably afford to add environmental indicators into their control and planning systems by allowing for slack in the economic performance objectives; and/or (b) Larger companies are subject to greater media scrutiny and pressures from stakeholder groups. These companies are thus forced to become more proactive on environmental responsiveness strategies that they follow.

8.7.3. Models 3 and 4: The impact of business exposure on importance of environmental stakeholders; and the influence of importance attached to environmental stakeholders on relationship strategies followed by the company in dealing with these stakeholders. The wider the business exposure of a company (*EXPOSURE*), the greater is the

importance expected to be attached to stakeholders that are perceived as spokespersons for the natural environment (*STAKENVL*).

Table 13: Regression results of the impact of business exposure on importance attached to environmental stakeholders; and the impact of importance attached to environmental stakeholders on stakeholder relationship strategies .

Independent variables	*Canada*				*U.S.*			
	Unstd *b* (std. errors)	Beta *B*	*t* value	*p* one-tailed	Unstd *b* (std. errors)	Beta *B*	*t* value	*p* one-tailed
EXPOSURE (b_{13} : H8)	.1280	.184	1.84	**.0683**	.1174	.179	1.512	.1350
(d.v.= STAKENVL)	(.069)				(.077)			
Constant (a_3)	4.153		11.86	**.0000**	3.579		8.595	**.0000**
	(.350)				(.416)			
R^2	.0339				.0321			
Adjusted R^2	.0239				.0181			
F Statistic	3.398				2.287			
Probability of F	**.0683**				.1350			
N	99				74			
STAKENVL (H9a)	.685	.626	7.699	**.0000**	.6009	.5465	3.218	**.0000**
(d.v. = RELATIONS)	(.088)				(.1116)			
Constant (a_3)	1.051		2.404	**.0000**	1.587		5.382	**.0020**
R^2	.3918				.2987			
Adjusted R^2	.3852				.2884			
F Statistic	59.27				28.96			
Probability of F	**.0000**				**.0000**			
N	99				74			

This regression equation indicates whether business exposure has an indirect effect upon corporate environmental responsiveness strategies via importance attached to environmental stakeholders, which in turn impacts upon stakeholder relationship strategies.

$$STAKENVL = a_3 + b_{13}\ EXPOSURE + e_3 \qquad (3)$$

The fourth model tests the hypothesis that the greater the importance attached to

environmental stakeholders (STAKENVL), the greater the likelihood of a company following relationship strategies that are collaborative and problem-solving (RELATIONS) with these stakeholders.

$$RELATIONS = a_4 + b_{14}\, STAKENVL + e_4 \qquad (4)$$

The impact of business exposure on importance attached to environmental stakeholders is statistically significant at $p < 0.07$ in the Canadian data and not statistically significant in the U.S. data. The model explains only 2% of the variance in the dependent variable in both the Canadian and the U.S. datasets.

The results of the regression model 3 show a low statistically significant relationship between business exposure and importance attached to environmental stakeholders. This may imply that: (a) Firms with a wider range of products and services need not necessarily feel pressured to respond to the concerns of stakeholders considered spokespersons for the natural environment, i.e., internal organizational variables are primary drivers for environmental responsiveness, and/or; (b) The measure for importance attached to environmental stakeholders is inadequate - it does not distinguish between positive (opportunity to learn from the influence) and negative (threat to operations) aspect of the measure. A measure that distinguishes between the positive and negative dimensions of this influence may be influenced by business exposure; and/or (c) The measure for business exposure is inadequate.

However, the results of regression model confirm Hypothesis 9a which states that the greater the importance attached to stakeholders considered spokespersons for the natural environment, the greater the likelihood of a company following relationship strategies that are

collaborative and problem-solving. The effects are significant at $p < .00001$ in both the Canadian and the U.S. datasets. It seems that while it is unclear whether business exposure or other factors influence the importance a company attaches to environmental stakeholders, there is a strong likelihood that companies that attach importance to environmental stakeholders will follow collaborative problem-solving strategies with these stakeholders.

8.7.4. Models 5,6, and 7: The impact of corporate environmental responsiveness strategies on firm performance. There are three measures of firm performance: (1) Organizational benefits arising from environmental responsiveness (COMPBNFT) and their features that mark them as unique organizational capabilities (CAPABLTY), (2) managerial perceptions of performance (PERFMNCE) in financial, product development, growth, and profitability domains, and (3) the return on assets ratio (ROA) - averaged over five years for the Canadian companies and over three years for U.S. companies. The regression equations are:

$$COMPBENFT = a_5 + b_{15}\, ENVSTRGY + b_{25}\, CAPABLTY + e_5 \quad (5)$$

$$PERFMNCE = a_6 + b_{16}\, ENVSTRGY + e_6 \quad (6)$$

$$ROA = a_7 + b_{17}\, ENVSTRGY + b_7 \quad (7)$$

It is predicted that the greater the company scores on the corporate environmental responsiveness strategies construct (*ENVSTRGY*), the greater the emergence of organizational benefits (COMPBENFT) that have features of unique organizational capabilities (*CAPABLTY*); the greater the managerial perceptions of firm performance relative to industry average (*PERFMNCE*); and the greater the return on assets ratio (*ROA*). The regression results are presented in Table 14.

Table 14: Regression results of the impact of environmental strategies on firm performance

Independent variables	*Canada*				*U.S.*			
	Unstd *b* (std. errors)	Beta *B*	*t* value	*p* one-tailed	Unstd *b* (Std. errors)	Beta *B*	*t* value	*p* one-tailed
d.v.= COMPBNFT								
ENVSTRGY(H10a)	.6151 (.099)	.4186	6.20	**.0000**	.3904 (.141)	.2980	2.76	**.0076**
CAPABLTY (H10b)	.5485 (.070)	.5285	7.82	**.0000**	.5380 (.117)	.4967	4.60	**.0000**
Constant	1.5178 (.314)		2.647	**.0000**	.1122 (.446)		.252	.8021
R^2	.6577				.7069			
Adjusted R^2	.6505				.4997			
F Statistic	91.281		10.19		30.966			
Probability of F	**.0000**				**.0000**			
d.v.= PERFMNCE								
ENVSTRGY (H11)	.3131 (.067)	.4321	4.70	**.0000**	.2041 (.075)	.312	2.72	**.0082**
Constant	3.688 (.216)		17.03	**.0000**	3.798 (.240)		15.80	**.0000**
R^2	.1867				.3116			
Adjusted R^2	.1782				.0971			
F Statistic	22.042				7.422			
Probability of F	**.0000**				**.0082**			
d.v. = ROA								
ENVSTRGY (H11)	2.510 (.637)	.3731	3.94	**.0002**	.0143 (.004)	.341	3.08	**.0029**
Constant	-5.407 (2.058)		-2.63	**.0100**	-.0219 (.014)		-1.49	.1404
R^2	.1392				.1166			
Adjusted R^2	.1302				.1043			
F Statistic	15.521				9.498			
Probability of F	**.0002**				**.0029**			

All the hypotheses 10a, 10b, and 11 are borne out as the three models are statistically significant at between $p < .00001$ and $p < 0.01$. Corporate environmental responsiveness

strategies and features of organizational capabilities explain around 65% (Canadian) and 50% (U.S.) of the variance in the emergence of organizationally beneficial outcomes.

Corporate strategies of environmental performance also explain 18% of the variance in firm performance relative to industry average as perceived by managers and 13% of the variance in the return on assets in the Canadian data. In the U.S. dataset, corporate environmental responsiveness explains around 10% of the variance in firm performance relative to industry average as perceived by managers and 10% of the variance in the return on assets. All hypothesized relationships are statistically significant at between $p < 0.00001$ and $p<.01$.

8.7.5. Summary. Table 15 presents a summary of the regression results. Hypotheses 1, 2, 7, 9a, 9b, 10a, 10b, and 11 all receive support in both datasets. Hypotheses 4c, 5 and 8 receive support in the Canadian dataset. Hypothesis 3 receives support in the U.S. dataset. Hypotheses 4a and 4b do not receive any support in either dataset.

The mail survey data analysis strengthens the hypothesized connections drawn from the exploratory study regarding the influence of managerial perceptions of corporate institutional identity (supported in both datasets), managerial discretion to take actions on the business-natural environment interface (supported in the Canadian dataset), and organizational environmental philosophy (supported in the U.S. dataset). Due to the high variance inflation factors for the other variables (or for these same variables in the datasets where they are not statistically significantly related to managerial interpretations), it can be speculated that the use of better measures for these variables can reveal the connections that appear to be significant in the exploratory study. Moreover, extant literature stresses the importance of control systems (Govindarajan, 1984,1986;

Simons, 1991) and information flows (Ackerman, 1975; Miles, 1987) in influencing managerial actions and corporate strategies.

Table 15: Summary of regression results

Variables	*Canada*	*U.S.*
Model 1(d.v. = threat interpretations)		
H3: Institutional identity	Supported***	Supported*
H2: Environmental philosophy	N.S.	Supported**
H4a: Line manager influence	N.S.	N.S.
H4b: Integration devices between line and staff managers	N.S.	N.S.
H4c: Co-operation between line and staff managers	Supported*	N.S.
H5: Managerial discretion	Supported**	N.S.
H6: Performance evaluation	N.S.	N.S.
Model 2 (d.v. = environmental strategies)		
H1: Threat interpretations	Supported***	Supported***
H7: Timing of response in issue lifecycle	Supported***	Supported***
H9b: Stakeholder relationship strategies	Supported***	Supported***
Control: Company size	Supported***	Supported****
H8a: Business exposure -- > Important stakeholders	Supported*	N.S.
H9a: Important stakeholders ---> Relationship strategies	Suuported****	Supported****
Performance:		
H10a: Environmental strategies -- > Org. Benefits	Supported****	Supported**
H10b: Capabilities --- > Org. Benefits	Supported****	Supported****
H11: Environmental strategies -- > Firm Performance	Supported****	Supported**
H11: Environmental strategies -- > Return on assets	Supported***	Supported**

**** p < .0001 *** p < .001 ** p < .01 * p < .10

The regression analysis reinforces the discussion based on the exploratory study that hypothesized that corporate environmental responsiveness strategies are influenced partly by managerial interpretations of environmental issues as threats versus opportunities, stakeholder relationship strategies, and timing of response in the issue lifecycle. These variables explain around 39% of the variance in corporate environmental responsiveness strategies the Canadian dataset and around 56% of the variance in the U.S. dataset. Stakeholder relationship strategies are seen as more important in the Canadian environment where the public consultation process is

encouraged. Addition of company size as a control variable increases the R^2 to 47% in the Canadian data and to 66% in the U.S. data. Thus, company size, either as a proxy for organizational slack or as an indicator for intensity of media and stakeholder attention, appears to influence corporate environmental responsiveness strategies.

Relationship strategies for dealing with stakeholders seen as representing the natural environment are also seen to be influenced by the importance attached to these stakeholders. At the same time, it appears that the importance attached to these stakeholders representing the natural environment is not influenced significantly by the business exposure of the company.

While no causality is imputed here, it is encouraging to note that companies seen to be proactive/interactive on corporate environmental responsiveness strategies, are above industry performers on economic indicators. This indicates that firm competitiveness may not be adversely affected by encouraging proactive/interactive corporate environmental responsiveness strategies. Corporate environmental responsiveness strategies are seen to have a statistically significant relationship with firm performance in terms of intangible and tangible benefits as also financial performance.

It may be speculated that the causality flows in the other direction, i.e., firms that are above industry-average economic performers have greater organizational slack to undertake proactive/interactive corporate environmental responsiveness strategies. However, it is argued that corporate environmental responsiveness strategies cannot be changed from reactive to proactive overnight, and that a pattern of actions taken on the business-natural environment interface over a long-term is necessary. It was seen from the exploratory study that the proactive

and interactive companies have been undertaking environmental policies and strategies that go beyond regulations and industry practice for a fairly long period of time. These strategies have persisted during high and low periods of economic performance, due to an organizational philosophy and organization design that is committed to corporate environmental responsiveness.

The following chapter discusses the implications of this research study based on results of the analysis of the exploratory study in the Canadian oil and gas industry and the results of the statistical analysis of the mail survey among Canadian and U.S. oil and gas companies.

CHAPTER 9: DISCUSSION AND IMPLICATIONS

The objective of this research study was to understand the strategies followed by individual firms within a single industry context in dealing with the business-natural environment interface, the organizational factors influencing these strategies, and the performance outcomes of different strategies. Due to inadequate theoretical development in this area and in order to generate a better understanding of the phenomenon, the study was undertaken in two phases. An exploratory study based on multiple case studies from the grounded perspective in the Canadian oil and gas industry, and a questionnaire-based mail survey conducted in the Canadian and U.S. oil and gas industries.

The study identified some of the key dimensions differentiating organizations' strategies for dealing with the business-natural environment interface and first induced a theoretical model to explain the occurrence of these strategies through multiple case studies, and then tested this model through survey techniques. Due to the inductive/deductive methods of research, the discussions presented in this chapter also include the findings as well as the limitations of the exploratory discovery-oriented research.

9.1. Principal findings.

The principal findings of this study are the following:

(1) Individual firms within a single industry context show a variation in the strategies that they adopt to deal with the business-natural environment interface. These strategies range from a reactive stance that emphasizes lobbying against regulations, regulatory compliance, and risk reduction; to proactive strategies that undertake environmental actions for economic benefit

through waste management and better products and processes; to interactive strategies that treat the natural environment as a domain issue that is better understood and dealt with through active collaboration with a wide variety of stakeholders seen to represent the natural environment.

(2) The strategies that an individual firm will adopt are influenced, among other factors, by the following.

(a) Interpretation of environmental issues as threats or opportunities by its managers- threat interpretations are associated reactive strategies, and opportunity interpretations are associated with proactive/interactive strategies.

(b) The response time in the lifecycle of the environmental issue - responding on an issue before its dimensions are shaped by public policy and legislation is associated with proactive/interactive strategies, and response after regulations have become rigid and stringent is associated with reactive strategies. Moreover, early response without pressure for regulatory compliance allows an organization the time to build-up a unique knowledge base on the business-natural environment interface.

(c) The relationship strategies adopted by the company to deal with stakeholders considered to represent environmental interests - collaborative problem-solving strategies are associated with proactive/interactive strategies, and adversarial litigation-based strategies are associated with reactive strategies.

Companies operate within their environments that consist of stakeholder groups concerned about the preservation of natural environment. Proactive/interactive strategies of corporate environmental responsiveness receive approvals of such stakeholder groups. These

approvals translate into favourable attitudes toward the company, and in the easing of opposition to everyday operations. In Alberta, one of the biggest obstacle oil and gas companies face is negotiating the public consultation process for new developments and projects. Thus, stakeholder approval, or disapproval, for corporate environmental responsiveness strategies undertaken by a company, feeds back to modify and change organizational philosophies, managerial interpretations, and ultimately, corporate environmental responsiveness strategies for the future.

Analysis of survey data using interactions between country and relationship strategies revealed (Table 10) a statistically significant ($p < 0.01$) difference between Canada and the U.S. on the extent to which collaborative problem-solving relationship strategies were used. This indicates that relationship strategies with stakeholders seen to represent the natural environment are considered more important by Canadian companies. This is possibly due to the greater emphasis in Canada on mediation and collaboration on environmental impact, as compared to resort to litigation and punitive penalties in the U.S. Canadian companies are forced by the regulatory environment to adopt a more conciliatory stance these with stakeholders.

(d) Company size - size may be argued to be a proxy for organizational slack (Bourgeois, 1981) or for the intensity of media/societal scrutiny of company environmental practices. Larger company size is associated with proactive/interactive strategies, and smaller size is associated with reactive strategies.

Managerial interpretations, along with other variables such as the following of collaborative problem-solving relationship strategies in dealing with environmental stakeholders, timing of response early in the environmental issue lifecycle, and company size are seen to explain

between 47% (Canada) to 66% (U.S.A.) of the variance in corporate environmental responsiveness strategies. Excluding company size as a control variable, the other three variables explain 39% (Canada) and 56% (U.S.A.) of the variance in corporate environmental responsiveness strategies.

(3) Managerial interpretations of environmental issues as threats or opportunities are influenced, among other factors, by organizational context. The organizational context influences identified are leadership influences that shape organizational environmental philosophy and managerial perceptions of organizational identity, and organization design influences in the form of managerial discretion.

(a) Organizational environmental philosophies that emphasize conformity with the traditional neo-classical economics viewpoint are associated with threat interpretations of environmental issues; and philosophies that emphasize conservation of resources and restoration of the natural environment are associated with opportunity interpretations of environmental issues.

(b) Managerial perceptions of their organization's identity as institution-oriented (Miles, 1987) which emphasizes the societal/institutional role of the company, are associated with opportunity interpretations; and perceptions of identity as enterprise-oriented (Miles, 1987) which emphasizes the role of the company as an unfettered free enterprise, are associated with threat interpretations.

(c) Budgeting and planning systems that allow discretion to managers for experimentation with alternative actions and approaches for dealing with the business-natural environment interface are associated with opportunity interpretations of environmental issues.

(4) Companies with proactive/interactive corporate environmental responsiveness strategies perceive organizational benefits in the form of organizational capabilities as a result of these strategies. Some of these capabilities are the capability for building-up of collaborative relationships with stakeholders which have non-economic objectives, capabilities for innovation, and capabilities for higher-order learning.

Companies with proactive/interactive corporate environmental responsiveness strategies also perform above industry-average on economic indicators. This indicates that going beyond regulations and accepted industry practice in environmental actions does not conflict with competitiveness.

The organizational capabilities that emerge are seen to influence the economic performance of the company through better products and lower costs, better management practices, and lower opposition to everyday operations from special interest groups and regulators, resulting in cost advantages. Higher scores on the corporate environmental strategies construct are associated with higher managerial perceptions of firm economic performance relative to industry average, as well as with a higher average return on assets ratio.

Cautious interpretation of these results is emphasized due to lack of knowledge about time-lags between corporate environmental responsiveness strategies and performance outcomes. The study does not control for the industry and other environmental influences (e.g., economic

cycle) that may influence firm economic performance. However, it can be stressed companies are not likely to lose their competitive positions by becoming proactive and interactive on corporate environmental responsiveness. Quite the contrary, they are likely to improve their corporate reputation, improve stakeholder relationships, get favourable treatment in everyday operations from certain stakeholder groups which consider the natural environment preservation as an important objective, and also spark organizational learning processes that may lead to competitively advantageous organizational capabilities.

9.2. Theoretical contribution.

The study makes theoretical contributions to literature on corporate environmental responsiveness, strategic issue diagnosis, strategic adaptation, the resource-based view of the firm, and organizational learning.

(1) Corporate environmental responsiveness. Literature on corporate environmental responsiveness strategies is either conceptual or consists of case studies across a wide variety of industries and businesses to develop typologies or categories of strategies. This study identifies a typology of strategies that is generic, rooted in corporate social responsibility/responsiveness literature (Post, 1978; Sethi, 1979), and integrates perspectives from the corporate environmental responsiveness literature (Hunt & Auster, 1990; Logsdon, 1985; Post & Altman, 1991; Vredenburg & Westley, 1993, 1995). At the same time, this study makes a contribution by identifying the influence of organizational context and managerial interpretations on corporate strategies to deal with the business-natural environment interface.

This study is a first attempt (in corporate environmental responsiveness literature) at operationalization of theoretical constructs for measuring corporate environmental responsiveness strategies and corporate environmental philosophies. Both constructs exhibit high scale reliabilities, and can serve as foundations for further research studies seeking to operationalize these variables.

(2) Strategic issue diagnosis. This study confirms the influence of managerial interpretations on organizational actions and strategies that has been highlighted by Daft & Weick (1984), Dutton & Duncan (1987), Dutton, Fahey & Naraynan (1983), Ginsberg & Venkataraman (1992, 1995), and Lyles & Mitroff (1980). Further, the study confirms the importance of issue interpretations as threats or opportunities (Jackson & Dutton, 1988; Dutton & Jackson, 1987; Ginsberg & Venkataraman, 1992; Thomas & McDaniel, 1990) as an influencing factor on organizational actions. The attributes of threat and opportunity interpretations emerging from the studies by Jackson & Dutton (1988), Dutton & Jackson (1987), and Thomas & McDaniel (1990) i.e., positive/negative, gain/loss, and controllable/uncontrollable, are confirmed as dimensions of environmental issues. These results are borne out in both Canadian and U.S. datasets.

Organizational strategies are also seen as influenced by organizational context, including some variables that have been highlighted in literature on corporate response to external/social issues (Ackerman, 1975; Miles, 1982, 1987; Sethi, 1979).

(a) One of these variables is the influence of an early response in the timing of the issue lifecycle in shaping proactive/interactive strategies. Early response refers to the time period when the dimensions of the issue are uncertain, the issue is either fresh or has yet to enter the domain of

public policy, and thus the zone of discretion available to the company is high (Ackerman, 1975; Post, 1978).

(b) The influence of collaborative problem-solving relationship strategies to deal with the concerns of stakeholders impacted by corporate actions on the business-natural environment interface is confirmed, as was found by Miles (1987). Further, this study finds that the importance attached to stakeholders seen as spokespersons for the natural environment by an organization, is seen to influence corporate environmental responsiveness strategies indirectly, through its influence on stakeholder relationship strategies.

(c) Company size can affect environmental strategies in two ways - by increasing the company's public profile and increasing company motivation to be seen to be taking actions for environmental preservation (Wartick, 1992), and by increasing organizational slack through availability of greater resources (Bourgeois, 1981). Organizational slack has been shown to permit experimentation and knowledge generation on emerging issues (Cyert & March, 1963). However, caution should be exercised in overemphasizing the role of company size. Company size is certainly not the sole determining factor for proactive/interactive environmental strategies.

Of course, none of these factors, by itself is enough to influence a company's corporate environmental responsiveness strategies. All these variables interact (as is modeled in the multivariate analysis), and one variable in the absence of others may not lead to changes in corporate environmental responsiveness strategies.

While some of the factors seen to influence organizational actions and strategies may have already been identified in literature, this study makes three contributions here: (a) it highlights

their importance in context of an emerging strategic issue - the natural environment; (b) it strengthens the findings of existing research, some of which is based on limited case studies (Ackerman, 1975; Miles, 1987, Post, 1978), and some based on survey-based studies (Dutton & Jackson, 1987; Jackson & Dutton, 1988; Ginsberg & Venkataraman, 1992, 1995, etc.); and (c) it identifies a unique configuration of influences on corporate environmental responsiveness strategies that is different in some of its elements from extant research on strategic issue diagnosis and external affairs strategies.

This study also adds to strategic choice literature by showing that corporate strategies can be influenced by internal organizational context. This does not deny the influence of the external environmental forces on corporate strategy, but confirms the strategic choice (Joyce & Hrebeniak, 1985) perspective. In fact, Milliken (1990) found that the resource-dependence of an organization (environmental forces) influenced organizational actions via managerial interpretations.

(3) Managerial cognition. The research study also suggests that organizational context influences managerial interpretations of strategic issues. This confirms other studies emphasizing the influence of organizational context on managerial interpretations of strategic issues (Ginsberg & Venkataraman, 1992, 1995; Milliken, 1990; Thomas & McDaniel, 1990). One of the primary influences found in this study is leadership influence in shaping organizational environmental philosophy. This variable was found to be a statistically significant predictor only in the U.S. data and not in the Canadian data. Possible reasons for this are discussed in the limitations section. The statistically significant connection, albeit in the U.S. dataset alone, strengthens and confirms

discussions in literature that suggest the influence of variables such as organizational ideologies on managerial interpretations (Beyer, 1981; Meyer, 1982).

Managerial perceptions of their organizational identity as institution-oriented (Miles, 1987) emerges as statistically significant predictor of managerial interpretations of environmental issues as threats or opportunities in both datasets. This reinforces the importance of organizational identity as a managerial influence (Albert & Whetten, 1985) and the influence of organizational identity on organizational strategies via managerial interpretations found by Dutton & Dukerich (1991) and Milliken (1990).

The influence of organizational design variables on organizational actions and strategies has been discussed in literature (Galbraith, 1977; Govindarajan, 1984, 1986, 1988; Simons, 1991). Thomas & McDaniel (1990) discuss the connection between top management information processing capacity and managerial interpretations of strategic issues. This study suggests that the influence of one organizational design variable - managerial discretion - on corporate strategy is moderated by managerial interpretations of strategic issues.

This is one area where the theoretical connections between organizational design variables identified during the exploratory study receive very little support in the mail survey. The exploratory study found that knowledge creation and dissemination mechanisms, managerial discretion, and control systems influenced managerial interpretations of environmental issues. This is borne out by discussions in organizational learning literature that highlight the need for the facilitation of knowledge creation and dissemination within an organization for higher-order learning (Argyris & Schön, 1978; Galbraith, 1977). However, statistically significant ($p < 0.01$)

support was found for the influence of managerial discretion to experiment on the business-natural environment interface, and for the extent of co-operation between line and staff managers on environmental knowledge creation and exchange ($p < 0.06$). Little or no support was found for the influence of control systems (even though this was highlighted in the exploratory study), mechanisms to integrate knowledge creation and exchange between line and staff managers, and the extent of line manager involvement in environmental strategies.

(4) Resource-based view of the firm. The exploratory study and the mail survey reveal linkages between proactive/interactive corporate environmental responsiveness strategies and the emergence of organizational capabilities. These capabilities are seen as sources of competitive advantage such as organization-wide learning, innovations in processes and products, better management practices, cost reduction, product differentiation, better relationships with stakeholders, lower costs of regulatory compliance, and improved corporate reputation and goodwill.

These competitive benefits are seen by the company managers to possess certain characteristics that mark them as unique firm-specific organizational capabilities. Examples of such features are that these capabilities take a long time of organizational actions and practices to build up; that they are difficult to identify by competitors; that these capabilities do not reside in an individual but span levels and functional areas within a company; that these capabilities spark further organizational learning and internal innovation activities, etc. (Amit & Schoemaker, 1993; Barney, 1986, 1991; Dierickx & Cool, 1989; Peteraf, 1993). These features of organizational capabilities are discussed in the resource-based view of the firm literature, and are seen to create

competitive advantage for the firm by creating barriers to imitation by competitors, and keeping the company a step ahead of competition in a rapidly changing environment.

The resource-based view of the firm literature is largely conceptual and is strengthened by very little empirical work. This study is one of the few early empirical research undertakings that attempts to identify organizational capabilities. The study adds to the resource-based view literature by identifying corporate environmental responsiveness as one of the catalysts that can spark the building-up of unique organizational capabilities. The study also adds to the resource-based view literature by identifying some of these unique organizational capabilities that can generate competitive advantage.

(5) Organizational learning. The development of organizational capabilities as outcomes of higher-order learning processes confirms that organizational learning is also triggered by changing environments (Hedberg, 1981; March & Olsen, 1975). This provides a contrary viewpoint to discussions in the management literature that only performance below aspirations will trigger processes of higher-order learning (Cyert & March, 1963; Lant & Mezias, 1990; Milliken & Lant, 1991). Thus, fundamental shifts in philosophy that accompany the need to incorporate environmental concerns into strategic decision processes, can create the experiential base of activities that triggers the processes of higher-order learning within organisations.

A direct mapping of organizational learning and internal innovations requires a qualitative research design based on long-term participant observation. Such a research design would be limited in its generalizability since it would be restricted to a few companies due to time and resource constraints (especially in a doctoral dissertation). However, enough evidence is

generated in the present study to argue that proactive and interactive environmental responsiveness strategies can change ideological paradigms within an organization that can lead to changing decision frameworks, a questioning of conventional wisdom, and thus spark processes of higher-order organizational learning.

9.3. Limitations of the study and future research implications.

The strength of this study is the inductive/deductive approach that strengthened the theoretical concepts and model before undertaking theory-testing. The theoretical framework revealed by the study is strengthened by rigorous testing of hypothesized connections. Thus, the role of managerial interpretations as threats or opportunities, along with the influence of early response in the issue lifecycle, adoption of collaborative problem-solving relationships with environmental stakeholders, and company size, are seen as important influences on proactive/interactive corporate environmental responsiveness strategies. Further, proactive/interactive corporate environmental responsiveness strategies are seen to contribute to competitiveness by catalyzing the emergence of unique organizational capabilities. Nevertheless, the study suffers from a number of limitations that can serve as guides for future research in corporate environmental responsiveness.

(1) Organizational environmental philosophy construct. The variables hypothesized to influence managerial interpretations of environmental issues, as emerging from the exploratory study, were leadership influences and organization design influences. The leadership influences are seen via the shaping of corporate environmental philosophy and organizational institutional identity. While managerial perceptions of organizational identity was found to be a statistically

significant predictor in both datasets, organizational environmental philosophy emerged as a statistically significant predictor only in the U.S. dataset.

It is argued that organizational environmental philosophy is a likely influence on managerial interpretations. This is because extant literature (Beyer, 1981; Meyer, 1981) discusses this influence, the managers stressed the influence of organizational ideologies in the exploratory study, and the U.S. data shows a statistically significant ($p < 0.01$) relationship. There may be several possible reasons for the lack of statistical significance for this variable in the Canadian dataset.

It can be speculated that the organizational environmental philosophies measure is not representative of the construct sought to be measured. This is an organizational level construct that is sought to be measured through individual responses. Unlike other such measures, this organizational construct is likely to be contaminated by personal values and ideologies of managers. Even though managerial responses are averaged, it is uncertain to what extent managerial responses truly reflect organizational philosophies as shaped by leadership, and to what extent are they personal ideologies of individuals. The nature of items used to measure this construct may be too emotionally charged to elicit objective organizational information. Further, the factor analysis of the items constituting this measure revealed a number of latent dimensions that had to be discarded due to theoretical uncertainty. A measure more representative of this organizational level construct needs to be constructed. Current work in this area is being undertaken (Cordano, 1994; Rands, 1995).

Another possible reason could be due to differences in the Canadian and U.S. societal and cultural contexts. It can be speculated that general awareness about environmental degradation is higher among the Canadian population as compared to the U.S. (Angus Reid, 1988-1993; Stisser, 1994). It is possible that Canadian managers are personally more concerned and aware about environmental degradation as compared to managers in the U.S. In that case, the responses of Canadian managers will be more emotionally biased toward environmental preservation even if their companies follow reactive corporate environmental responsiveness strategies. In any case, a better and more representative construct is needed to examine this relationship between organizational philosophy and managerial interpretations of environmental issues.

(2) Organization design measures. Among the organizational design variables, the importance given to environmental indicators in employee performance evaluation does not emerge as a statistically significant predictor of managerial interpretations of environmental issues. Managers interviewed in the exploratory study emphasized control systems as a variable that distinguished between proactive/interactive and reactive strategies. Buffalo and Sioux had had incorporated environmental performance indicators into employee performance evaluation, and had given these indicators weighting and importance. The other five companies had either not included environmental indicators in control systems, or had not given them any importance in evaluating performance. However, this variable does not emerge as statistically significant predictor in a larger survey.

It is possible that control systems are guides only to managerial actions as found by Govindarajan (1984, 1986, 1988) and Simons (1991), and not influences on managerial

interpretations. Managers may form their interpretations about a strategic issue before organizations provide them with guides to action via control systems. It is also possible that control systems influence managerial interpretations only when they are accompanied by commensurate managerial authority (discretion) to expend resources for knowledge creation. Therefore, an interaction between managerial discretion and control systems needs to be explored.

It is also possible that the measure for control systems is a three-item measure that is ambiguous and does not distinguish between control measures that emphasize voluntary environmental actions and experimentation (associated with proactive/interactive strategies), and those that emphasize regulatory compliance (associated with reactive strategies). It is possible that the questions were wrongly interpreted by managers to imply only whether they are evaluated on the extent to which they comply with environmental regulations. The influence of this variable needs further exploration through a better measure. A reformulation of the theoretical framework with control systems as a direct predictor of corporate environmental responsiveness strategies (rather than as an indirect influence via managerial interpretations) can also be attempted.

Managerial discretion emerges as a statistically significant ($p < 0.01$) predictor of managerial interpretations only in the Canadian data. Similarly, among the three measures for knowledge creation and dissemination mechanisms, only the extent of co-operation between line and staff managers emerges as statistically significant ($p < 0.06$) in the Canadian data. This could be either due to wrong specification of the model or due to poor and non-representative measures. Similar to the arguments presented above for control systems influence, it can be argued that organization design variables influence strategies directly and not via managerial

interpretations. It is also possible that the measures for these constructs consist of a single-item or few items. As a result, they may not adequately measure the construct (Pedhazur, 1982).

Another major problem among the organization design variables is the high level of multicollinearity among these variables in the U.S. data. This can imply that while the influence of managerial discretion and line-staff co-operation is reflected in the Canadian data, it is obscured in the U.S. data due to multicollinearity. Better measures are needed to cleanly draw out this relationship in the U.S. dataset and in other studies.

The theoretical framework can be tested after treating design variables as direct influences on corporate environmental responsiveness strategies. This may lead to some insights and a reevaluation of the theoretical framework tested in this study.

(3) Managerial interpretations measure. The items used to measure the managerial interpretations as threats or opportunities are intended to measure these dimensions as opposite ends of a continuum. It is possible that (a) threats and opportunities are not opposite ends of a continuum; and (b) the questionnaire items, as they are framed in statements, only measure threat interpretations and not opportunity perceptions. This possibility can be investigated by using separate sets of items for threats and opportunities.

(4) Measures for business exposure and importance attached to environmental spokespersons. The relationship between business exposure and corporate strategies is found by Miles (1987). This study hypothesizes a relationship between business exposure and corporate environmental responsiveness strategies indirectly via importance attached to environmental stakeholders and relationship strategies followed to deal with these stakeholders. The relationship

between business exposure and importance attached to environmental stakeholders is non-significant.

It is possible that the range of activities of a firm is not a representative proxy for business exposure. Business exposure is also a function of liabilities and risks associated with each type of activity (Miles, 1987). This is not reflected in a measure that is operationalized by adding together the number of activities of a company. It is also possible that the range of a company's activities does not influence the importance it attaches to stakeholders who interface with the company on the natural environment at these activity points.

The third possibility is that the measure for importance attached to stakeholders considered spokespersons for the natural environment does not distinguish between a positive and negative aspects of this importance. If a company perceives certain stakeholders as important in influencing its understanding of environmental issues, it can seek to avert the threat posed by these stakeholders through public relations and political manipulation, or it can treat these stakeholders' concerns as welcome opportunities to create knowledge on the business-natural environment interface as well as opportunities for positive relationships. This measure needs to be improved to draw out the positive/negative dimensions of importance attached to stakeholders.

(5) Interaction terms. Due to limitations of the number of cases in the survey data, several interactions between variables could not be measured. Although interactions were run for country of response (and a difference found among relationship strategies adopted by firms), some other interaction effects can be investigated with a larger database. Some of these interactions could be the influence of organizational environment philosophy on organization design. It is also possible

that managerial perceptions of organizational identity influence organizational environmental philosophy. Ideology is likely to be shaped by perceptions of organizational members of the core, enduring, and distinctive character of their firm (Albert & Whetten, 1985).

It is assumed that leadership influences corporate ideology and also organization design. Do certain organization design configurations accompany certain organizational environmental philosophies? Do control systems influence managerial interpretations of environmental issues only when they are accompanied by authority structures that allow managerial discretion? This can be investigated through an interaction of control systems and managerial discretion measures.

A path analysis model can also be investigated to explore the magnitude of indirect influences of organizational context on corporate environmental responsiveness strategies. The indirect effects may help in a better specification of the theoretical framework. However, these alternative frameworks need to informed by theoretical discussion - exploratory analyses are contrary to theory-driven research.

(6) Historical/ institutional perspective. Miles (1982, 1987) stresses the influence of organizational character on corporate external affairs strategies. Organizational character is proposed by Miles (1987) to consist of the founding characteristics of an organization (i.e., the influence of the era in which it was founded), the unique flow of events in the history of the organization, and the organization's unique reaction to each of these events.

There is no doubt that such a historical analysis is invaluable in informing a discussion on influences on managerial interpretations of environmental issues as well as on corporate environmental responsiveness strategies. However, time and resource constraints in this study

would have limited such a detailed historical institutional analysis to between 3 to 5 firms (as was the case in the studies by Miles (1982, 1987) of the U.S. tobacco and insurance industries). This is due to the sheer volume of analysis required of archival data dating back a hundred years or more for each company. Even in the current study, it was very time consuming to procure annual reports and environmental policy documents of the seven companies dating back to 1980. Most companies did not provide external documents going further back beyond 1980 and did not allow any access to internal company documents.

To the extent that this study does not address the perspectives of historical influences on corporate environmental strategies, it is limited. However, in a survey of 174 company responses, individual historical analysis of each company is impossible within the time-frame of a doctoral dissertation.

(7) External validation. The study relies on self-reporting by company mangers. Triangulation is undertaken in the form of multiple informants in each company in both the exploratory study and the mail survey (65%), a study of company annual reports and environmental policy statements for the seven companies in the exploratory study, interviews with environmental groups, industry association, and regulators. However, external validation in the exploratory study was limited by the availability of only two environmental groups who have not been active for very long in Alberta. This is mainly because environmental groups are staffed by volunteers who have busy schedules and are often not available for discussions. Several environmental groups were also extremely suspicious of a study undertaken by a "business school". Some members of these organizations made it clear that they considered the business

school as much an enemy as business firms. Ten environmental groups were contacted, but their members who were familiar with the practices of the oil and gas industry were not available for interviews within the time frame of the study.

Regulators were contacted for validation of corporate environmental responsiveness strategies categories. However, they expressed their inability to comment comparatively on more than ten companies. The public complaints data available with regulators is not considered a validation of corporate environmental responsiveness strategies, since larger companies with a greater number of facilities are likely to have a larger number of complaints.

(8) Assumptions driving exploratory study. It should be emphasized here that the exploratory study was undertaken to generate a better understanding of a phenomenon with insufficient theoretical development - corporate environmental responsiveness strategies. The exploratory study was designed to precede a survey and supplement literature review in developing a theoretical framework. Seven firms were studied until all emerging themes were repeated by managers within a firms and between firms, and no new themes emerged. Interviews with managers within each firm were also limited by access within time and resource constraints. Within a longer time frame, more managers interviewed, and more firms could have been studied.

In an inductive study of this type, the possibility always exits that even if the same themes are repeated in each subsequent interview, the next interview may generate new insights. The researcher has to make a decision to stop data collection when it seems that a phenomenon is substantially explained by the themes that emerge. It is never possible to explain a hundred percent of the phenomenon in any research study. Even quantitative surveys that cover entire

populations in social science research seldom explain more than 50% of a phenomenon (Tabachnik & Fidell, 1989). By these standards, the regression models tested succeed in explaining between 50% to 66% of the variance in dependent variables such as managerial interpretations and corporate environmental responsiveness strategies; and between 10% to 18% of the variance in firm performance variables.

During data collection/analysis in the exploratory study, the themes which were to be retained were determined by the number of interview quotes supporting the theme and literature support. However, the researcher's bias cannot be avoided. The data was coded only by the researcher and coding by an independent source could have avoid this limitation.

(9) Cross-sectional data. Both, the exploratory study (which was conducted over five months), and the mail survey, generated cross-sectional data that could not account for feedback processes or even predict evolution of individual firm environmental responsiveness strategies. However, interviews with managers and archival data analysis did provide a limited historical perspective on the evolution of the strategies of the seven firms over fifteen years. It can also be predicted that a change in leadership that influences changes in organizational environmental philosophies and organizational identity is likely to change environmental strategies of the firm. National underwent an ownership change and this affected its organizational identity from institution-orientation to enterprise-orientation. As a result, its environmental philosophy and environmental strategy changed.

Albert & Whetten (1985) stress that organizational identities change from utilitarian (enterprise-oriented) toward normative, resulting in dual identities. This process also takes place

in the reverse. This study could only measure the organizational identities at a point of time. Similarly, it may be useful to longitudinally track changes in organizational philosophies and perceptions of identity, organization design changes, and their impacts upon managerial interpretations of environmental issues as they evolve.

The feedback effect shown in the theoretical framework (figures 1 and 2) indicates that performance outcomes feed back to change managerial interpretations of environmental issues as also corporate environmental responsiveness strategies. A longitudinal analysis can examine the influence of feedback effects.

(10) Generalizability. One issue is whether or not an exploratory study conducted in the Canadian oil and gas industry can inform theoretical perspectives in the U.S. industry. The regulatory and societal contexts in the two countries differ (Pasquero, 1991), but these differences, though often discussed, are uncertain in their effect on organizational behavior and strategies. The resource and time constraints did not permit a similar exploration in the U.S. industry. In fact, the argument can be extended to the fact that the U.S. industry is concentrated in Texas, Colorado, Louisiana, and Oklahoma - states with differences in regulatory contexts. The objective of testing the theoretical framework in the U.S. data was to identify whether any of the variables identified in the Canadian industry also applied to the U.S. industry, and thus improve the generalizability of at least some of the variables in the study. In fact, except for organization design influences on managerial interpretations, the results of models tested are very similar in the magnitude of effects and total variances explained in the dependent variables.

It is argued that while the specifics of different industry situations may change, the factors influencing issue interpretations and strategies are organizational and thus widely applicable. Even though the model is successfully tested in two different contexts - Canada and the U.S., further research in oil and gas sectors in substantially different regulatory contexts such as those with state ownership (e.g., Mexico, India), different cultural and societal contexts (e.g., Nigeria, Saudi Arabia), different industrial contexts (e.g., mining, forestry, pulp and paper, chemicals, etc.) is needed to clarify whether this framework applies in the same manner and whether similar strategies of environmental responsiveness emerge in industries which face low levels of regulatory and external pressures for environmental responsibility.

It can be argued that the results of the study may be applicable not only to the oil and gas industry in Canada and the U.S., but could be generalised across similar highly regulated and highly visible industries that are ecologically unsustainable. To illustrate, the mining industry, the forestry industry, the chemical industry, etc., are similar industries that extract or use non-renewable resources and impact negatively on the natural environment.

A confirmation of this model reinforces several theoretical connections in the models, based on limited case studies, presented by Ackerman (1975) and Miles (1982, 1987), extends and enhances understanding of how corporate environmental responsiveness strategies differ from other external affairs strategies and social performance by business firms, and develops and tests a theoretical framework of corporate environmental responsiveness.

(11) Other influences. Thomas & McDaniel (1990) and Ginsberg & Venkataraman (1992, 1995) found that managerial interpretations of strategic issues were influenced by corporate

strategy or competitive posture of the company. While this may well be an influencing factor, the lack of a theoretical connection in the exploratory study led to the exclusion of this variable. Miles (1987) also stresses the importance of current corporate strategies in influencing external affairs strategies of a company. This connection can be explored by separating out companies that are cost leaders from companies that are product differentiators (Porter, 1980), or downstream companies from upstream companies from integrated companies. It is possible that upstream and downstream companies adopt completely different competitive postures and hence interpret environmental issues differently.

Thomas & McDaniel (1990) found that managerial interpretations of strategic issues are also influenced by information processing capacity of the top management. In some ways, this influence is indirectly examined in the current study through organization design that includes knowledge creation and dissemination mechanisms shared by the top management. Milliken (1987, 1990) proposes that managerial interpretations of strategic issues are mediated by the state, effect, and response uncertainties of these issues as perceived by managers. This relationship can be explored by introducing uncertainty variables as mediators influencing managerial interpretations as threats or opportunities.

External environmental perspectives may also affect managerial interpretations in addition to organizational context. Milliken (1990) found a link between the resource-dependence (Pfeffer & Salancik, 1978) of an organization and managerial interpretation of strategic issues. An institutional analysis may also be seen to influence both managerial interpretations and corporate strategies (Miles, 1982, 1987).

(12) Mapping learning processes. The resource-based view of the firm literature is largely conceptual with very little empirical support. The concepts about competitive advantage of organizational capabilities and competencies need to be strengthened by both theory-building studies and confirmatory theory testing. However, organizational capabilities are tied up to individual and organizational cognitive processes that lead to learning and innovations. These cognitive processes taking place within individuals, between individuals, within networks of individuals, and between networks of organizations, need to be mapped through psychological techniques and detailed participant observation and other interactive methods of research. The present study is lacking in these dimensions due to time and resource constraints.

Future research, both exploratory and confirmatory, is bound to add to, and alter, the model and concepts presented in this study. However, this framework provides a useful initial guide for further research as well as for practitioners seeking to make organizational changes and adaptations toward more proactive environmental responsiveness strategies, while maintaining their competitiveness.

9.4. Implications for management

This study finds that organizations that create a context within which their employees are influenced to embrace environmental issues as opportunities, are likely to reap significant benefits from a number of sources - lower costs of input materials, higher process efficiencies, lower energy use, waste reuse and recycling, differentiated products, better relationships with stakeholders such as local communities, regulators, and environmental groups, and higher levels of corporate reputation and goodwill. It can certainly be argued that the resource and

organizational commitments that need to be made for undertaking proactive and interactive strategies do not detract from competitiveness of a company. Companies may find it competitively viable in the long-term to undertake proactive/interactive environmental responsiveness strategies at an early stage rather than in reaction to an upwardly escalating spiral of increasing regulation and societal pressures (Porter, 1991, 1990; Porter & van der Linde, 1995; Schmidheiny, 1992).

Organizations can undertake to adopt proactive/interactive corporate environmental responsiveness strategies that do not conflict with competitiveness by following a set of actions.

(1) Organizational environmental philosophy. The top management has to shape the organizational environmental philosophy with environmental preservation as an objective. This can be done by (a) altering corporate mission statement to include an overall vision for environmental preservation and sustainability; (b) formulating an environmental policy with broad goals and objectives; (c) Formulating a strategic plan for environmental responsiveness that is specific, e.g., waste/emissions reduction targets, technology change, product specification changes, recycling and reuse targets, reduction in use of non-renewable materials, energy conservation, use of alternative fuels, reuse and recovery of water and steam, habitat/species protection, etc.; (c) setting an early example by undertaking waste reduction and recycling and reuse programs in the offices; (d) investing in training programs for employees that educate them about the interface of the natural environment with the business operations; (e) using symbolism by displaying the corporate environmental mission statement in offices, sales outlets, annual reports, and on stationary, etc.

(2) Organizational identity. A company's identity is much more resistant to change (Albert & Whetten, 1985; Miles, 1987), and is the outcome of its unique history. The top management can emphasize the company's role as a corporate citizen and member of society in its corporate mission, policies, strategic plans, and in annual reports and other public documents.

(3) Organization design. Changes in organization design require the following actions:

(a) Knowledge creation and dissemination: Set up a board level committee on environmental affairs; set up a top management steering committee to formulate environmental plans and policies; set up task forces that integrate line and staff managers to provide information and knowledge for formulating environmental plans; disseminate this information and knowledge about actions that reduce environmental impact throughout the organization via meetings around the theme of environmental preservation. Undertake detailed environmental audit and utilise this information for formulating environmental policies and plans.

(b) Managerial discretion: Build-in a flexibility in budgeting and planning systems that allows managers discretion to utilise a proportion of the resources for experimentation with material specifications, processes, equipment, and product specifications, to reduce environmental impact. A useful guide may be Buffalo's discretionary allocations of between 2-7% of the budgets.

(c) Control systems: The knowledge creation mechanisms should also generate specific economic performance indicators for each department or operational area. This may be in terms of specific percentages of waste/emissions reduction, water recovery, energy conservation, reducing use of non-renewable materials, habitat protection, etc. These indicators should form an integral part of

employee performance evaluation systems. Actual performance must be measured against these norms to provide feedback on performance.

Top management driven changes in organizational philosophy and identity accompanied by organization design changes create the context within which managers view environmental issues as welcome opportunities rather than as threats.

(4) Early response. Top management needs to stress early interpretation and understanding of the dimensions of environmental issues by managers, and the encouragement of early voluntary actions to reduce environmental impact. Regulations and societal expectations on environmental issues are still evolving, as is the understanding of the extent of the environmental degradation of the planet. Even if firms choose to act now, they may be late in responding in some areas, but they will be early in other areas of environmental impact. This enables managers to undertake actions in these uncharted areas without pressures of impending regulations and societal pressures. The zone of discretion available to managers at an early stage allows them to generate knowledge and undertake actions at their own pace and within the framework of their economic performance objectives.

(5) Stakeholder relationship strategies. Employees should be encouraged (through control systems and organizational policies) to adopt collaborative and conciliatory approaches in dealing with stakeholders such as environmental groups, regulators, local communities, and special interest groups. The top management should de-emphasize litigation and confrontation and stress the use of collaboration and open dialogue. Instead of merely holding open houses at operational facilities, the company's managers should proactively go out and generate dialogues around

environmental preservation with impacted stakeholders. U.S. Oil's confrontationist approach can be contrasted with Buffalo's collaborative relationships with its "neighbours".

(6) Organizational slack. The creation of organizational slack involves providing managers with some leeway in terms of the resources placed at their disposal and the economic targets to be met with those resources. Either the available resources are increased or the output targets are relaxed. When managers are also required to meet environmental targets and they are uncertain about the impacts of certain actions on environmental and economic outcomes, they need slack in terms of resources. Flexible budgets with discretionary amounts at disposal of managers is an example of such slack.

(7) Actions and strategies to reduce environmental impact. The discussion on the development of corporate environmental responsiveness strategies construct in chapter seven lays out actions which companies can undertake to reduce environmental impact. All the actions are not applicable to each company - the relevant actions will depend upon whether it is an upstream, downstream, or integrated company. To summarise, these actions are along the following dimensions - specific examples of actions can be seen from the questionnaire items (Appendix 1a):

(a) Habitats and species preservation - this includes impact assessment and modification of operations to reduce impact.

(b) Voluntary actions for environmental restoration and clean-up.

(c) Waste reduction including recycling, reuse, and modifications of processes, products, and materials purchased.

(d) Reduced use of non-renewable materials.

(e) Use of alternative and renewable energy sources.

(f) Reduced energy use.

(g) Risk reduction, emergency response, and training and involvement of local communities in risk reduction.

(h) Products with reduced environmental impact.

(i) Stakeholders partnerships for reducing environmental impact.

(j) Disclosure - Environmental impact assessment, environmental audit, release of public environmental report, and immunity to employees who report environmental accidents.

(k) Research and training commitment for environmental impact reduction.

It is expected that undertaking these steps will not only create an organizational context that frames environmental issues as opportunities, but will also generate higher-order learning processes that can lead to the emergence of organizational capabilities in the form of better relationships, innovation, and higher reputation/credibility.

9.5. Implications for public policy.

It was hoped that the comparative study of the Canadian and U.S. datasets would bring out clear differences in corporate environmental responsiveness strategies in the two countries. This may have reflected the different regulatory contexts - the U.S. context which highlights detailed and specific action guidelines with punitive penalties for violations, and the Canadian context that emphasizes broader guidelines with greater collaboration and public consultation to establish specific actions (Pasquero, 1991). However, the frequency distribution of U.S. and Canadian companies at the higher end of the corporate environmental responsiveness scale are

about even in proportion to the total numbers, even though the numbers of U.S. companies at the lower end of the scale are higher in proportion. This drags down the U.S. average value on this construct and increases the dispersion around the mean. No conclusions about the greater efficacy of either of the regulatory systems can be drawn.

The public policy implications that result from this study are the following:

(1) Collaborative problem-solving relationship strategies with stakeholders considered to represent the environment is an important predictor of proactive/interactive environmental strategies. Buffalo's goodwill with stakeholders generates considerable benefits in its day-to-day operations by way of reduced operating obstacles. U.S. Oil's confrontationist stance has cost the company in delayed or scrapped developments and wasted resources.

Governments and regulatory agencies can create mechanisms for encouraging collaborative processes that rely on face-to-face negotiations and mediation between impacted stakeholders and the company, rather than resort to legal action through courts. To a large extent, the Canadian context encourages these collaborative processes. Regulatory bodies such as the erstwhile Alberta Energy Resources and Conservation Board can undertake the mediation role as a main function in collaboration with the industry association(s). U.S. state governments can learn from the Canadian example to reduce the protracted litigation that goes on between companies and regulatory bodies (such as the EPA) and impacted stakeholders.

(2) Governments should provide companies positive incentives (instead of only punitive penalties for infringement) for undertaking proactive/interactive responses for environmental preservation. This may be provided in the form of tax breaks or other incentives for pollution

prevention activities that require change in equipment, technology, process and product specifications. Current tax laws provide tax-breaks for investments in pollution control equipment.

These incentives can spur a company to initiate voluntary actions to reduce environmental impact in a non-threatening environment where regulations and societal pressures do not demand immediate actions. Organizational learning and knowledge generation can be initiated that can lead to organizational benefits. These benefits will reinforce and spur self-motivated environmental responsiveness from companies as organizational benefits of these actions become apparent.

(3) Governments should provide funding, information, training, and expertise to industry associations, universities, and research institutions for developing benchmarks and indices for measuring corporate environmental performance in each industry. This will provide information flow and guidelines to enable companies to measure their actions against specific benchmarks.

Ultimately, it is doubtful that either North American companies and governments are interested in perpetuating environmental degradation while continuing to foster economic development. The interviews and discussions with managers at all levels within the seven companies studied in the exploratory study, revealed a strong desire in the Canadian industry to find ways of reconciling environmental preservation with economic growth. While many companies may need to understand that short-term economic sacrifices are necessary for long-term economic growth and survival, some companies such as Buffalo and Sioux (and others scoring high on the corporate environmental responsiveness strategies construct in the survey data) have been following these principles for several years. Governments need to encourage such

a long-term thinking by influencing the operation of investment markets such as stock exchanges that still reward short-term corporate performance.

9.6. Conclusion

Interactive and proactive environmental responsiveness strategies that enhance corporate competitiveness hold promise for reducing the negative environmental impact of business activities. Environmental issues are important to society today and will, in likelihood, gain in importance as regulations become more stringent and the global environment deteriorates at an accelerating rate. It is argued that corporations will benefit competitively by responding early as issue dimensions are still being debated in public policy domains, at their own pace and with the ability and flexibility to try different approaches, rather than under pressure of immediate regulatory compliance. The research study highlights the leadership and managerial influences that can help make companies greener and more responsible in preserving the environment, while continuing to exist as competitive entities. The study also points to certain actions that governments can take to help companies deal with the apparent conflict between competitiveness and environmental preservation.

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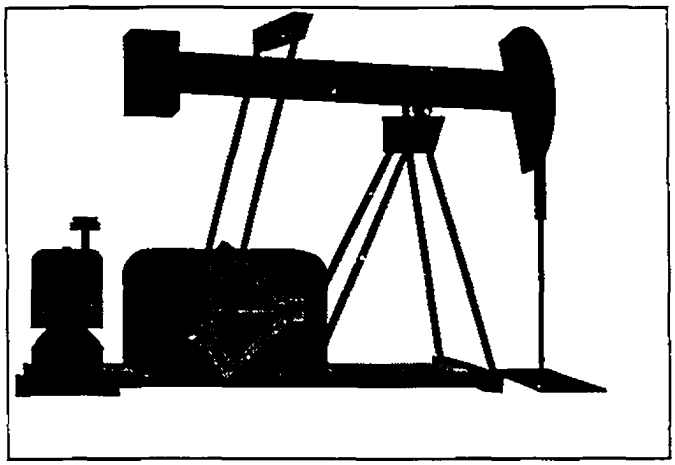
Appendix 1a.



The objective of this survey is to increase understanding of different environmental strategies followed by individual firms in the Canadian and U.S. oil and gas industries, the impact of these strategies on competitiveness, and the opinions of managers about environmental issues. Your name was selected because of the nature of your work and your knowledge of these issues and your answers will enhance the validity of this research. Without the cooperation of individuals like yourself, we will not be able to obtain meaningful information on these issues.

Individual company names, respondent names, and personal details are not asked for. The survey does not require any financial or proprietary company data to be revealed. Individual company or respondent information will not be revealed, and only aggregate data and summary statistics will be reported. Complete confidentiality is assured for all responses. All responses will be coded and stored separately in a secure computer file. If you would like to obtain copies of the final summary results, please fill in the enclosed card and return.

This questionnaire should take you approximately 30 minutes to complete. To ensure the accuracy of results, please answer the survey carefully and complete all questions. If any question is not applicable to your company, please leave blank. After you have completed the survey, place it in the enclosed envelope and mail it back. If you have any questions, please call Sanjay Sharma, or Dr. Harrie Vredenburg at the Faculty of Management, University of Calgary: (403) 220-3998. Thank you for your cooperation and valuable contribution to increasing knowledge in this area of management.

As per University of Calgary Research Ethics Guidelines it is stated that the completion of this survey indicates that you have understood to your satisfaction the information regarding your participation in this research project. In no way does this waive your legal rights or release the researchers or involved institutions from their legal and professional responsibilities. If you have any questions concerning your participation in this project, you may also contact the office of the Vice-President (Research) and ask for Karen McDermid, 403-220-3381.

Section 1: Environmental Issues and Business

Questions in this section ask for **your opinions about environmental issues** in context of your job and your company's and main competitors' business activities. The areas for your response are surrounded by a border. Please indicate your response by circling a number on the scale below.

1	2	3	4	5	6	7
Strongly disagree			*Neutral*			*Strongly agree*

1. By circling a number in each row, please indicate the **extent of your agreement/ disagreement** with the following statement intended to describe **your attitudes toward environmental issues.**

(a) While modifying a business practice in response to environmental concerns, profits should not be sacrificed.	1	2	3	4	5	6	7
(b) Business firms should wait for clarity in regulations before initiating any action for environmental preservation.	1	2	3	4	5	6	7
(c) Sustainable development is a desirable ideal for business.	1	2	3	4	5	6	7
(d) Business firms are responsible for the preservation of natural resources for future generations.	1	2	3	4	5	6	7
(e) Preservation of species biodiversity is not a responsibility of business firms.	1	2	3	4	5	6	7
(f) Companies will eventually have to find ways of doing business with zero discharges of wastes and pollution.	1	2	3	4	5	6	7
(g) Current rates of economic growth and development are not sustainable without major redesign of business organizations.	1	2	3	4	5	6	7
(h) Environmental concerns of society offers a multitude of market opportunities for business firms.	1	2	3	4	5	6	7
(i) The industry faces excessive environmental regulation.	1	2	3	4	5	6	7
(j) Environmental problems can not be solved without ensuring justice and equity for all of the world's communities.	1	2	3	4	5	6	7
(k) Companies respond to demand - it is up to the consumers to change their consumption patterns to reduce environmental degradation.	1	2	3	4	5	6	7
(l) Environmental damage can not be reversed without reducing the scale at which business is conducted.	1	2	3	4	5	6	7

1	2	3	4	5	6	7
Strongly disagree			*Neutral*			*Strongly agree*

2. By circling a number in each row, please indicate the **extent of your agreement/ disagreement** with the following statements intended to describe **your perceptions about the impact of environmental issues on your job.**

(a) By responding on an environmental issue on which regulations are not yet clear, I am likely to lose rather than gain in any way.	1	2	3	4	5	6	7
(b) Others in the company constrain any independent actions that I may wish to take for environmental preservation.	1	2	3	4	5	6	7
(c) I lack the technical information and knowledge necessary to act independently on environmental issues.	1	2	3	4	5	6	7
(d) Resolution of environmental problems, as a consequence of any actions that I might take, are unlikely.	1	2	3	4	5	6	7
(e) Benefits to the company cannot result due any actions that I might take for environmental preservation.	1	2	3	4	5	6	7

3. By circling a number in each row, please indicate the **extent of your agreement/ disagreement** with the following statements intended to describe **your perceptions about your company's identity.**

(a) Maximizer of shareholder wealth.	1	2	3	4	5	6	7
(b) Involved with community/ social problems.	1	2	3	4	5	6	7
(c) Environmental leader.	1	2	3	4	5	6	7
(d) Technological leader.	1	2	3	4	5	6	7
(e) Scrupulous in following regulations.	1	2	3	4	5	6	7
(f) Patron of the arts and/or charities.	1	2	3	4	5	6	7
(g) Good corporate citizen.	1	2	3	4	5	6	7
(h) An example of free enterprise success.	1	2	3	4	5	6	7
(i) Problem-solving "can-do" organization.	1	2	3	4	5	6	7
(j) Collaborative in stakeholder relationships.	1	2	3	4	5	6	7

1	2	3	4	5	6	7
Strongly disagree			*Neutral*			*Strongly agree*

4. By circling a number in each row, please indicate the **extent of your agreement/ disagreement** with the following descriptions of the **environmental strategies of your main competitors.** Since you may perceive a number of competitors with different strategies, please circle as many items as are applicable.

(a) Scrupulous in following environmental regulations.	1	2	3	4	5	6	7
(b) Lobbying against environmental regulations.	1	2	3	4	5	6	7
(c) Exploiting markets for "green" products.	1	2	3	4	5	6	7
(d) Industry leader in environmental preservation.	1	2	3	4	5	6	7
(e) Collaborating with environmental groups and other stakeholders for environmental preservation.	1	2	3	4	5	6	7
(f) Public relations to hide poor environmental practices.	1	2	3	4	5	6	7

Section 2: The Company's Environmental Policies and Practices

This section asks questions about your company's environmental policies, practices, and actions. *If any item is not applicable to your company, please leave blank.*

1	2	3	4	5	6	7
To a very little extent			*To a moderate extent*			*To a very great extent*

5. To what **extent** has your company **modified business practices** in the following areas of operation, in order to **reduce impact on animal species and natural habitats?**

(a) Exploration and prospecting sites.	1	2	3	4	5	6	7
(b) Drilling sites and wellheads.	1	2	3	4	5	6	7
(c) Oil and gas production.	1	2	3	4	5	6	7
(d) Oil and gas gathering pipelines.	1	2	3	4	5	6	7
(e) Refining facilities.	1	2	3	4	5	6	7
(e) Transportation of petroleum products/chemicals.	1	2	3	4	5	6	7
(f) Retail outlets.	1	2	3	4	5	6	7

1	2	3	4	5	6	7
To a very little extent			*To a moderate extent*			*To a very great extent*

6. To what **extent** has your company **undertaken** the following **voluntary actions** (i.e., **actions that are not required by regulations) for environmental restoration**?

(a) Clean-up of abandoned well sites.	1	2	3	4	5	6	7
(b) Restoration of organic properties of contaminated soil.	1	2	3	4	5	6	7
(c) Clean-up of abandoned retail gas station sites.	1	2	3	4	5	6	7
(d) Protection of, and withdrawal from ecologically sensitive habitats.	1	2	3	4	5	6	7
(d) Disposal and treatment of hazardous/ toxic wastes.	1	2	3	4	5	6	7
(e) Compensation to local communities, employees, and other impacted parties for injury caused due to the company's environmental policies and accidents.	1	2	3	4	5	6	7

7. To what **extent** has your company **reduced wastes and emissions** from operations as a result of the following actions?

(a) Safe disposal of solid/ hazardous wastes.	1	2	3	4	5	6	7
(b) Investment in pollution/ emission control equipment.	1	2	3	4	5	6	7
(c) Recycling programs.	1	2	3	4	5	6	7
(d) Closed-loop waste use within the organization.	1	2	3	4	5	6	7
(e) Closed-loop waste use with other organizations.	1	2	3	4	5	6	7
(f) Process modifications to reduce waste at source.	1	2	3	4	5	6	7
(g) Changes in input material specifications.	1	2	3	4	5	6	7
(h) Modifications of product specifications.	1	2	3	4	5	6	7
(i) Implemented new technology to reduce wastes.	1	2	3	4	5	6	7

8. To what **extent** has your company **reduced purchases of non-renewable materials, chemicals, and components,** as a result of the following actions?

(a) Reduction in total materials used.	1	2	3	4	5	6	7
(b) Substitution by renewable materials.	1	2	3	4	5	6	7
(c) Use of recycled/ waste materials.	1	2	3	4	5	6	7

1	2	3	4	5	6	7
To a very little extent			*To a moderate extent*			*To a very great extent*

9. To what **extent** has your company **reduced the use of traditional fuels**, by substitution of, and research into, the following energy sources?

(a)Substitution by renewable energy sources.							
(i) Photovoltics/ Solar Energy.	1	2	3	4	5	6	7
(ii) Wind Power.	1	2	3	4	5	6	7
(b) Substitution by alternative energy sources.							
(i) Natural Gas.	1	2	3	4	5	6	7
(ii) Geothermal Energy.	1	2	3	4	5	6	7
(iii) Methane.	1	2	3	4	5	6	7
(iv) Biomass.	1	2	3	4	5	6	7
(v) Energy from wastes.	1	2	3	4	5	6	7
(c) Increase in cogeneration facilities.	1	2	3	4	5	6	7
(d) Investment in research into alternative energy sources.	1	2	3	4	5	6	7

10. To what **extent** has your company **reduced energy use**, due to the following actions?

(a) Better housekeeping / maintenance procedures.	1	2	3	4	5	6	7
(b) Retrofitting / replacement of high energy consuming equipment.	1	2	3	4	5	6	7
(c) Changes in process technology.	1	2	3	4	5	6	7
(d) Changes in product specifications.	1	2	3	4	5	6	7
(e) Changes in specifications of input materials.	1	2	3	4	5	6	7

11. To what **extent** has your company **undertaken the following actions to reduce the risk of environmental accidents, spills, and releases?**

(a) Investments in equipment and control/ alarm systems.	1	2	3	4	5	6	7
(b) Rigorous emergency response procedures.	1	2	3	4	5	6	7
(c) Employee training in emergency response procedures.	1	2	3	4	5	6	7
(d) Employee involvement and responsibility for emergency response.	1	2	3	4	5	6	7
(d) Training of local communities in emergency response procedures.	1	2	3	4	5	6	7
(e) Fundamental changes in design of processes and products to reduce/ eliminate environmental accidents, spills, releases, and hazardous waste.	1	2	3	4	5	6	7
(f) Reduce/ eliminate storage and use of hazardous chemicals/wastes.	1	2	3	4	5	6	7

1	2	3	4	5	6	7
To a very little extent			*To a moderate extent*			*To a very great extent*

12. To what **extent** has your company **undertaken the following actions to reduce the environmental impact of your products?**

(a) Introduced gasoline blends with lower emissions.	1	2	3	4	5	6	7
(b) Introduced chemicals with lower environmental impact.	1	2	3	4	5	6	7
(c) Made changes in packaging for engine oils/ chemicals sold:							
(i) Reduced packaging.	1	2	3	4	5	6	7
(ii) Introduced packaging made from recycled materials.	1	2	3	4	5	6	7
(iii) Introduced biodegradable/recyclable packaging.	1	2	3	4	5	6	7
(iv) Eliminated packaging that damages the ozone layer.	1	2	3	4	5	6	7
(f) Introduced used engine oil collection facilities.	1	2	3	4	5	6	7
(h) Adopted comprehensive product life cycle analysis.	1	2	3	4	5	6	7
(i) Obtained ecological certification for of a product or service.	1	2	3	4	5	6	7
(j) Reduced production of, eliminated, or replaced a product harmful to the environment.	1	2	3	4	5	6	7
(k) Changed product specifications in order to make production processes less environmentally damaging.	1	2	3	4	5	6	7
(l) Combined the functions of more than one product.	1	2	3	4	5	6	7

13. To what **extent** has your company **established partnerships** to reduce environmental impact?

(a) Technology and research alliances with other companies:							
(i) Within the oil and gas industry.	1	2	3	4	5	6	7
(ii) Outside the oil and gas industry.	1	2	3	4	5	6	7
(b) Agreements with other companies to process wastes.	1	2	3	4	5	6	7
(c) Partnerships to establish environmental standards for products, processes, operations, and materials with:							
(i) Other companies.	1	2	3	4	5	6	7
(ii) Environmental groups.	1	2	3	4	5	6	7
(iii) Suppliers.	1	2	3	4	5	6	7
(iv) Distributors or retailers.	1	2	3	4	5	6	7
(v) Industry Associations.	1	2	3	4	5	6	7
(d) Establishment of consultative councils with local communities/ governments, and environmental groups.	1	2	3	4	5	6	7
(e) Education programs for reduction of wasteful consumption.	1	2	3	4	5	6	7
(f) Partnerships in developing countries for environmental preservation.	1	2	3	4	5	6	7

1	2	3	4	5	6	7
To a very little extent			*To a moderate extent*			*To a very great extent*

14. Please indicate the **extent** to which your company **undertakes the following actions or adopt the following policies** for **environmental assessment/ audit, public disclosure, employee training, and employee immunity**?

(a) Detailed assessment of the environmental impact of operations.	every _____ year(s).
(b) Comprehensive environmental audit.	every _____ year(s).
(c) Release of a public environmental stewardship report.	every _____ year(s).
(d) Employee training programs on environmental issues.	1 2 3 4 5 6 7
(e) Provide immunity and protection to employees who report environmental accidents to management or authorities.	1 2 3 4 5 6 7
(f) Inform in a timely manner everyone who may be affected by conditions that might endanger health, safety, or the environment.	1 2 3 4 5 6 7
(g) Follow environmental practices according to North American regulations in developing countries where environmental regulations are less stringent.	1 2 3 4 5 6 7
(h) Invest in research for environmental preservation:	
(i) Within company.	1 2 3 4 5 6 7
(ii) With industry associations.	1 2 3 4 5 6 7
(iii) With universities and other research agencies.	1 2 3 4 5 6 7

15. In which **year** did the company **first modify, or initiate, business practices** (if at all) in the following areas of operations, **to accommodate environmental protection concerns**?

	YEAR
(a) Modifications in exploration and drilling practices.	_____
(b) Oil and gas production.	_____
(c) Modifications in refining processes.	_____
(d) Modification in material specifications and purchase procedures.	_____
(e) Modifications in product specifications.	_____
(f) Environmental assessment of operations and activities.	_____
(g) Environmental audit of operations/ activities.	_____
(h) Release of a public environmental stewardship report.	

Section 3: The Impact of Environmental Practices on Competitiveness

16. To what **extent** do you consider the **following areas of activity/operation as core** for your company, and **in which the company' s competitive or technological strengths and expertise lie?**

1	2	3	4	5	6	7
To a very little extent			*To a moderate extent*			*To a very great extent*

(a) Upstream operations - exploration, drilling,, production.	1	2	3	4	5	6	7
(b) Refining of oil/natural gas, and chemical production.	1	2	3	4	5	6	7
(c) Pipelines/ transportation of petroleum products.	1	2	3	4	5	6	7
(d) Downstream - retail and marketing operations.	1	2	3	4	5	6	7

17. Please indicate the **extent to which the company's environmental practices** [illegible]te/ emissions reduction, energy conservation, recycling, process/ product change, material substitution, disclosure, etc., **have led to any of the following benefits** or **capabilities.**

1	2	3	4	5	6	7
To a very little extent			*To a moderate extent*			*To a very great extent*

(a) Reduction in costs:							
(i) Material costs.	1	2	3	4	5	6	7
(ii) Process/production costs.	1	2	3	4	5	6	7
(iii) Costs of regulatory compliance.	1	2	3	4	5	6	7
(b) Improved operations:							
(i) Increased process/ production efficiency.	1	2	3	4	5	6	7
(ii) Increases in productivity.	1	2	3	4	5	6	7
(iii) Increased knowledge about effective ways of managing operations.	1	2	3	4	5	6	7
(iv) Process innovations.	1	2	3	4	5	6	7
(d) Improved product quality.	1	2	3	4	5	6	7
(e) Product innovations.	1	2	3	4	5	6	7
(f) Initiation of organization-wide learning among employees.	1	2	3	4	5	6	7
(g) Improved employee morale.	1	2	3	4	5	6	7
(h) Overall improved company reputation or goodwill.	1	2	3	4	5	6	7
(i) Better relationships with stakeholders such as local communities, regulators, and environmental groups.	1	2	3	4	5	6	7

1	2	3	4	5	6	7
To a very little extent			*To a moderate extent*			*To a very great extent*

18. Some of the **benefits/ capabilities** discussed in question 17 above, e.g. reputation, goodwill, relationships with stakeholders, etc., can generate **competitive advantage** for the company because they are hard to imitate by competitors. Please indicate the **extent** to which these **benefits/capabilities** have the **following features that can prevent them from easy imitation by competitors.**

(a) They take a long period of time to build up.	1	2	3	4	5	6	7
(b) Competitors can not build up these capabilities faster through a greater application of resources.	1	2	3	4	5	6	7
(c) They can not be easily be identified or imitated by competitors.	1	2	3	4	5	6	7
(d) They span (provide benefits) to several functional areas/ departments.	1	2	3	4	5	6	7
(e) They span different levels within the company.	1	2	3	4	5	6	7
(f) They lack a clearly identified owner within the company, i.e. an employee cannot walk away with an organizational capability.	1	2	3	4	5	6	7
(g) They act as triggers for collective learning within company.	1	2	3	4	5	6	7
(h) They act as triggers for innovation within the company.	1	2	3	4	5	6	7
(i) They combine with other assets to generate benefits for the company, e.g. improved reputation combines with an established retail network.	1	2	3	4	5	6	7

19. On the following scale, please **position your company's performance relative to your main competitors** in the industry.

1	2	3	4	5	6	7
Significantly lower			*About the same*			*Significantly higher*

(a) Product cost.	1	2	3	4	5	6	7
(b) Product quality, features, and performance.	1	2	3	4	5	6	7
(d) New product and market development.	1	2	3	4	5	6	7
(e) Production technology.	1	2	3	4	5	6	7
(f) Sales growth and market share.	1	2	3	4	5	6	7
(g) Profit margins.	1	2	3	4	5	6	7
(h) Personnel development.	1	2	3	4	5	6	7
(i) Environmental performance.	1	2	3	4	5	6	7
(j) Safety performance.	1	2	3	4	5	6	7

Section 4: The Environmental Function and Miscellaneous Information

By circling a number in the scale below, please indicate the **extent** of the **importance** and/ or **influence** of certain **functional areas in your company in dealing with environmental issues.**

1	2	3	4	5	6	7
To a very little extent			*To a moderate extent*			*To a very great extent*

20. Please indicate the **extent** to which **the following functional areas in the company deal with environmental issues.**

(a) Staff/ corporate legal department.	1	2	3	4	5	6	7
(b) Staff/ corporate public relations department.	1	2	3	4	5	6	7
(c) Staff/ corporate environmental department.	1	2	3	4	5	6	7
(d) Other staff/ corporate department. (Please specify_____)	1	2	3	4	5	6	7
(e) Line/operating managers.	1	2	3	4	5	6	7
(f) Profit centers/ Business Divisions.	1	2	3	4	5	6	7

21. To what **extent are the following devices for the discussion of, and resolution of, environmental issues used** within your company?

(a) The establishment of top management steering committees on environmental issues.	1	2	3	4	5	6	7
(b) The designation of specific liaison roles that link staff and line managers on environmental issues.	1	2	3	4	5	6	7
(c) The incorporation of environmental performance objectives in the annual business planning and review system.	1	2	3	4	5	6	7
(d) The inclusion of environmental indicators in performance evaluation and reward systems of line managers.	1	2	3	4	5	6	7
(e) The weighting of environmental performance indicators on par with economic performance indicators.	1	2	3	4	5	6	7
(f) The assignment of managers to environmental task forces.	1	2	3	4	5	6	7
(g) The rotation of line managers through temporary and full-time job assignments in departments dealing with environmental issues.	1	2	3	4	5	6	7
(h) Environmental committees on Board of Directors.	1	2	3	4	5	6	7

1	2	3	4	5	6	7
To a very little extent			*To a moderate extent*			*To a very great extent*

22. Please indicate the **extent** of the **relative importance** and/or **influence of the line and staff functions** in dealing with environmental issues in your company.

(a) The importance of line managers as a source of information and knowledge on environmental issues.	1	2	3	4	5	6	7
(b) The importance of staff/ corporate managers as a source of information and knowledge on environmental issues.	1	2	3	4	5	6	7
(c) The influence of line managers on environmental decisions.	1	2	3	4	5	6	7
(d) The influence of staff managers on environmental decisions.	1	2	3	4	5	6	7
(e) Cooperation between line and staff managers on environmental issues.	1	2	3	4	5	6	7
(f) The discretion available to line/operating managers in making decisions for reducing the environmental impact of business operations:							
(i) Modification of business practices.	1	2	3	4	5	6	7
(*ii*) Investment and commitment of resources.	1	2	3	4	5	6	7

23. To what extent are the following **stakeholders strategically important to the company's operations and a source of influence in understanding environmental issues?**

(a) Customers.	1	2	3	4	5	6	7
(b) Investors.	1	2	3	4	5	6	7
(c) Suppliers.	1	2	3	4	5	6	7
(d) Regulators.	1	2	3	4	5	6	7
(e) Local communities at operation sites.	1	2	3	4	5	6	7
(f) Employees.	1	2	3	4	5	6	7
(g) Environmental groups.	1	2	3	4	5	6	7
(h) Wildlife, fisheries, and forestry protection groups.	1	2	3	4	5	6	7

1	2	3	4	5	6	7
To a very little extent			*To a moderate extent*			*To a very great extent*

24. Please indicate the **extent** to which the company **adopts the following strategies for dealing with environmental / action groups, and local communities** concerned about the natural environment?

(a) Awaits direct communication from environmental groups or local communities before initiating action on an environmental issue of public concern.	1	2	3	4	5	6	7
(b) Follows the following strategies in dealing with environmental groups:							
(i) Litigation through courts or regulatory bodies.	1	2	3	4	5	6	7
(ii) Bilateral negotiations.	1	2	3	4	5	6	7
(iii) Problem-solving informal consultations.	1	2	3	4	5	6	7
(iv) Collaborative alliances.	1	2	3	4	5	6	7

25. Please **place a check mark** on the blanks in the box below to indicate **the product range and activities** of your company.

(a) Products:	
Crude Oil	_____
Refined Oil	_____
Natural gas.	_____
Petro-chemicals.	_____
Other (Please specify_____)	
(b) Activities:	_____
Exploration and drilling.	_____
Pipelines/transportation.	_____
Refining.	_____
Retail of petroleum products.	_____
Other (Please specify_____)	

26. Please indicate **approximate percentage of total sales revenues** represented by the following **categories of customers** (total need not be 100%).

(a) Retail.	_____%
(b) Wholesale/bulk.	_____%
(c) Public utilities.	_____%
(d) Pipeline operators.	_____%
(e) Industrial consumers.	_____%
(f) Government owned companies (may include companies already included in other categories above.)	_____%

27. Please provide the following information regarding your job and your company?

(a) Average number of **hours** per week spent by you in dealing with environmental issues.	_____hours
(b) In which **year** did you start dealing with environmental issues as a part of your job?	_____(year)
(c) Approximate total number of employees in the company.	_____(num.)
(d) Approximate annual sales revenues of the company. **($ million)**	_____($ mill.)
(e) Percentage of sales revenues derived from: Oil Natural Gas Pipeline business. Chemicals	 _____(%) _____(%) _____(%)
(f) What is the company's legal status? PRIVATE PUBLIC	 _____ _____
(g) Your position in the company:_____	

Do you have any comments on the questionnaire, or is there any information that you would like to add regarding your company's environmental policies and practices?

If you wish to receive a copy of the summary of results of the survey, please return the card enclosed with your name and address. Your name will only be used for mailing survey results, and complete confidentiality is assured. Once again, we wish to thank you for your cooperation and valuable contribution to increasing knowledge in this area of management.

THE UNIVERSITY OF CALGARY

CALGARY

Appendix 1b.

Dear

We, with the cooperation of the **Canadian Association of Petroleum Producers,** are carrying out a survey of corporate environmental strategies and competitiveness in the North American oil and gas industry. The objective of this survey is to increase understanding of the different types of environmental strategies followed by individual firms in the Canadian and U.S. oil and gas industries, the impact of these strategies on competitiveness, and the opinions of managers on environmental issues. Your name was selected because of the nature of your work and your knowledge of these issues, and your answers are very important to enable us to obtain meaningful information on these issues. The survey is expected to enhance understanding of environmental strategies that are compatible with maintaining and enhancing the competitiveness of the oil and gas industry. If you would like to obtain copies of the final summary results, please fill in the enclosed card and return.

Individual company names, respondent names, and personal details are not asked for. The survey does not require any financial or proprietary company data to be revealed and only aggregate data and summary statistics will be reported. Complete confidentiality is assured for all information. The responses will be coded and stored separately in a secure computer file. More than one person in your company may have been sent this questionnaire because determination of corporate strategies requires obtaining viewpoints from different managers in an organization. If you have time constraints in filling out this survey over the next 2 to 3 weeks, please pass it on to someone in your organization with a knowledge of corporate environmental strategies.

The questionnaire should take you approximately 30 minutes to complete. To ensure the accuracy of results, please complete all the questions. If any questions are not applicable to your company, please leave them blank. After you have completed the survey, place it in the enclosed envelope and mail it. If you have any questions, please call either of the undersigned at: (403) 220-3998 (fax: 403-282-0085) . Thank you for your cooperation and valuable contribution to increasing knowledge in this area of management.

Sincerely,

Dr. Harrie Vredenburg
Associate Professor - Strategic Management & Marketing

Sanjay Sharma
Doctoral Candidate

2500 University Drive N.W., Calgary, Alberta, Canada T2N 1N4
Office: (403) 220-3998; (403) 284-0638 Faculty: (403) 220-5685 Fax: (403) 282-0095

APPENDIX 2

List of innovations in the oil and gas industry

Reactive companies: (a) Royal Petroleum: Advancements in soil restoration technology made between 1991-94. (b) Royal Petroleum & National Oil: Joint development of emergency response guidelines and risk assessment procedures in the oil and gas industry during 1989-1993, to prevent environmental accidents. Both these companies do not have environmental audit procedures in place as both Buffalo and Sioux do. The environmental audit procedures adopted by Buffalo and Sioux have been developed jointly by Buffalo with Shell Canada, another proactive company which was not included in the present study. According to these companies, besides reduction in energy use, environmental response involved heavy investments in equipment that could not result in cost efficiencies.

Proactive companies: (I) Buffalo Oil - Pre-1993: (i) Patented technology to recover oil out of used filters and the crushing of filters to reduce solid waste disposal space and costs; the recovered oil is collected and sent once a year to Sioux Oil's recovery plant.(ii) A patented process improvement that reduces wastes and improves recovery in oil refining by 5%. This innovation has been sold to over 30 oil refiners in six countries. (iii) Patented improvements in the technology and practice of horizontal drilling of wells that reduce the requirement for number of wells that need to be dug to access a pool of oil. This also reduces costs of oil production and improves efficiency. (iv) Patented improvements in remote sensing technology for oil exploration from the air. (v) Several simple innovations to reduce environmental impact during prospecting, exploration, and development, such as the use of backpacking and horse riding scientists accompanied by biologists to study geological formations in ecologically sensitive areas. In

contrast, the reactive companies send in trucks and jeeps. While being ridiculed as "mule riders" by other oil companies, Buffalo's geological crew have excellent rapport with local communities and environmental groups. These changes have also resulted in cost reductions during exploration. (vi) Development of the industry's first detailed environmental assessment procedure in 1985. The law requiring environmental assessment was passed in 1986. (vii) Buffalo's biologists and ecologists has developed unique detailed documentation of migration patterns and habitat biodiversity covering over 200 species in ecologically sensitive areas. Buffalo lends use of this database to regulatory authorities and other oil companies forced by regulation to conduct environmental assessments. It uses this data as a common resource to protect the environment. (viii) Patented innovations in refineries undertaken without any investments or costs allow a 99% average rate of sulphur recovery, resulting in 40% less sulphur dioxide emissions that permitted under the license requirements of 98% recovery. In contrast, the managers of a reactive companies stated that reduction of air emissions by 1% from 98% to 99% would involve an investment of $1 billion across the entire oil and gas industry. (ix) Patented waste management procedures at refineries to recycle oily waste. (x) Patented development of innovative and low cost asphalt reclaimers at refineries. (xi) The first oil company to set up high altitude meteorological monitoring systems to assist all plants in meeting air quality standards and reduce energy consumption and carbon dioxide emissions. (xii) This company pioneered the used oil collection plan at its service stations in collaboration with Sioux Oil to recover used engine oil from consumers. (xiii) The first oil company to set up landfarms in 1983, at its refineries to biodegrade oily sludges. (xiv) In 1982 it developed the use of steamers to clean oil from equipment instead of using chemical solvents. These innovations resulted from an ongoing

process of thorough housekeeping analysis, replacement of components and high energy use equipment, and analysis of waste patterns.

1993-94: (xv) Patented process for recovery of sulphur contaminated with soil. (xvi) Development of higher efficiency vapour recovery systems technology to capture gasoline vapour from storage tanks to reduce ground-level ozone buildup. (xvii) Advances in ongoing research in photovoltic cell based batteries in collaboration with research institutes in the U.S., Japan, and Europe. No details are available due to the confidentiality of this research programme. (xviii) Ongoing enlargement of the database on species migration patterns and biodiversity by documentation of 11 more species of flora and fauna. (xix) Several new patents on innovations to reduce wastes and steam recovery in the refining process. (xx) Development of two new high oxygenated blends of petroleum with lower carbon emissions. This company's fully owned subsidiary in the U.S. is a world leader in hydrogenation technology, specializing in the development and licensing of advanced technologies for producing environmentally clean fuels from various fossil fuels such as heavy crude oils and high sulphur coals.

(II) Sioux Oil - pre 1993: (i) Sioux pioneered the technology for large-scale cleaning of used engine oil to produce usable clean engine oil. The first plant was set up in 1980. (ii) In 1981, it set up the first used engine oil collection programme covering all service stations in Western Canada. (iii) It set up the first commercial plant in Canada to manufacture vegetable based engine oils in 1985. (iv) Sioux pioneered ethanol blended gasolines in Canada in 1979. (v) Patent on the development of a super lightweight fuel tank for storage of compressed natural gas for automotive use. (vi) It set up a facility in 1988 to convert trucks and automobile engines to natural gas.

1993-94: (vii) Patents on 10% improvements in productivity at its ethanol distilleries while reducing wastes. (viii) Advancements in research in photovoltic cells based rechargeable automotive batteries at its research centre. (ix) Development of a new ethanol blend - 10% ethanol and highly oxygenated and reformulated gasoline that has the lowest total emissions of particulates and carbon gases in the world.

Appendix 3
Scatter plots and histograms of standardised residuals of the dependent variables over values of independent variables

3.1.1. Canada: Normal Plot for standardised residuals of d.v. = environmental responsiveness strategies over values of independent variables.

3.1.2. Canada: Histogram with normal curve fitted for standardised residuals of d.v = environmental strategies over values of independent variables.

3.2.1. U.S.: Canada: Normal Plot for standardised residuals of d.v. = environmental responsiveness strategies over values of independent variables.

3.2.2. U.S.: Histogram with normal curve fitted for standardised residuals of d.v = environmental strategies over values of independent variables.

3.1.3. Canada: Normal Plot for standardised residuals of d.v. = managerial interpretations over values of independent variables.

3.1.4. Canada: Histogram with normal curve fitted for standardised residuals of d.v = managerial interpretations over values of independent variables.

3.2.3. U.S.: Normal Plot for standardised residuals of d.v. = managerial interpretations over values of independent variables.

3.2.4. U.S.: Histogram with normal curve fitted for standardised residuals of d.v = managerial interpretations over values of independent variables.

3.1.5. Canada: Normal Plot for standardised residuals of d.v. = competitive organizational benefits over values of the independent variables = environmental strategies and capability features.

3.1.6. Canada: Histogram with normal curve fitted for standardised residuals of d.v = competitive organizational benefits over values of the independent variables = environmental strategies and capability features.

3.2.5. U.S.: Normal Plot for standardised residuals of d.v. = competitive organizational benefits over values of the independent variables = environmental strategies and capability features.

3.2.6. U.S.: Histogram with normal curve fitted for standardised residuals of d.v = competitive organizational benefits over values of the independent variables = environmental strategies and capability features.

3.1.7. Canada: Normal Plot for standardised residuals of d.v. = stakeholder relationship strategies over values of the independent variable = importance of environmental stakeholders.

3.1.8. Canada: Histogram with normal curve fitted for standardised residuals of d.v = d.v. = stakeholder relationship strategies over values of the independent variable = importance of environmental stakeholders.

3.2.7. U.S.: Normal Plot for standardised residuals of d.v. = d.v. = stakeholder relationship strategies over values of the independent variable = importance of environmental stakeholders.

3.2.8. U.S.: Histogram with normal curve fitted for standardised residuals of d.v = d.v. = stakeholder relationship strategies over values of the independent variable = importance of environmental stakeholders.

3.1.9. Canada: Normal Plot for standardised residuals of d.v. = managerial perceptions of economic performance relative to industry average over values of the independent variable = environmental strategies.

3.1.10. Canada: Histogram with normal curve fitted for standardised residuals of d.v = managerial perceptions of economic performance relative to industry average over values of the independent variable = environmental strategies.

3.2.9. U.S.: Normal Plot for standardised residuals of d.v. = managerial perceptions of economic performance relative to industry average over values of the independent variable = environmental strategies.

3.2.10. U.S.: Histogram with normal curve fitted for standardised residuals of d.v = managerial perceptions of economic performance relative to industry average over values of the independent variable = environmental strategies.

3.1.11. Canada: Normal Plot for standardised residuals of d.v. = return on assets (five years average) over values of the independent variable = environmental strategies.

3.1.12. Canada: Histogram with normal curve fitted for standardised residuals of d.v = return on assets (five years average) over values of the independent variable = environmental strategies.

3.2.11. U.S.: Normal Plot for standardised residuals of d.v. = return on assets (three years average) over values of the independent variable = environmental strategies.

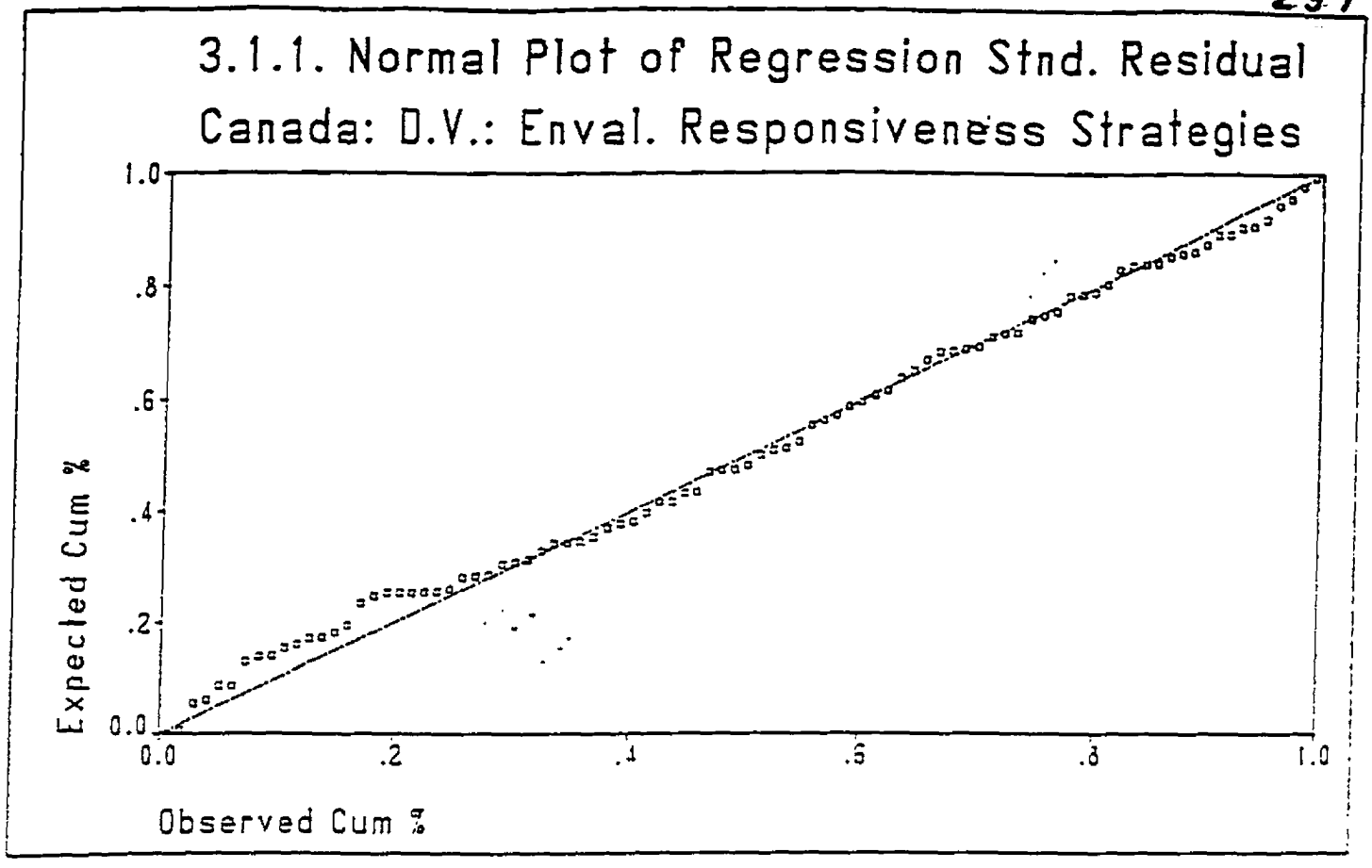
3.2.12. U.S.: Histogram with normal curve fitted for standardised residuals of d.v = return on assets (three years average) over values of the independent variable = environmental strategies.

3.1.13. Canada: Normal Plot for standardised residuals of d.v. = importance of environmental stakeholders over values of the independent variable = business exposure.

3.1.14. Canada: Histogram with normal curve fitted for standardised residuals of d.v = importance of environmental stakeholders over values of the independent variable = business exposure.

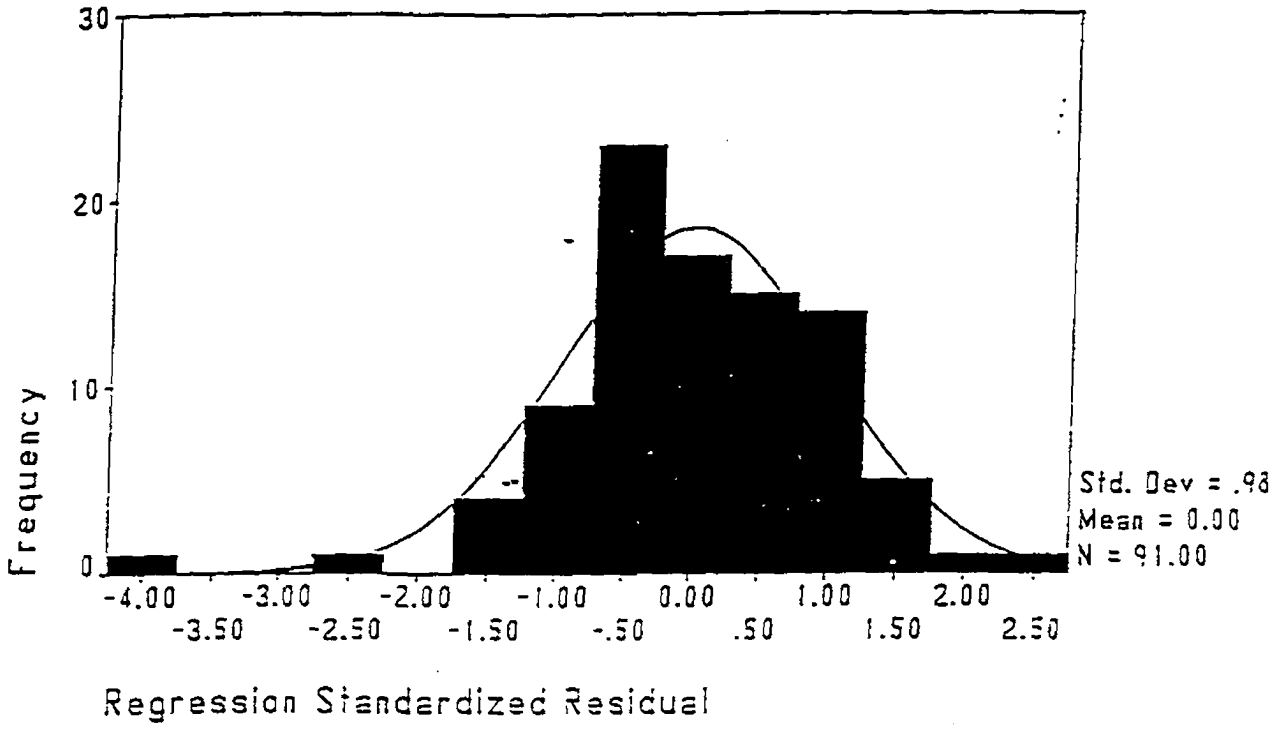
3.2.13. U.S.: Normal Plot for standardised residuals of d.v. = importance of environmental stakeholders over values of the independent variable = business exposure.

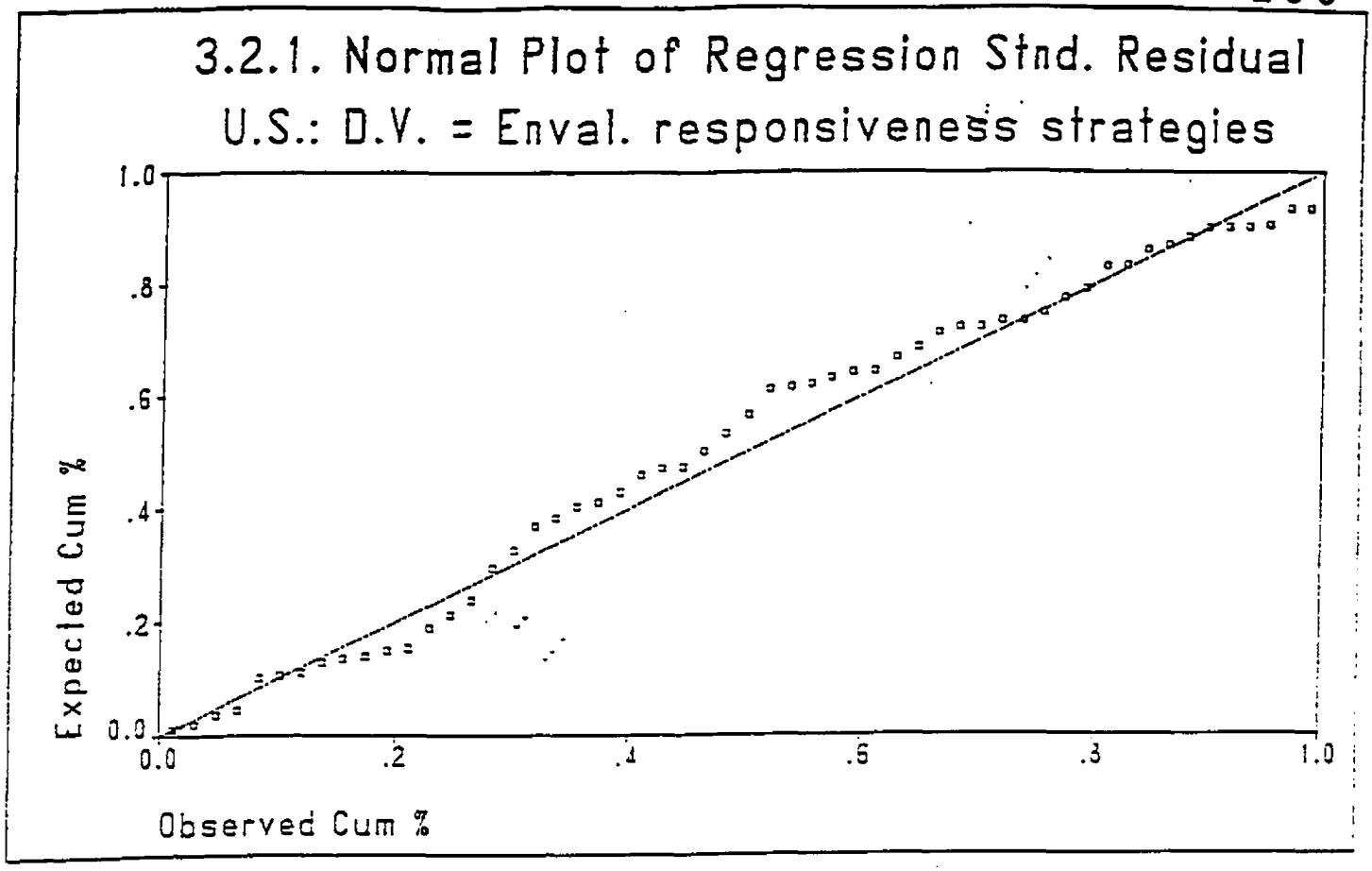
3.2.14. U.S.: Histogram with normal curve fitted for standardised residuals of d.v = importance of environmental stakeholders over values of the independent variable = business exposure.



3.1.2. Histogram - Canada

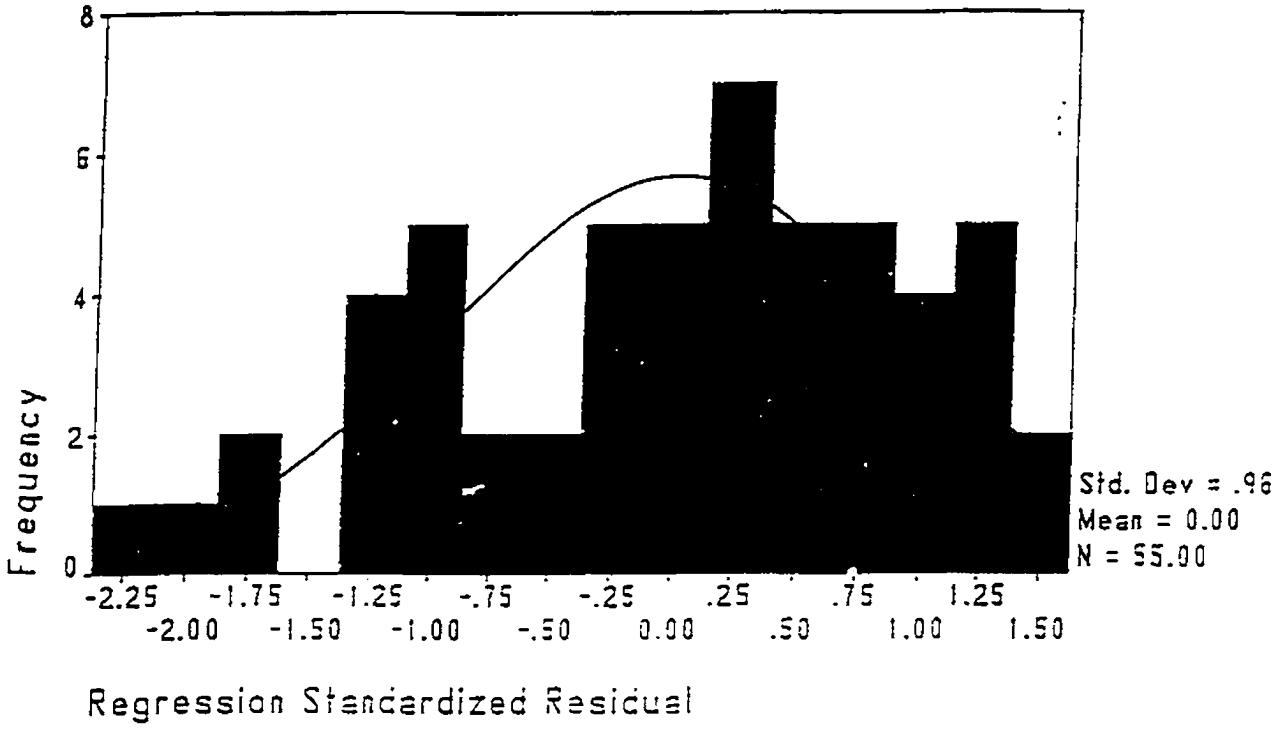
D.V.: Enval. Responsiveness Strategies





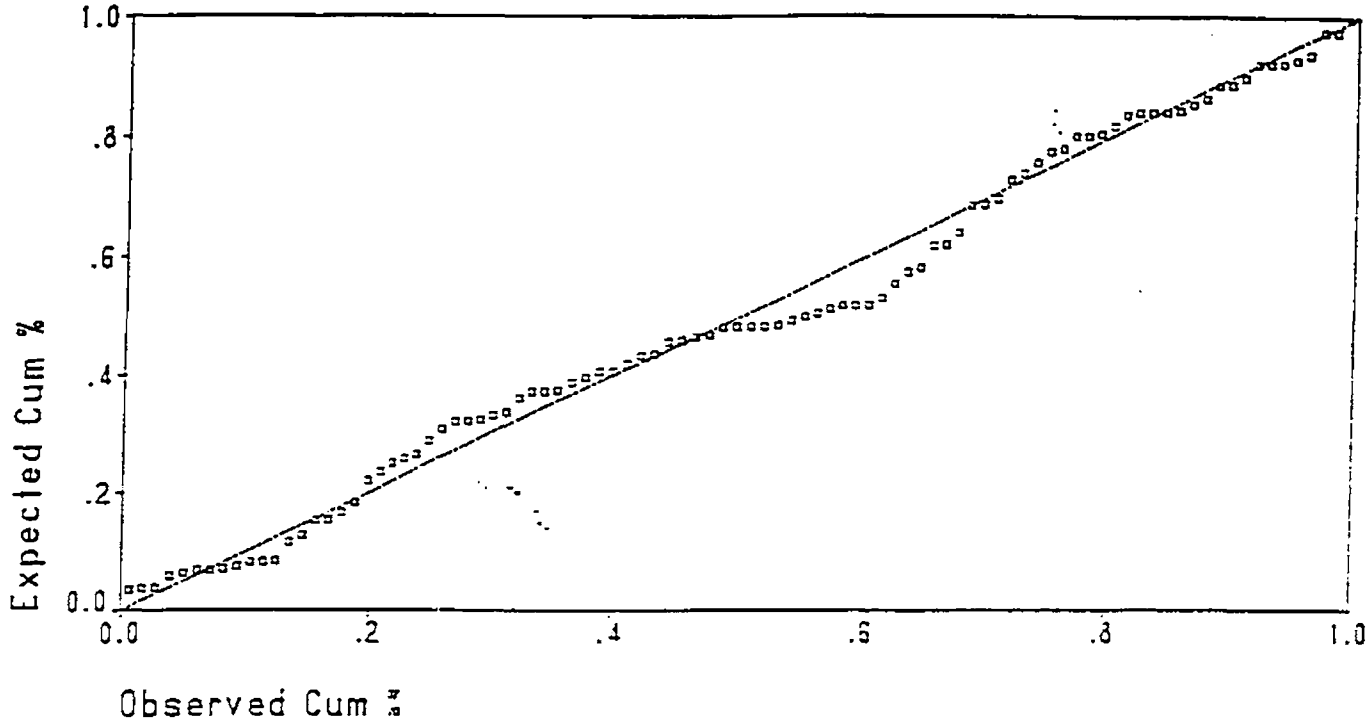
3.2.2. Histogram - U.S.

D.V.= Enval. responsiveness strategies



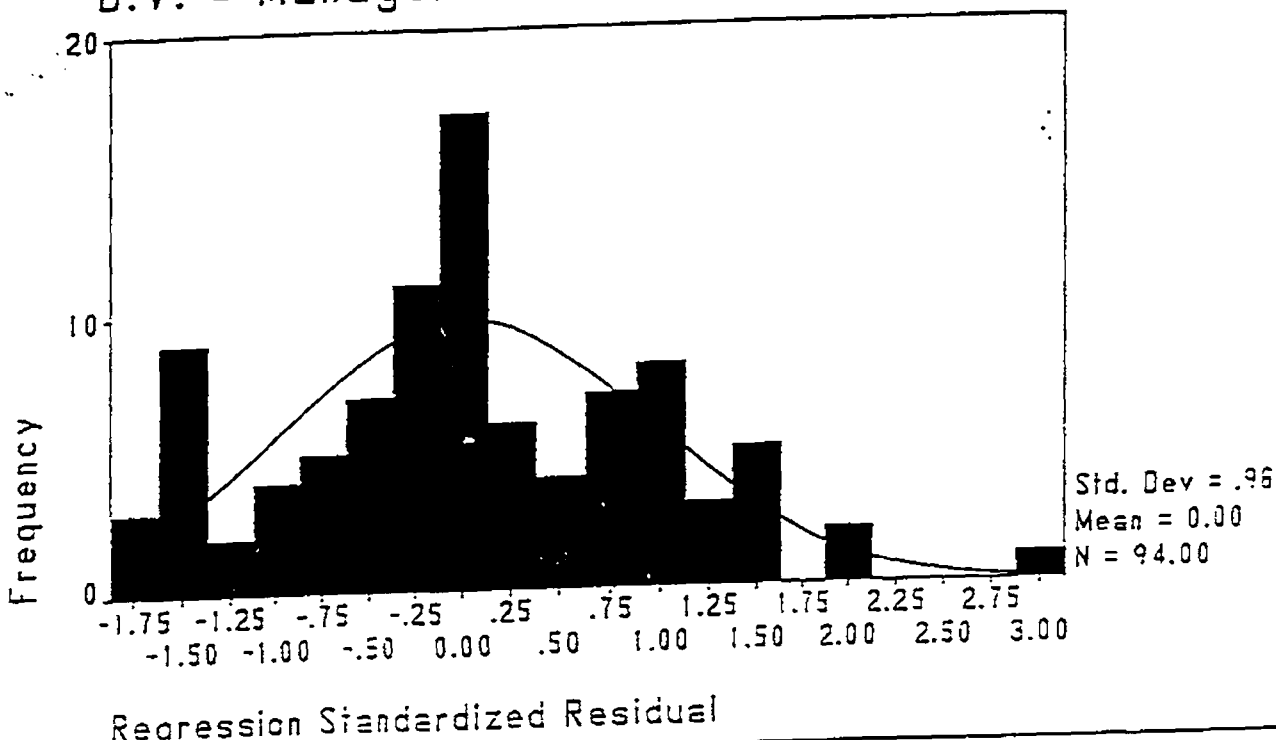
3.1.3. Normal Plot of Regression Stnd. Residual

Canada: D.V. - Managerial threat interpretations



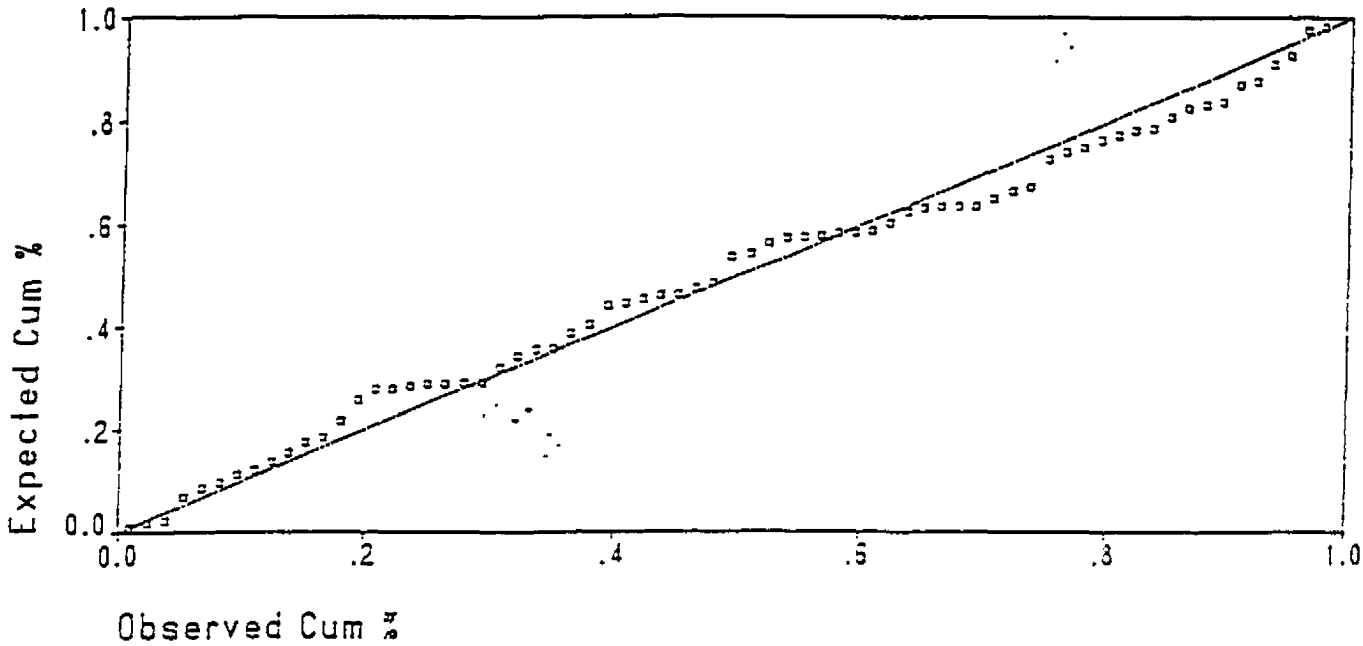
3.1.4. Histogram - Canada

D.V. = Managerial threat interpretations



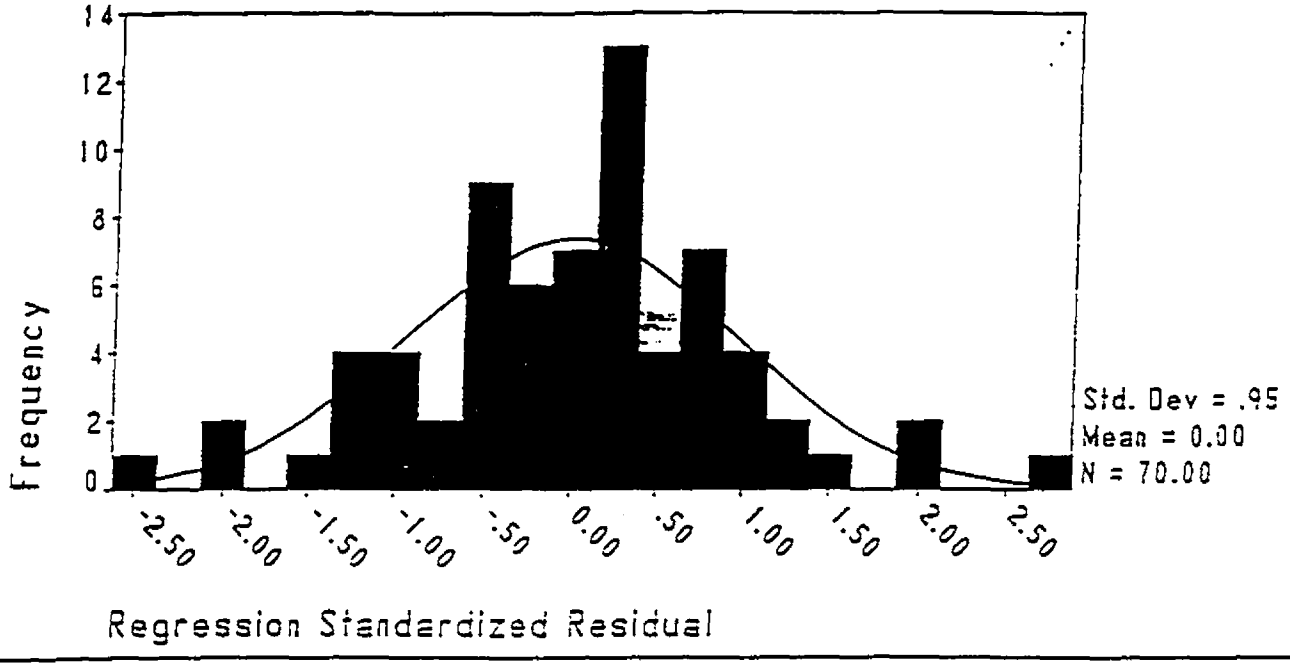
3.2.3. Normal Plot of Regression Stnd. Residual

U.S.: D.V. = Managerial interpretations of environmental issues



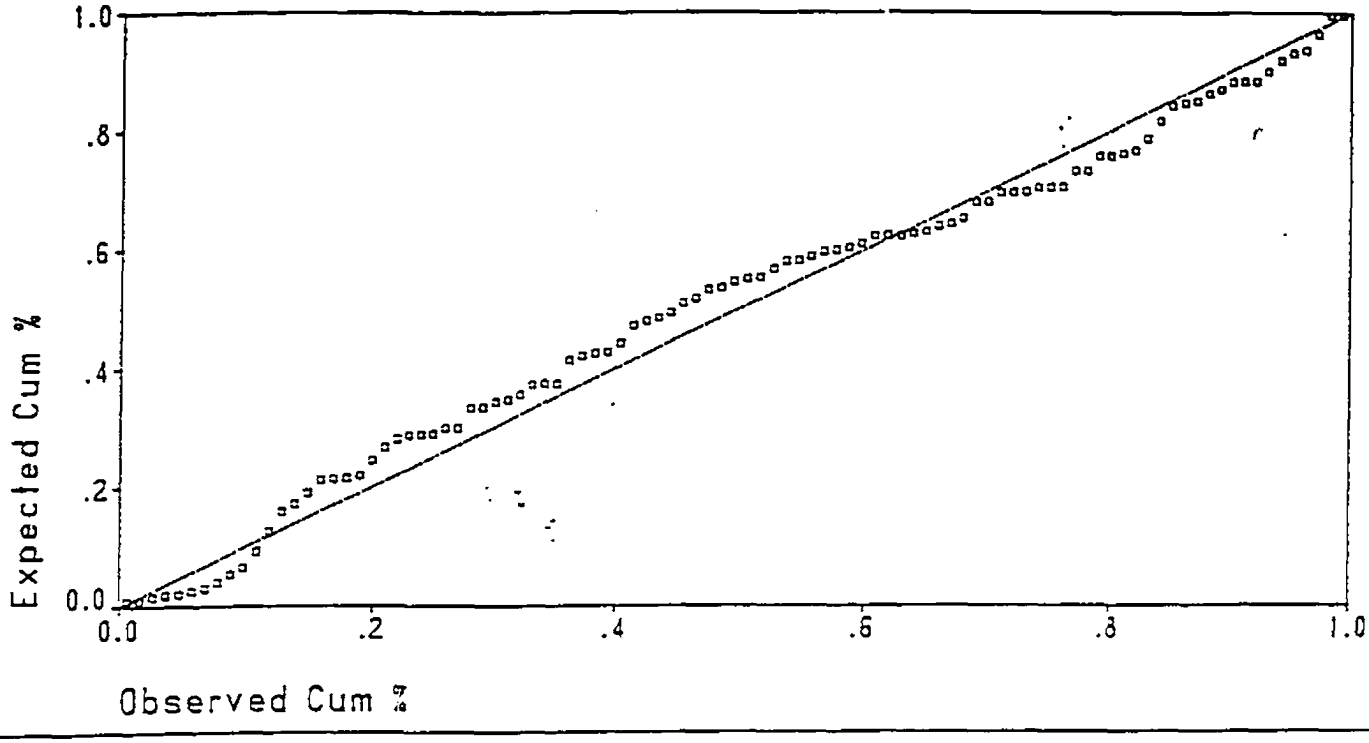
3.2.4. Histogram - U.S.

D.V. = Managerial interpretations of environmental issues



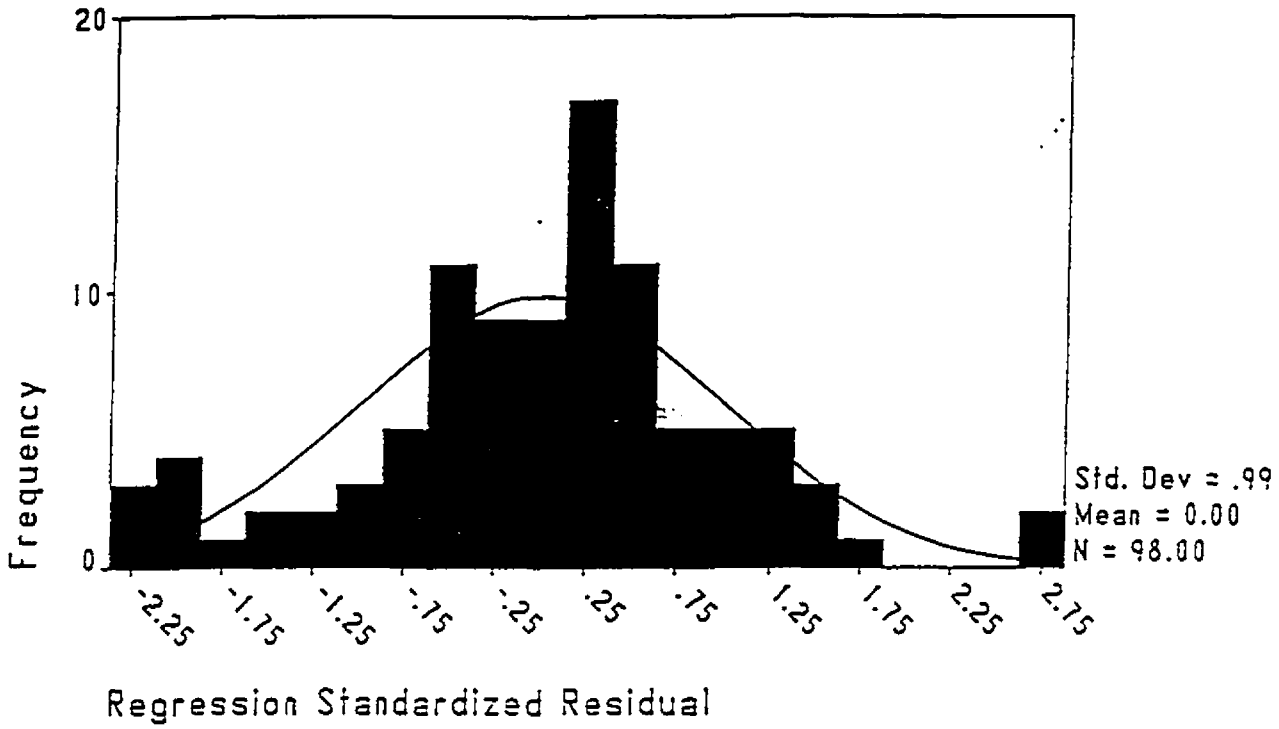
3.1.5. Canada - Normal Plot of Reg. Std. Residuals

D.V. = Competitive benefits



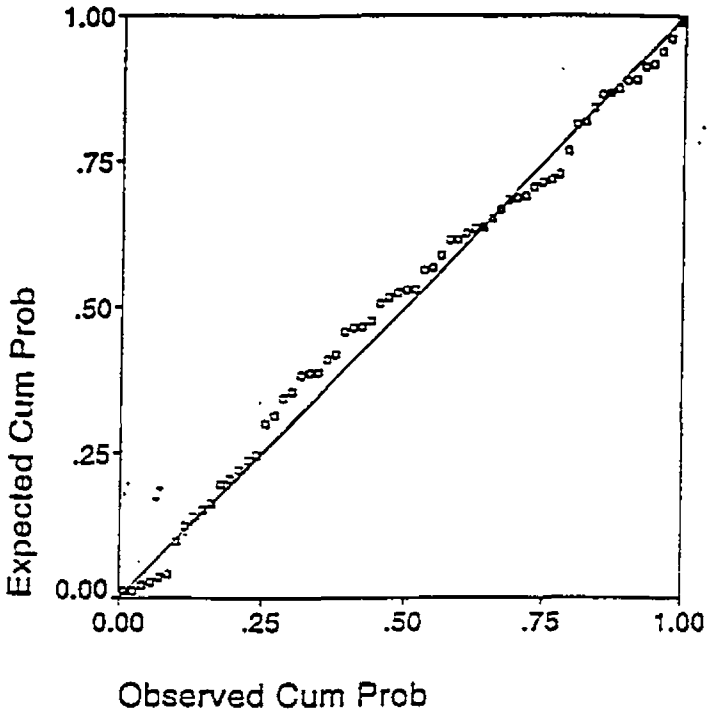
3.1.6. Histogram - Canada

D.V. = Competitive benefits



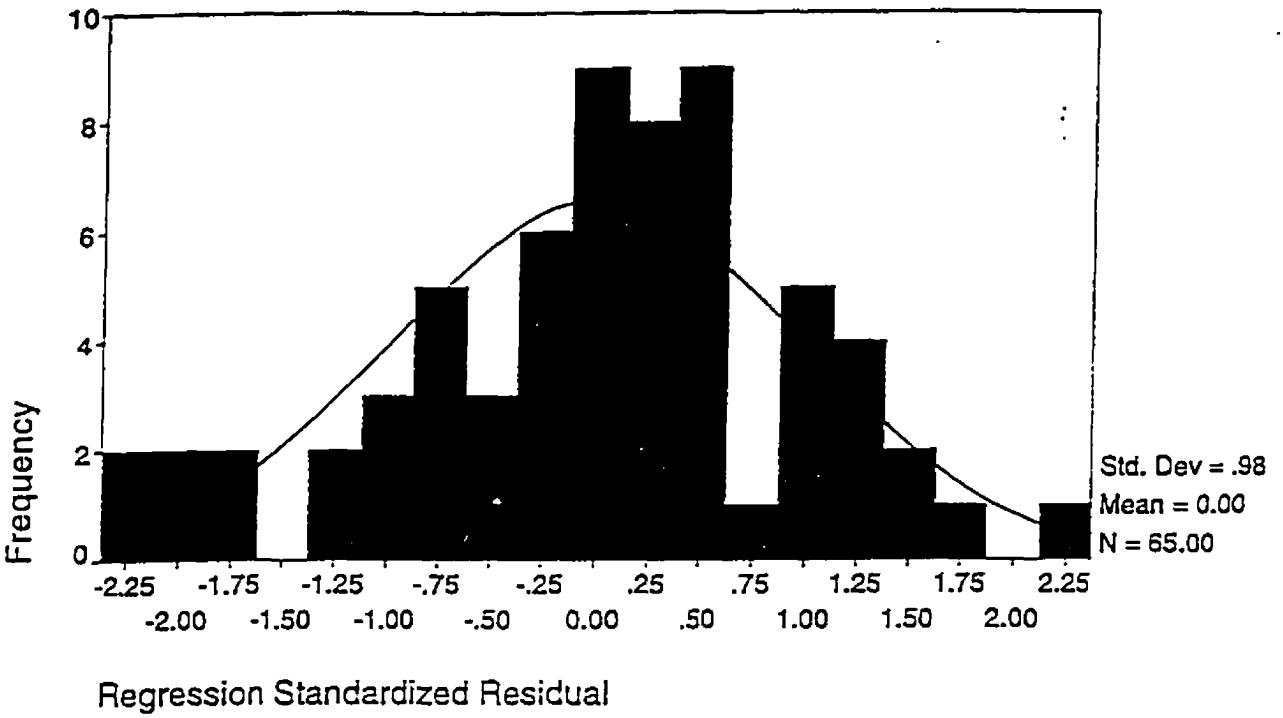
3.2.5. Normal Plot of Reg. Std. Residual - USA

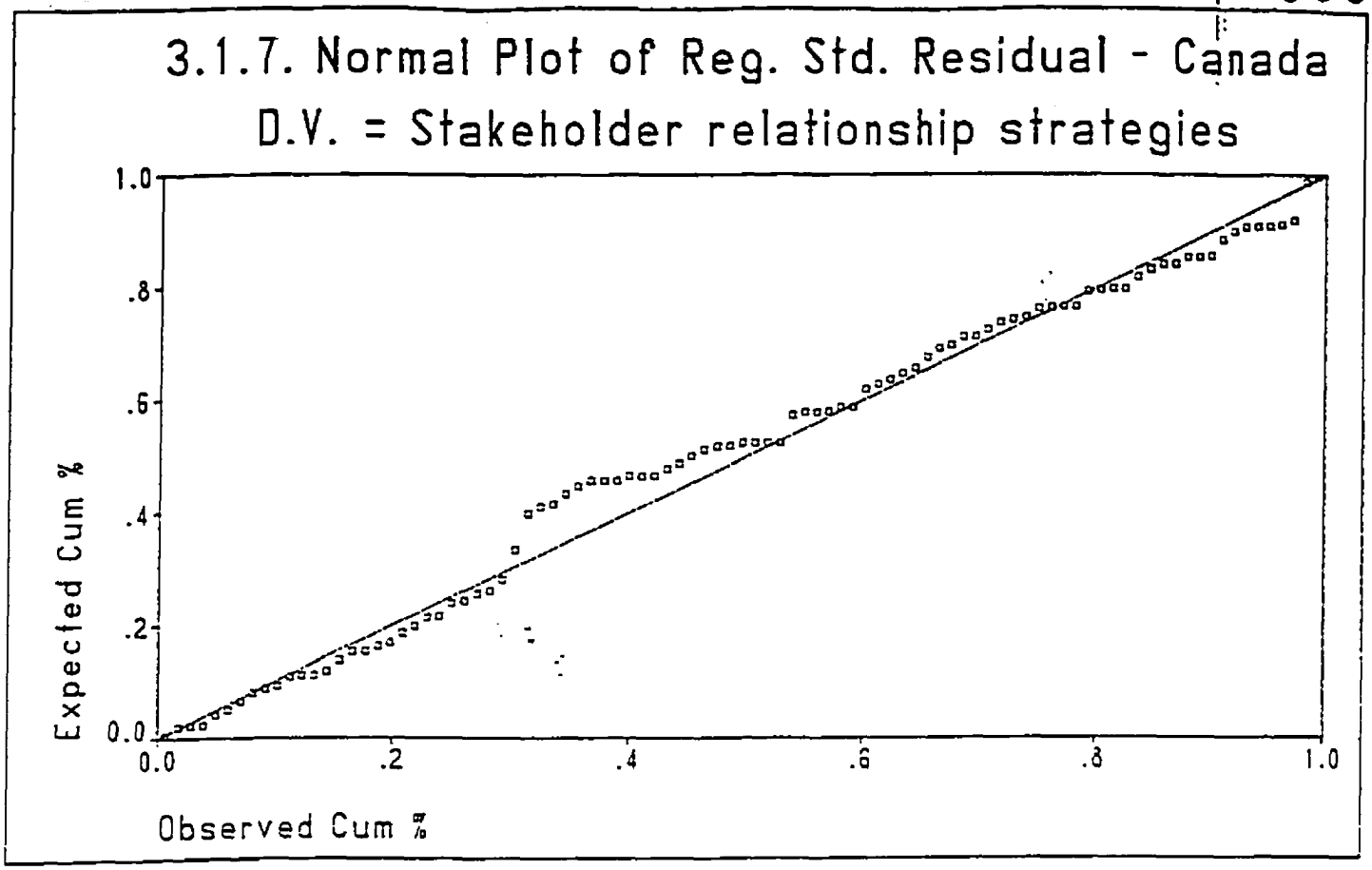
D.V. = Competitive Benefits



3.2.6. Histogram - USA

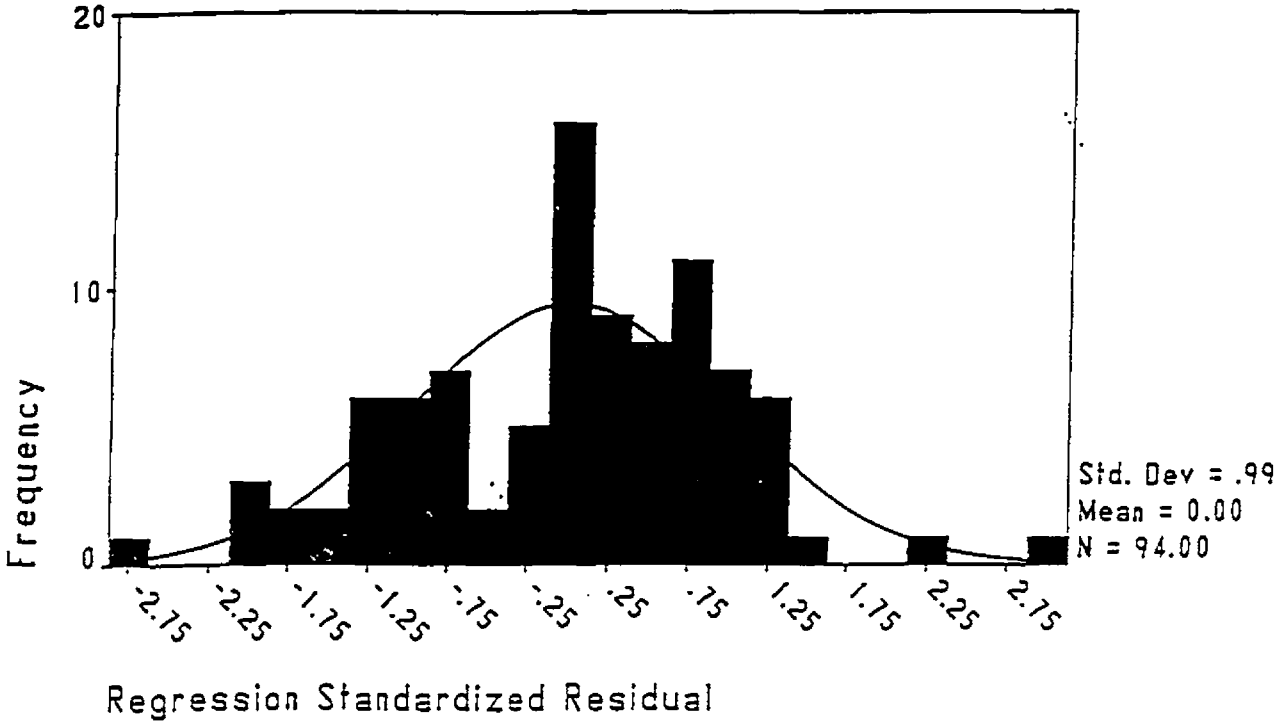
D.V. = Competitive Benefits

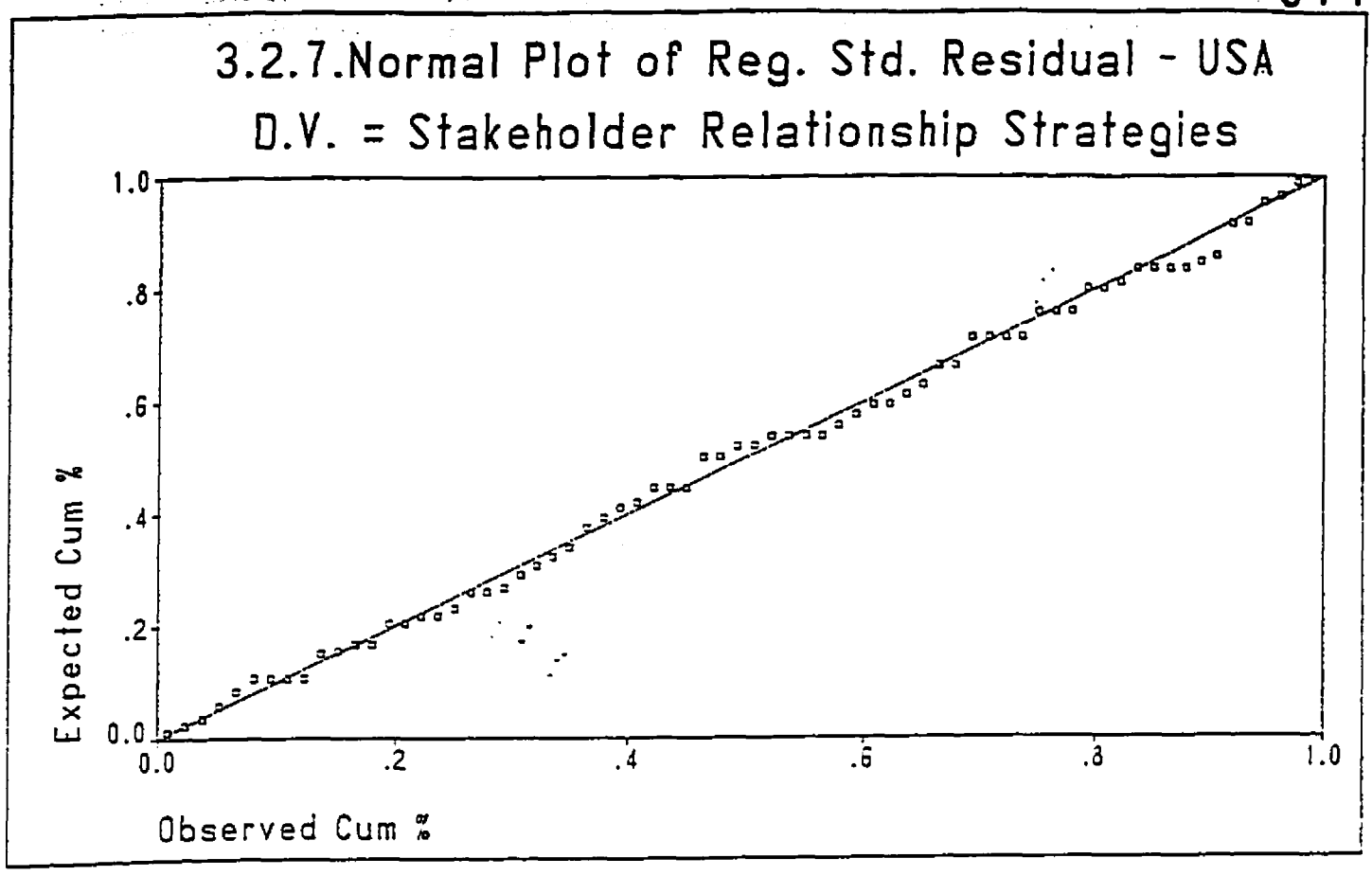




3.1.8. Histogram - Canada

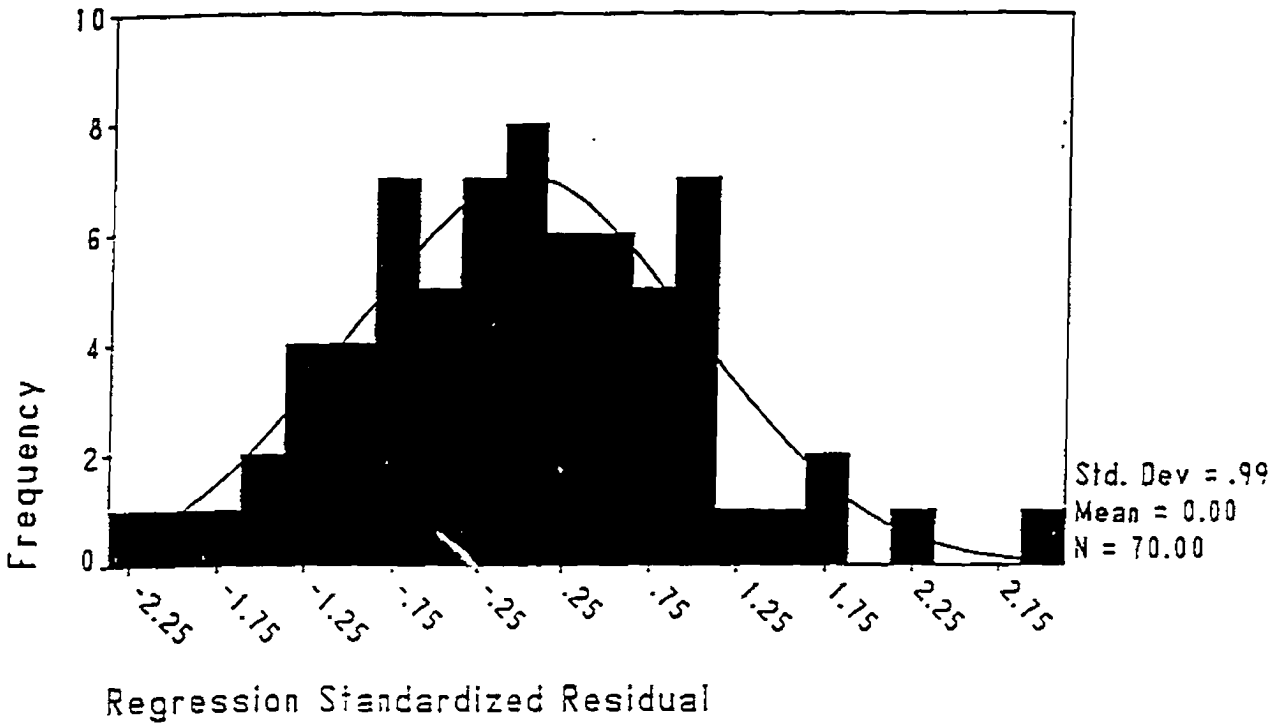
D.V. = Stakeholder relationship strategies





3.2.8. Histogram - USA

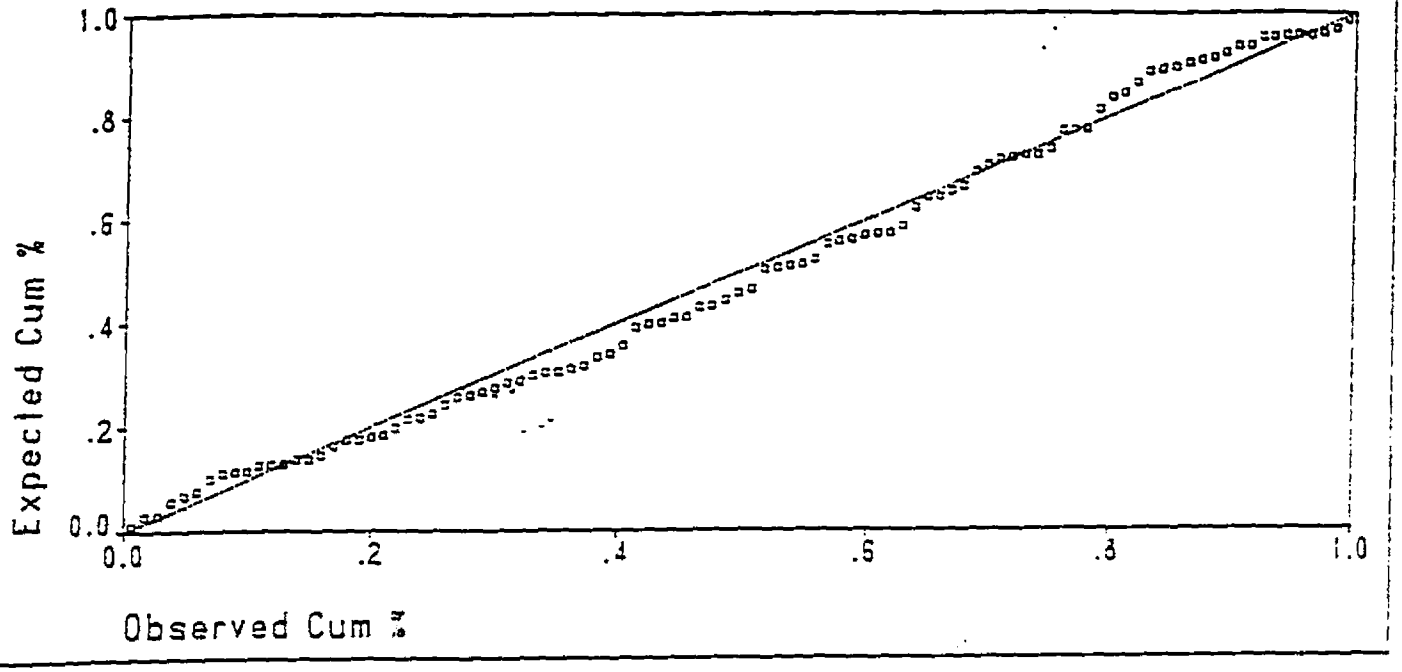
D.V. = Stakeholder relationship strategies



3.1.9. Normal Plot of Regression Stnd. Residual

Canada: D.V. = Managerial perceptions of performanc

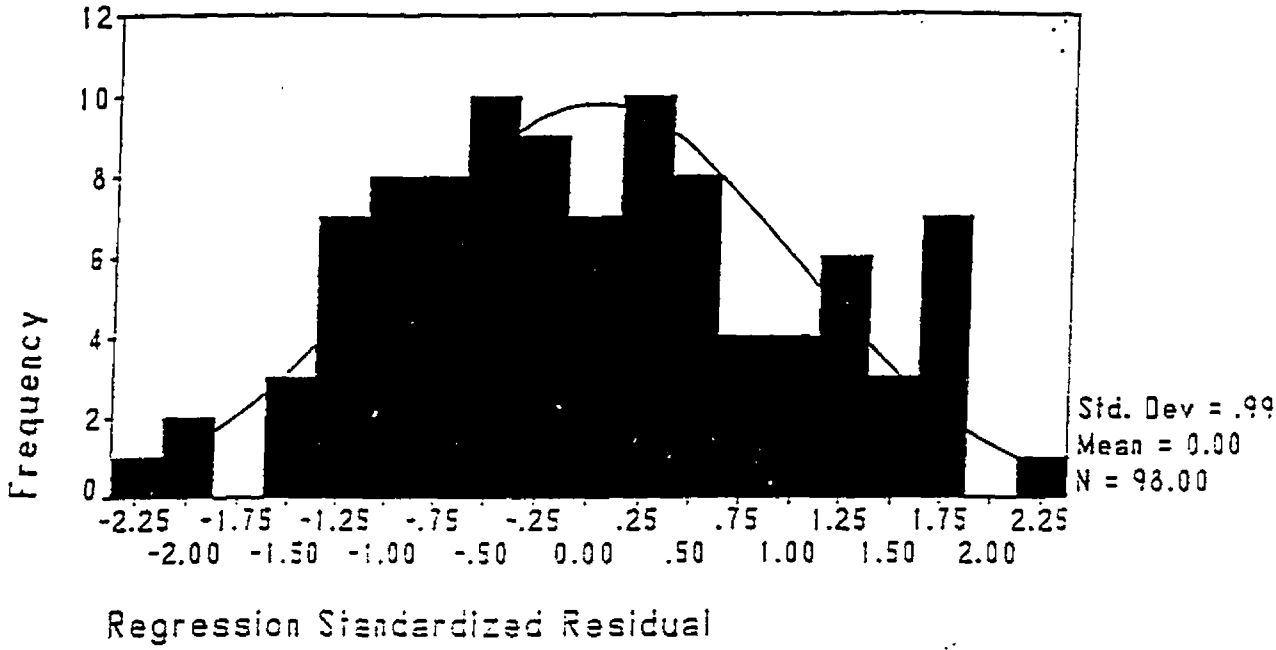
I.V. = Environmental responsiveness strategies



3.1.10. Histogram - Canada

D.V. = Managerial perceptions of performance

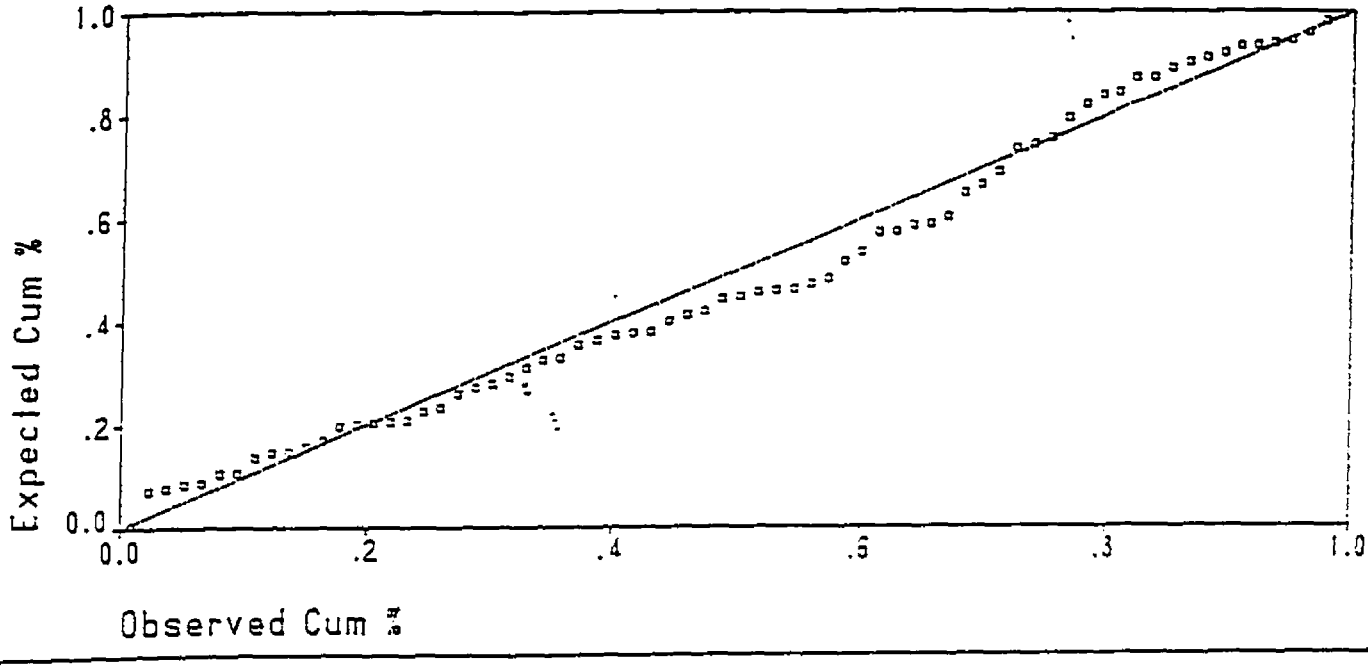
I.V. = Environmental responsiveness strategies



3.2.9. Normal Plot of Regression Stnd. Residual

U.S.: D.V. = Managerial perceptions of performance

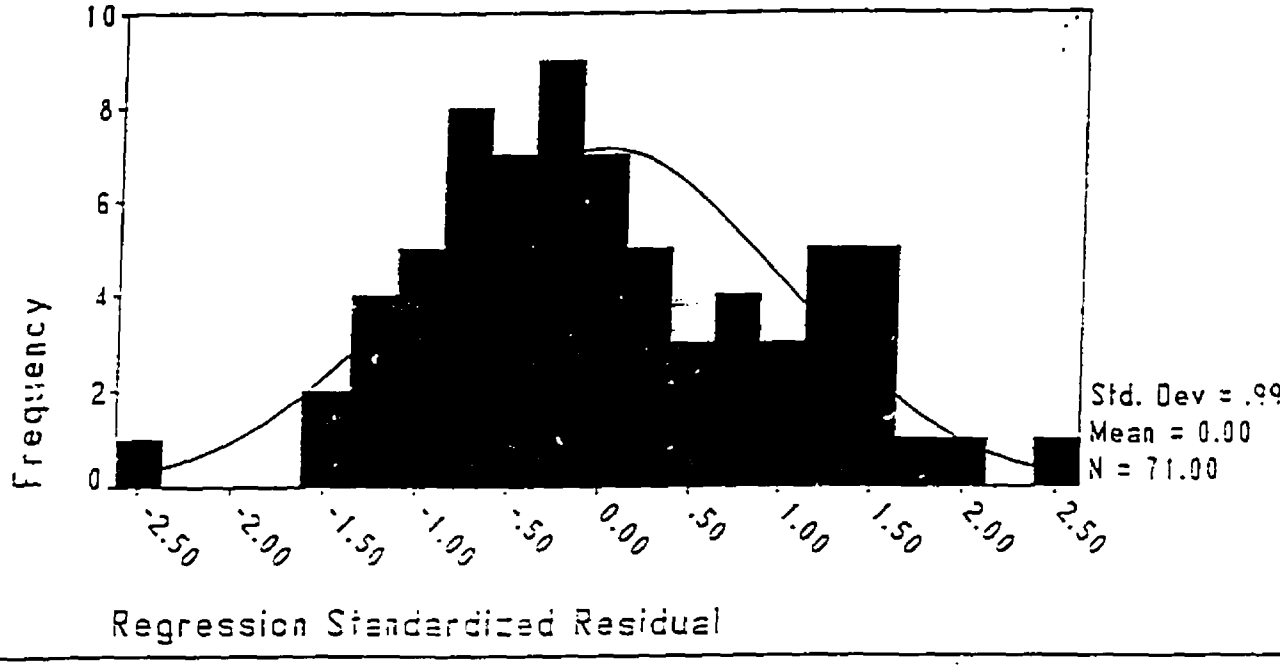
I.V. = Environmental responsiveness strategies



3.2.10. Histogram - U.S.

D.V. = Managerial perceptions of performance

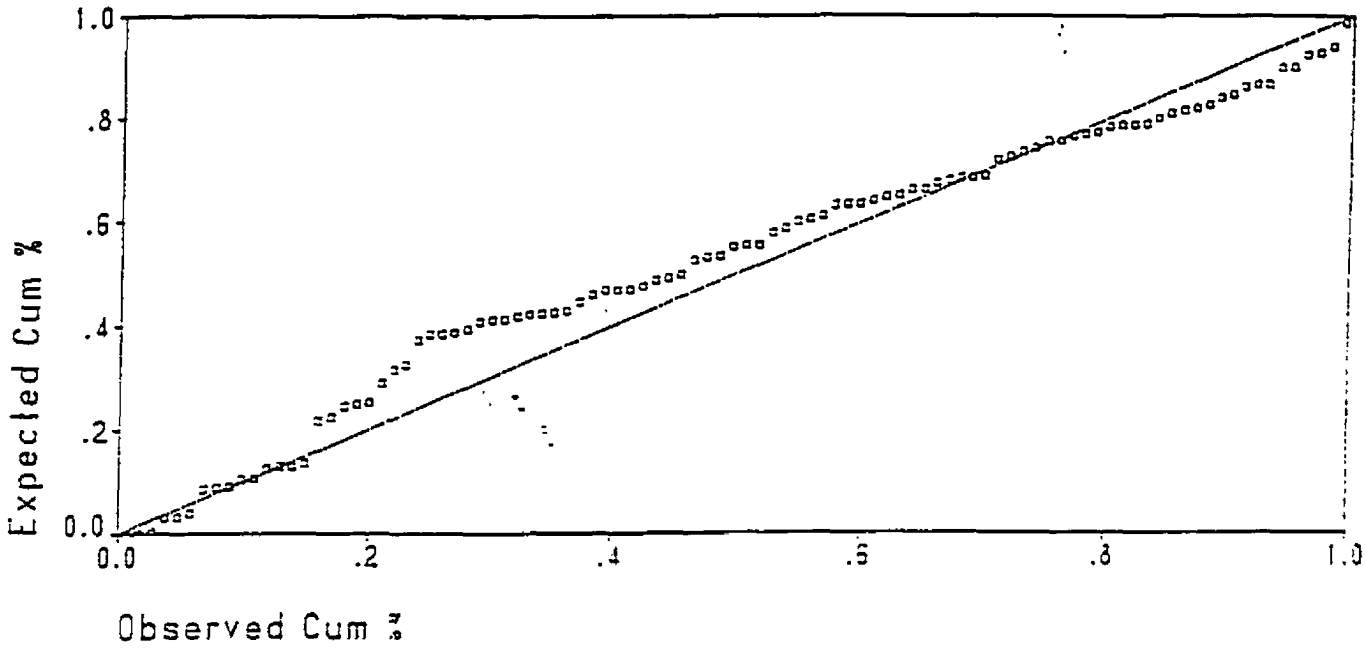
I.V. = Environmental responsiveness strategies



3.1.11. Normal Plot of Regression Stnd. Residual

Canada: D.V. = Return on assets(5 yrs avg.)

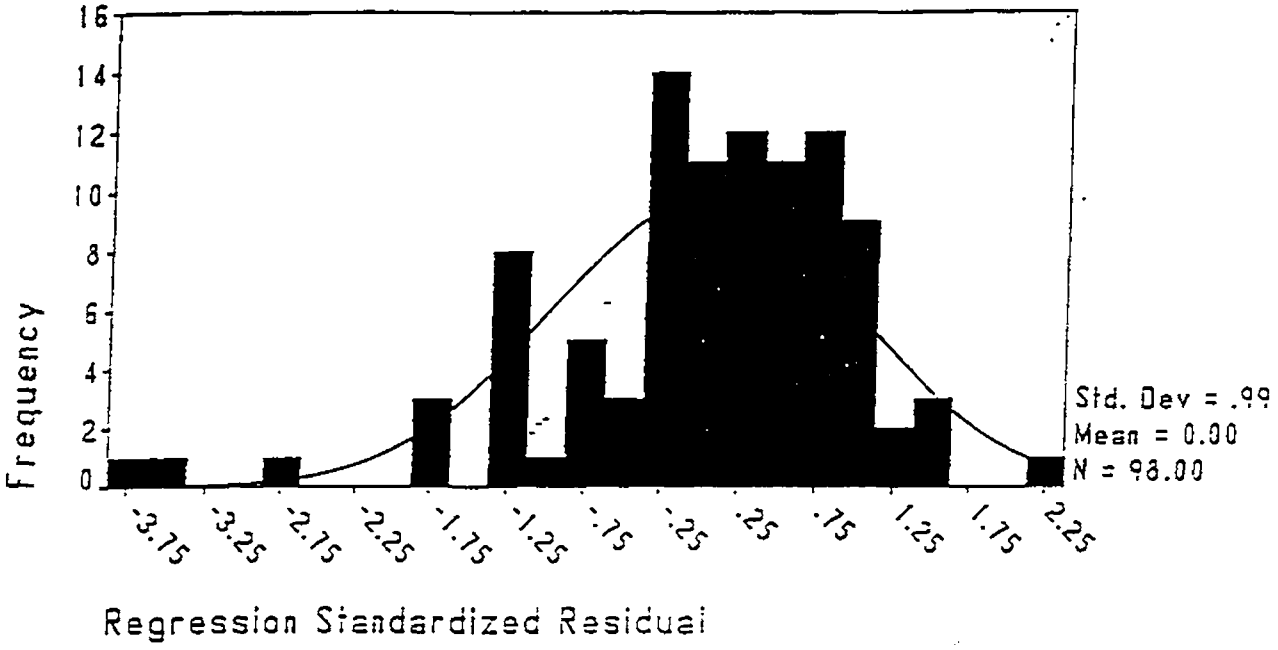
I.V. = Environmental responsiveness strategies



3.1.12. Histogram - Canada

Canada: D.V.= Return on assets (5 yrs. avg.)

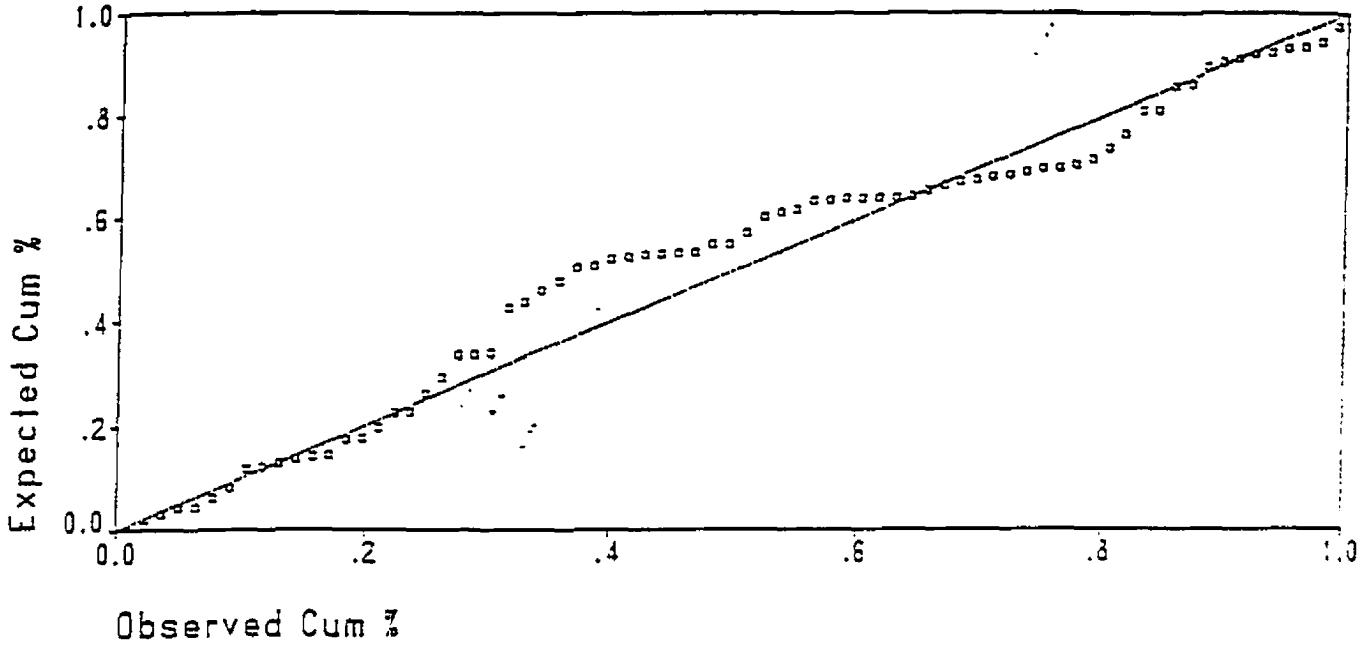
I.V. = Environmental responsiveness strategies



3.2.11. Normal Plot of Regression Stnd. Residual

U.S.: D.V. = Return on assets (3 yrs avg.)

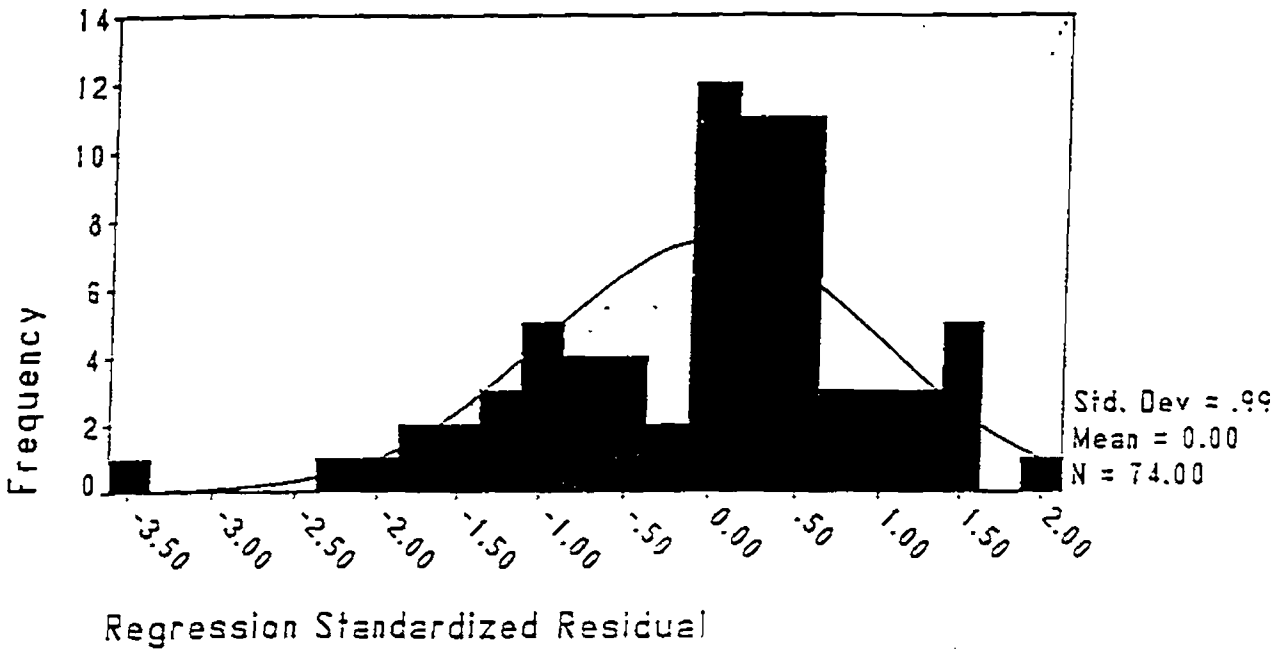
I.V. = Environmental responsiveness strategies



3.2.12. Histogram - U.S.

D.V. = Return on assets (3 yrs avg.)

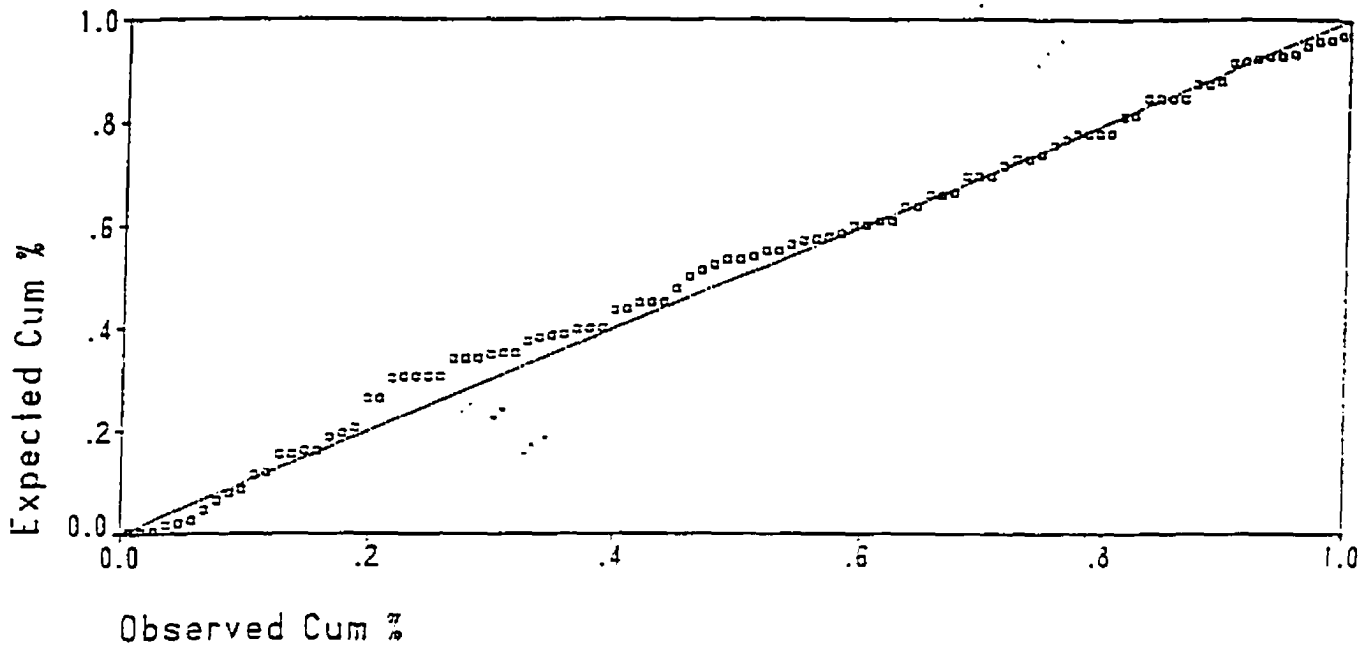
I.V. = Environmental responsiveness strategies



3.1.13. Normal Plot of Regression Stnd. Residual

Canada: D.V.= Importance of enval. stakeholders

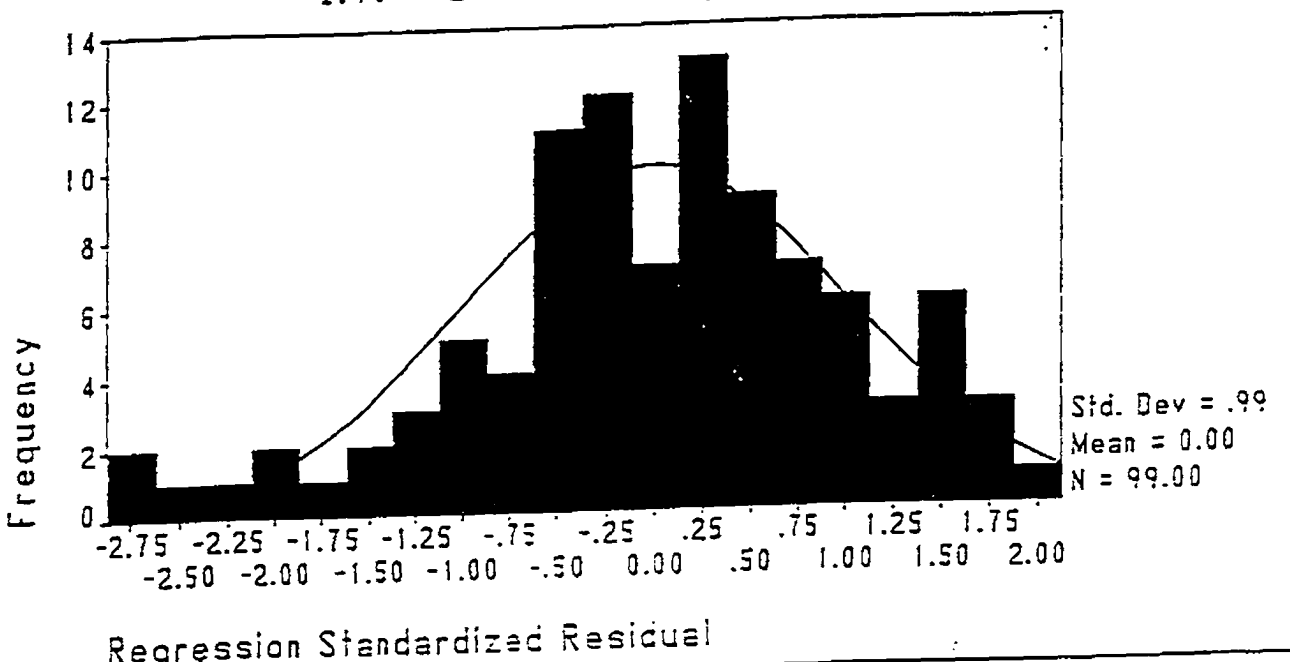
I.V. = Business exposure



3.1.14. Histogram - Canada

D.V. = Importance of enval. stakeholders

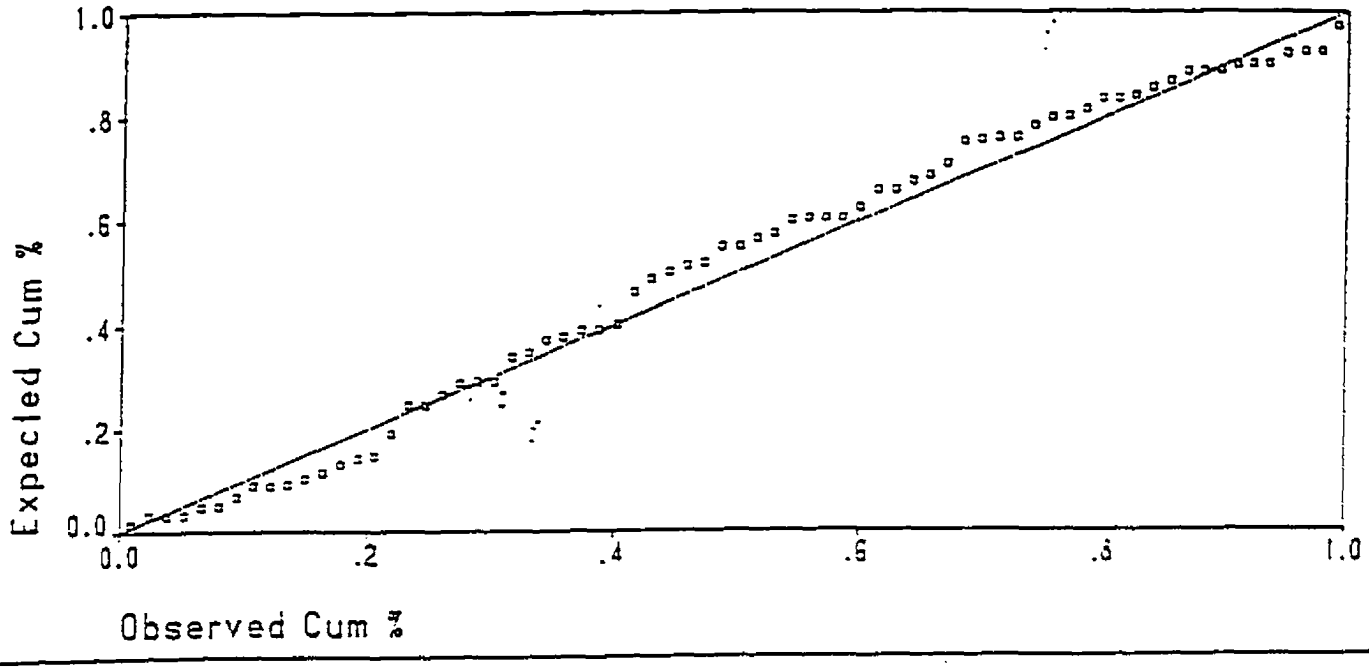
I.V. = Business exposure



3.2.13. Normal Plot of Regression Stnd. Residual

U.S. : D.V. = Importance of enval. stakeholders

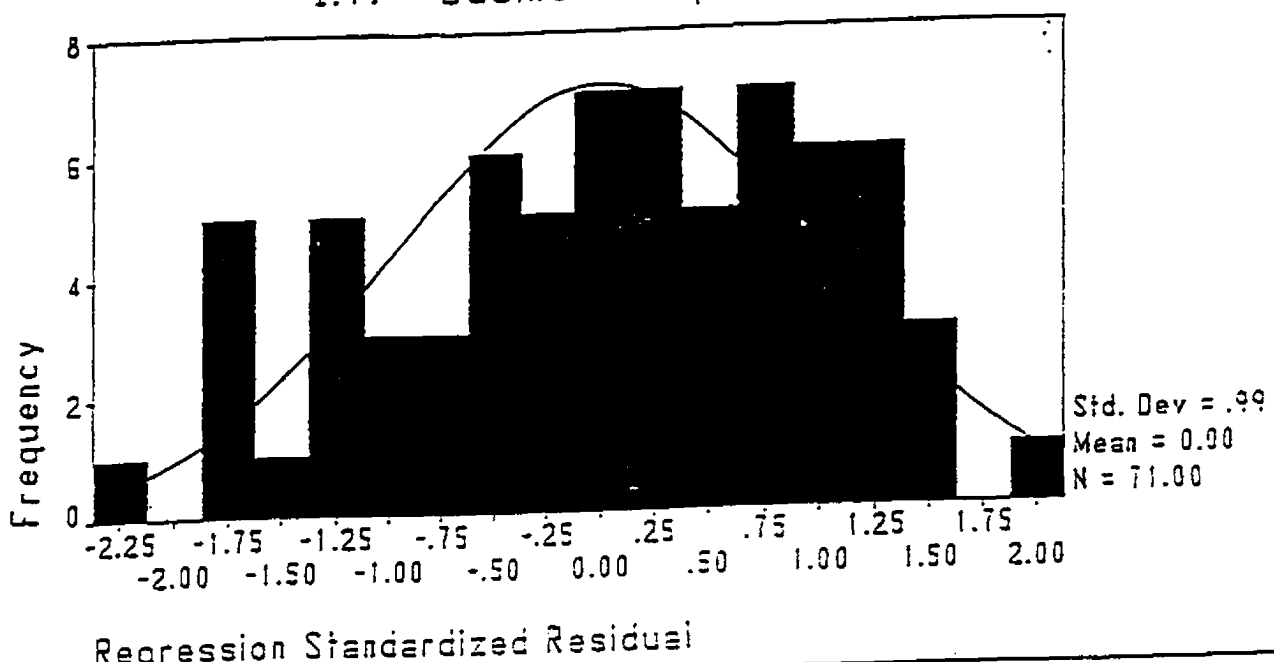
I.V. = Business exposure



3.2.14. Histogram - U.S.

D.V. = Importance of enval. stakeholders

I.V. = Business exposure



Appendix 4
Histograms with normal curve fitted of frequency distributions of variables

4.1.1. Canada: Environmental responsiveness strategies.

4.2.1. U.S.: Environmental responsiveness strategies.

4.1.2. Canada: Managerial threat interpretations of environmental issues.

4.2.2. U.S.: Managerial threat interpretations of environmental issues.

4.1.3. Canada: Competitive organizational benefits.

4.2.3. U.S.: Competitive organizational benefits.

4.1.4. Canada: Features of organizational capabilities.

4.2.4. U.S.: Features of organizational capabilities.

4.1.5. Canada: Managerial perceptions of firm performance.

4.2.5. U.S.: Managerial perceptions of firm performance.

4.1.6. Canada: Return on assets.

4.2.6. U.S.: Return on assets.

4.1.7. Canada: Importance of environmental stakeholders.

4.2.7. U.S.: Importance of environmental stakeholders.

4.1.8. Canada: Managerial perceptions of institutional identity.

4.2.8. U.S.: Managerial perceptions of institutional identity.

4.1.9. Canada: Organizational environmental philosophy.

4.2.9. U.S.: Organizational environmental philosophy.

4.1.10. Canada: Influence of line managers in environmental decisions.

4.2.10. U.S.: Influence of line managers in environmental decisions.

4.1.11. Canada: Co-operation between line and staff managers on business/natural environment interface.

4.2.11. U.S.: Co-operation between line and staff managers on business/natural environment interface.

4.1.12. Canada: Integration devices.

4.2.12. U.S.: Integration devices.

4.1.13. Canada: Managerial discretion.

4.1.13. U.S.: Managerial discretion.

4.1.14. Canada: Employee performance evaluation systems.

4.2.14. U.S.: Employee performance evaluation systems.

4.1.15. Canada: Timing of response in issue lifecycle.

4.2.15. U.S.: Timing of response in issue lifecycle.

4.1.16. Canada: Stakeholder relationship strategies.

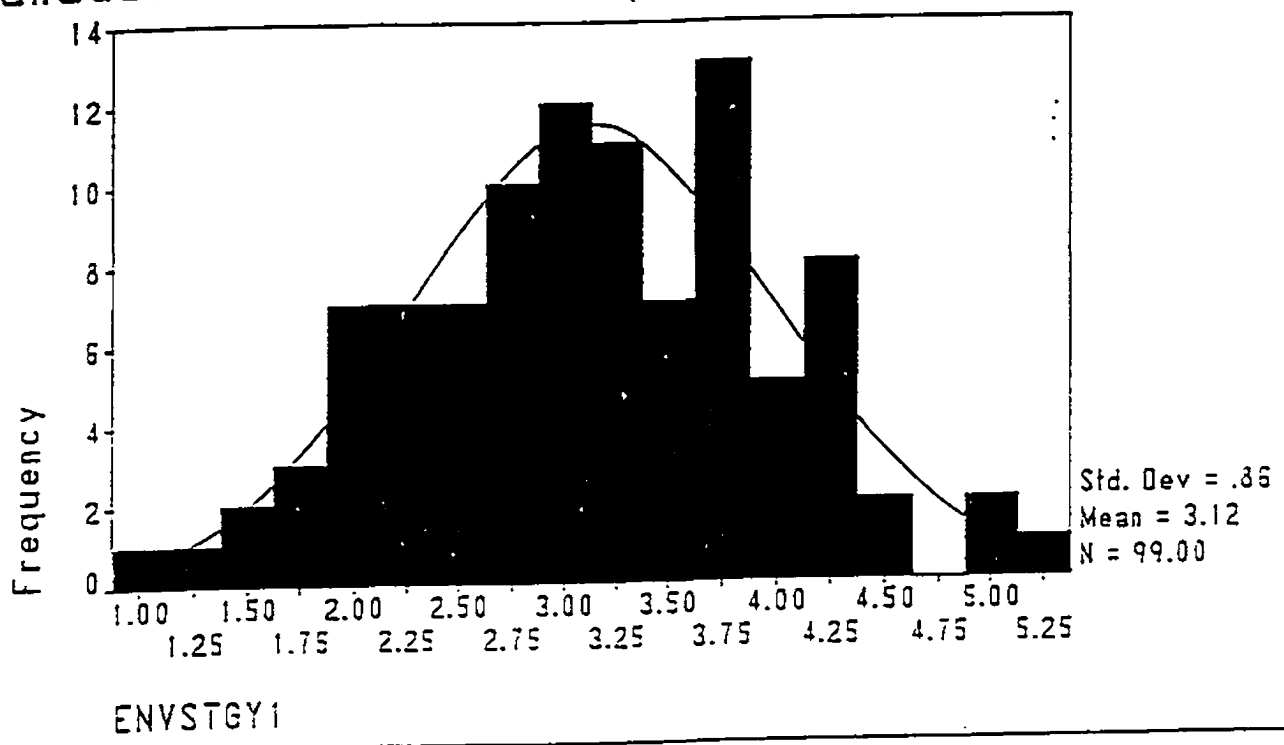
4.2.16. U.S.: Stakeholder relationship strategies.

4.1.17. Canada: Company size.

4.2.17. U.S.: Company size.

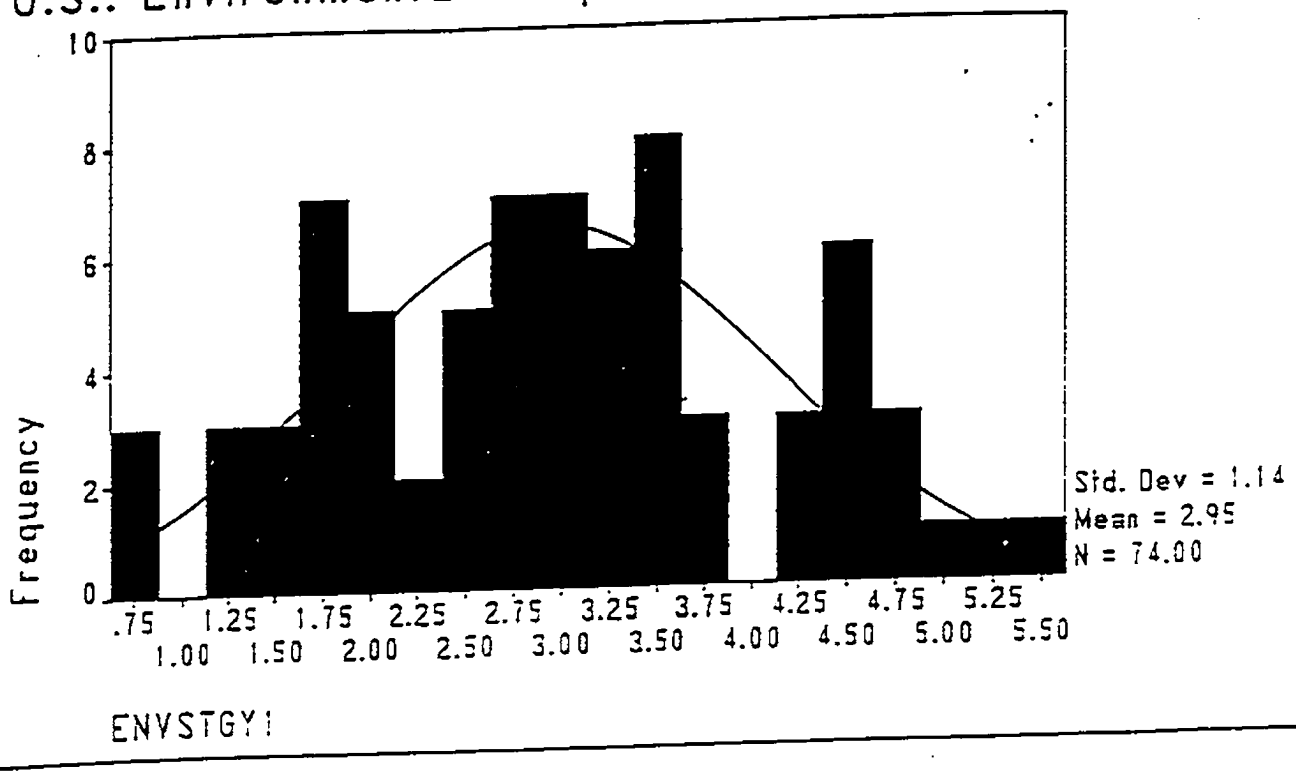
4.1.1. Histogram

Canada: Environmental Responsiveness Strategies



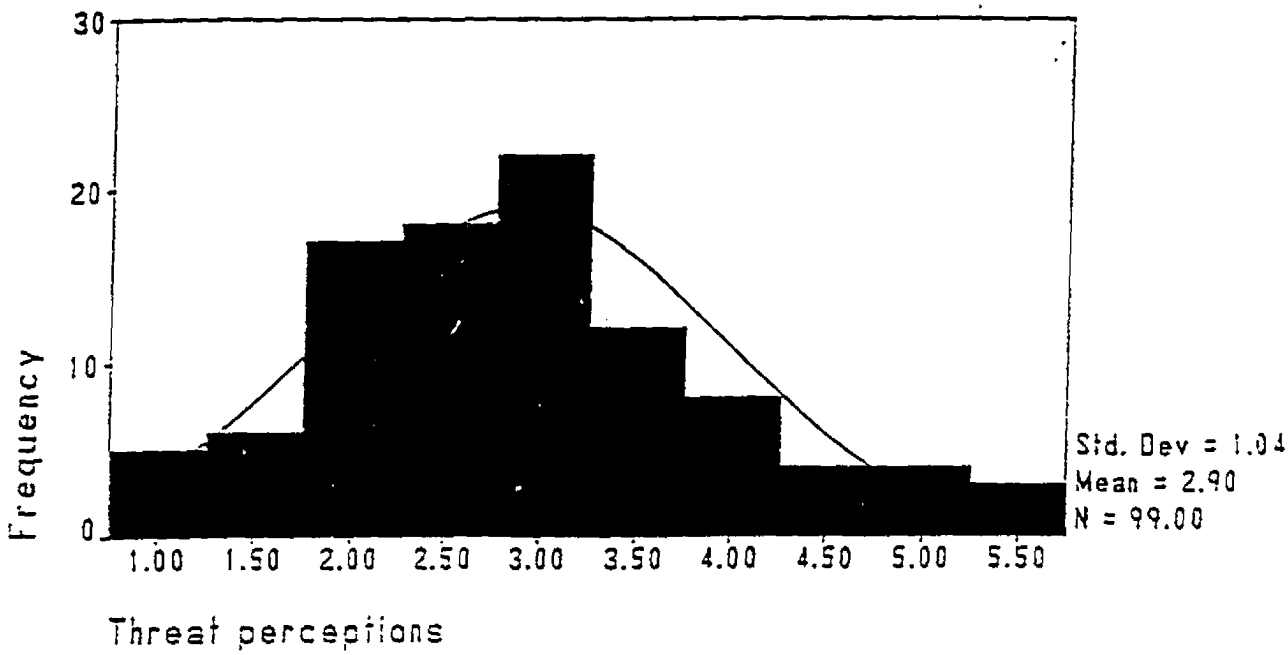
4.2.1. Histogram

U.S.: Environmental responsiveness strategies

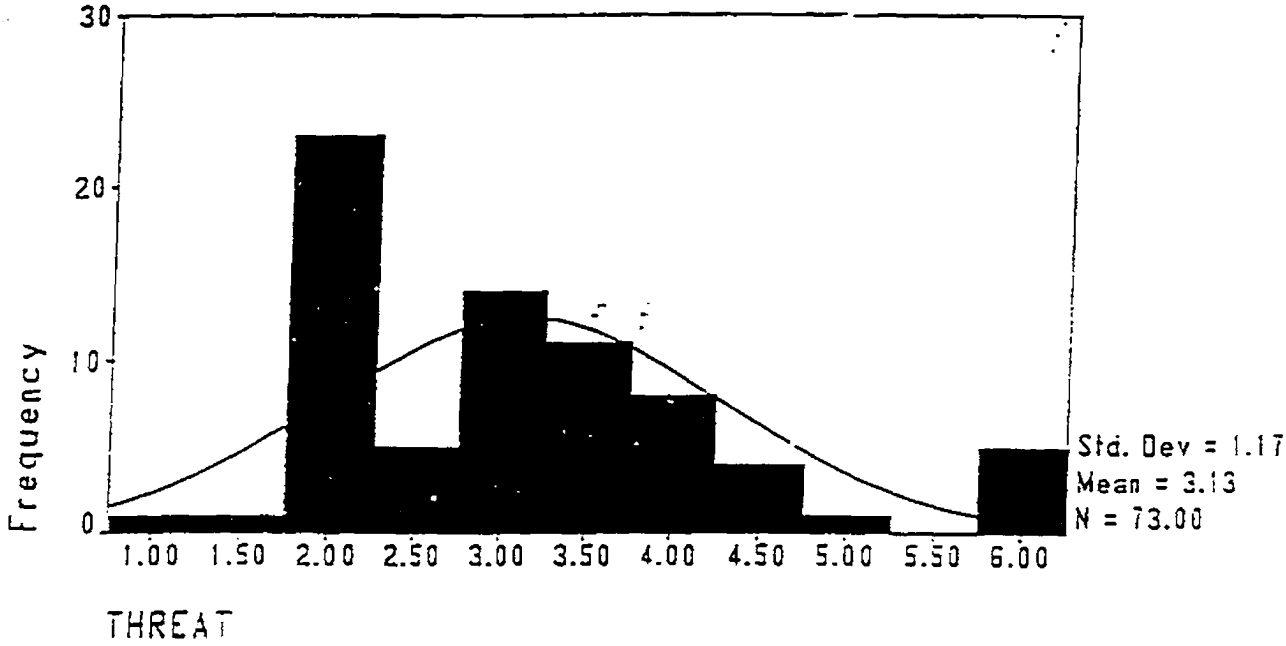


4.1.2. Histogram

Canada: Managerial interpretations of environmental issues



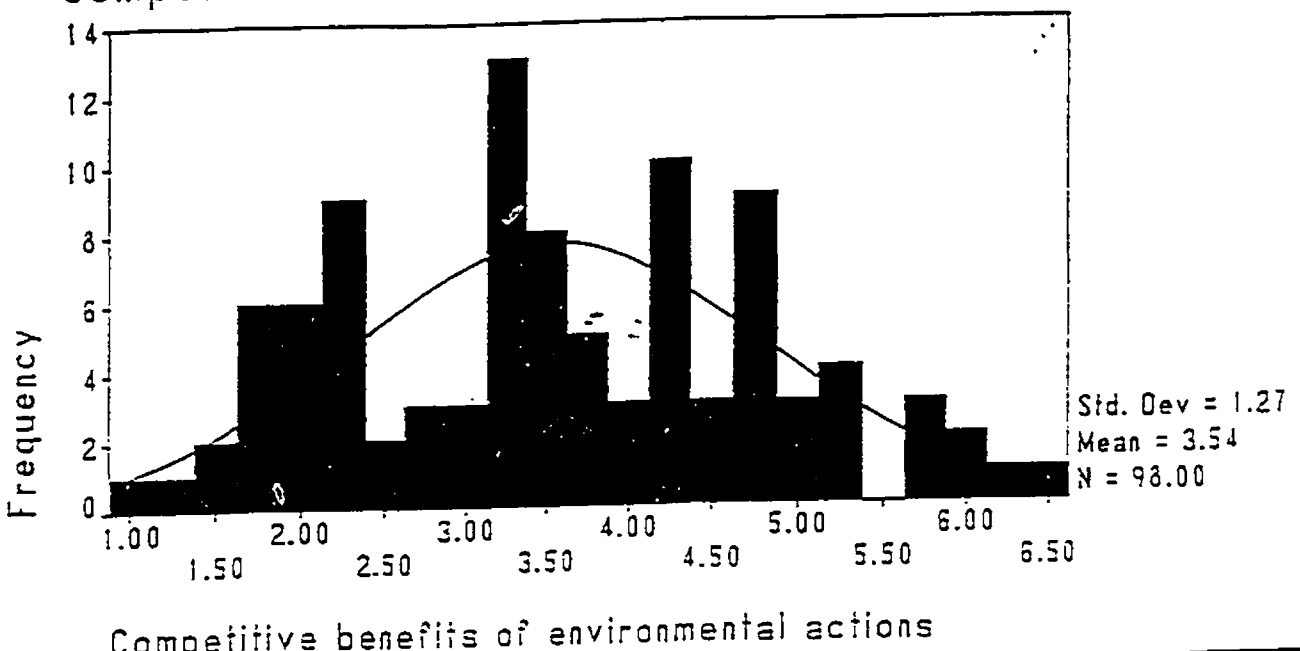
4.2.2. Histogram - U.S. Managerial interpretations of environmental issues



4.1.3. Histogram

Canada: Organizational benefits

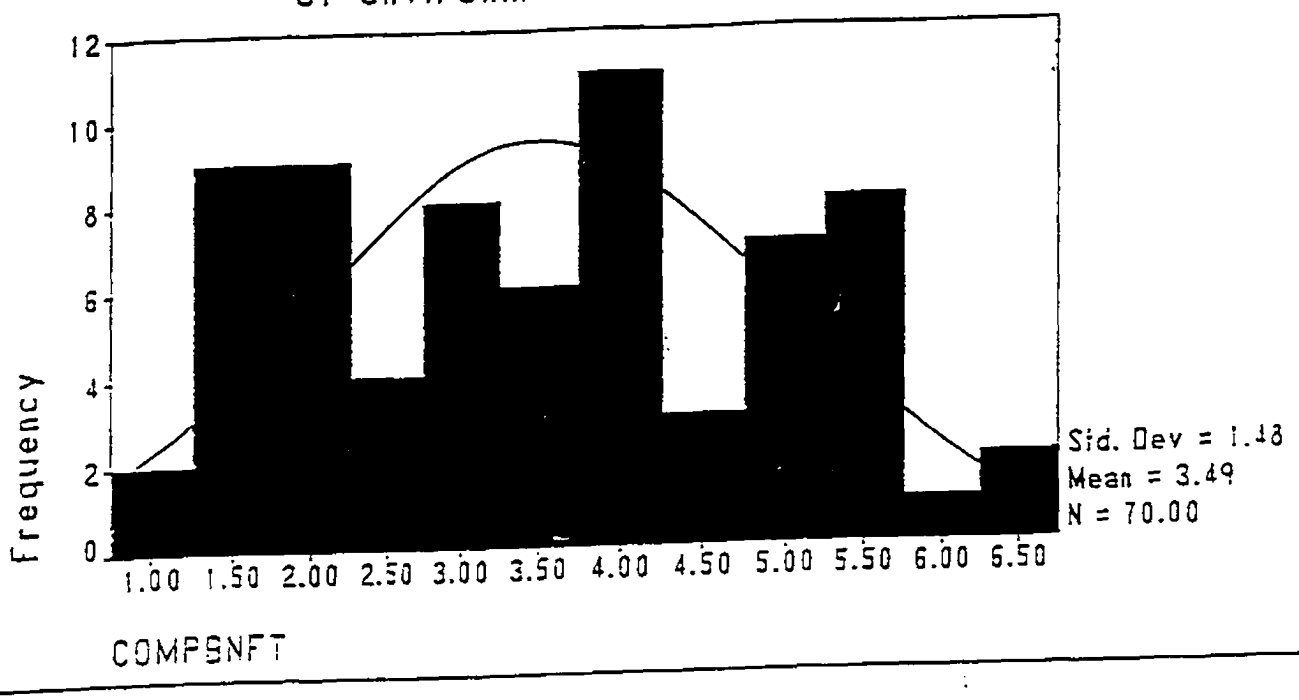
Competitive benefits of environmental strategies



Competitive benefits of environmental actions

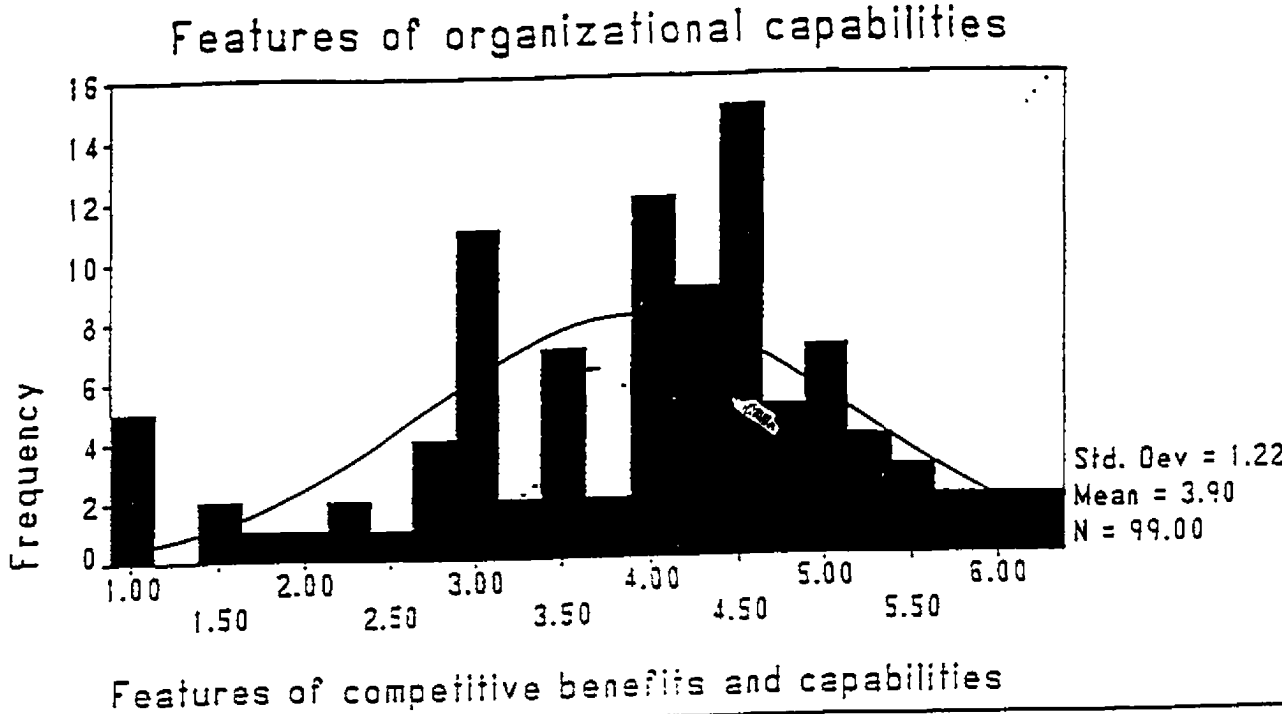
4.2.3. Histogram

U.S.: Competitive benefits of environmental strategies



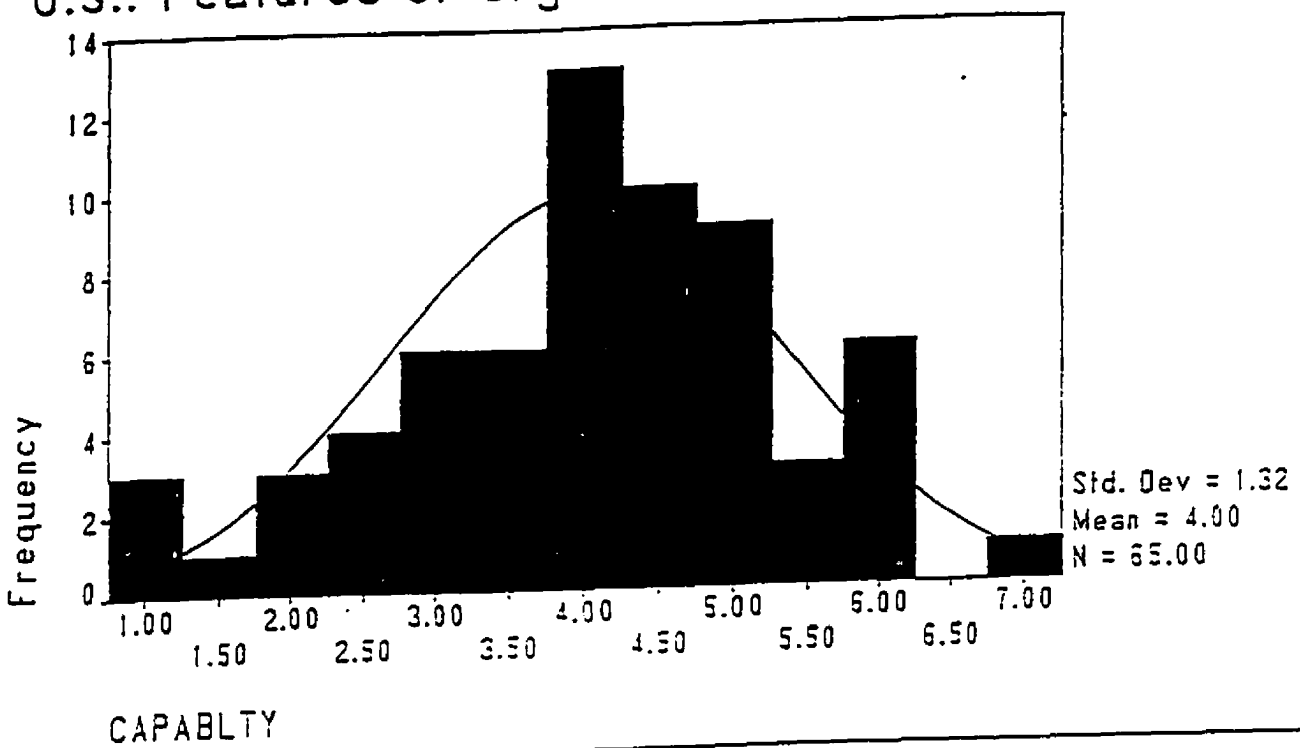
4.1.4. Histogram

Canada: Capabilities



4.2.4. Histogram

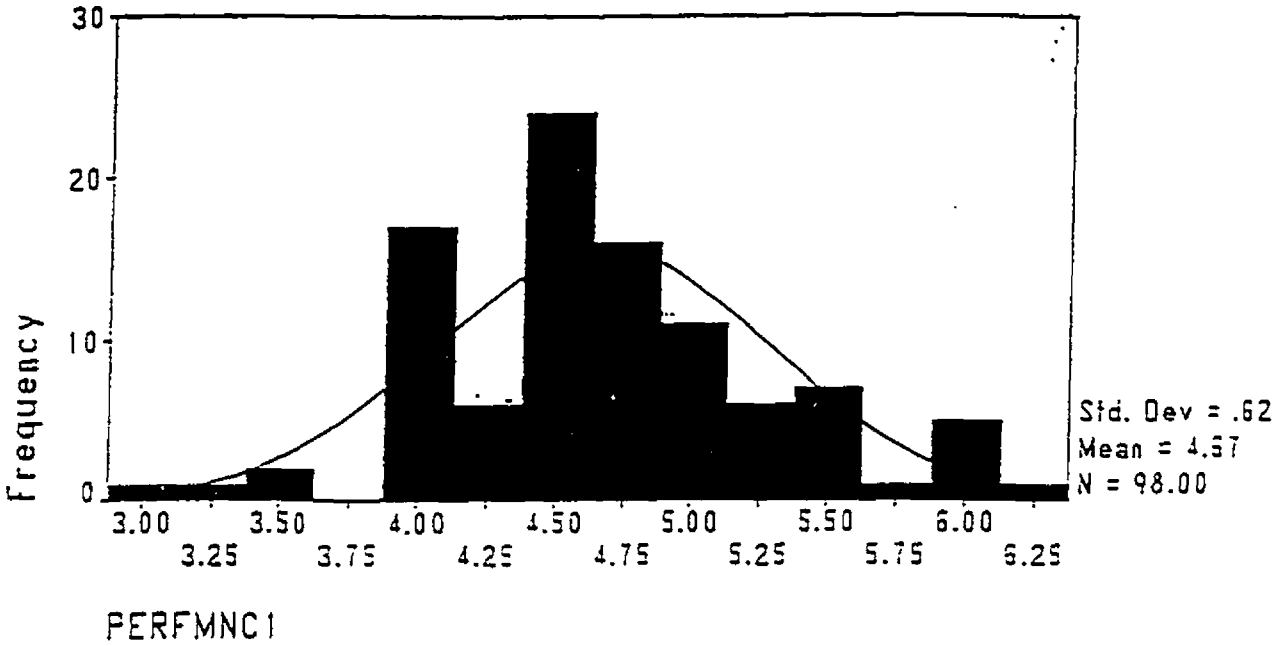
U.S.: Features of organizational capabilities



4.1.5. Histogram

Canada: Firm performance

rmanagerial perceptions relative to industry average



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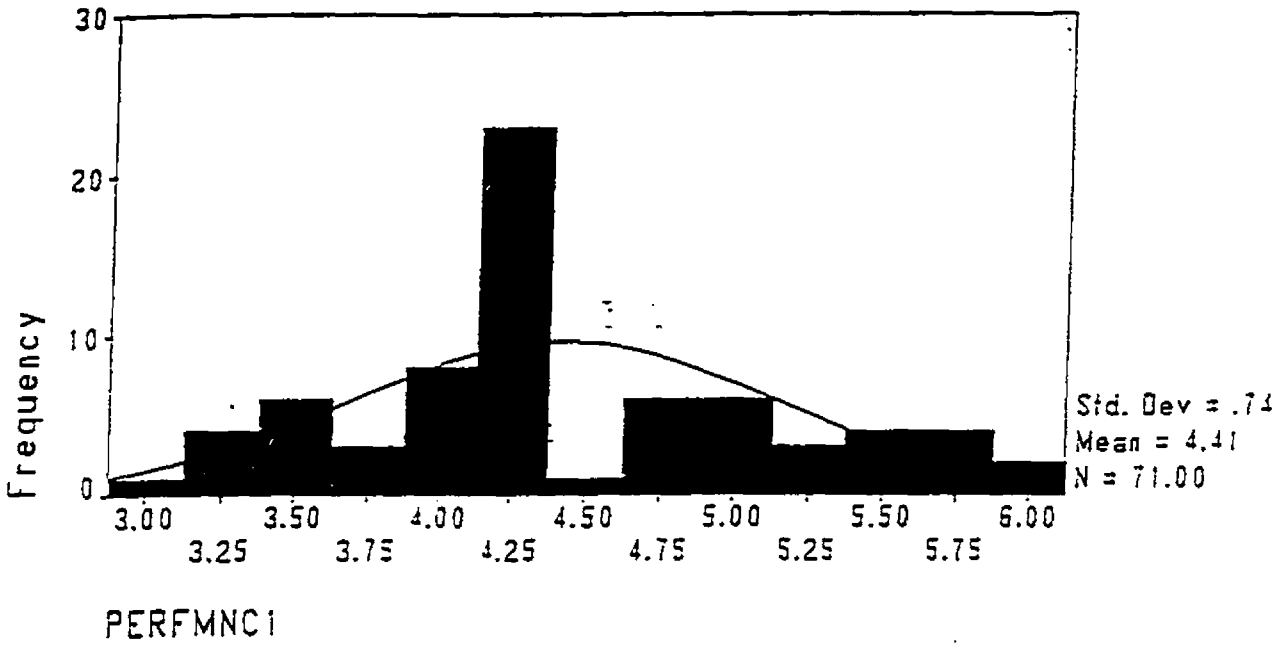
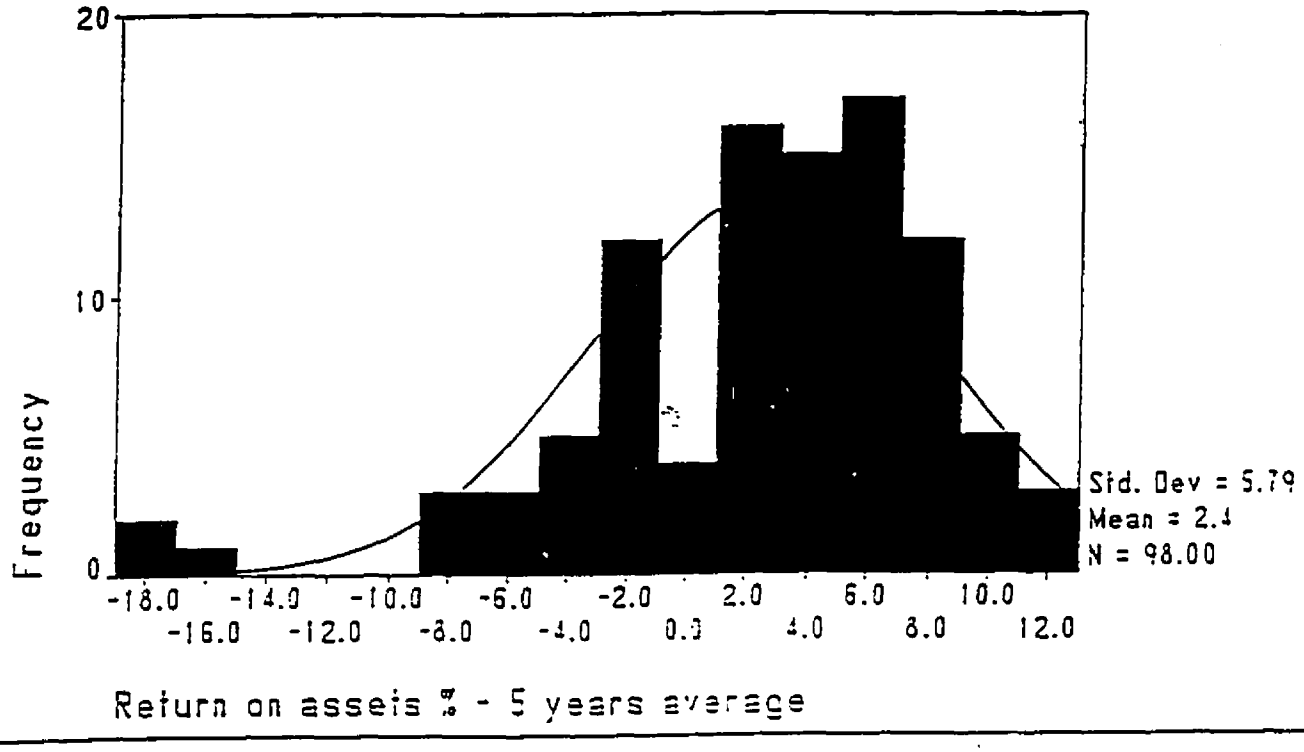
4.2.5. Histogram - U.S.

Managerial perceptions of firm performance relative to industry average



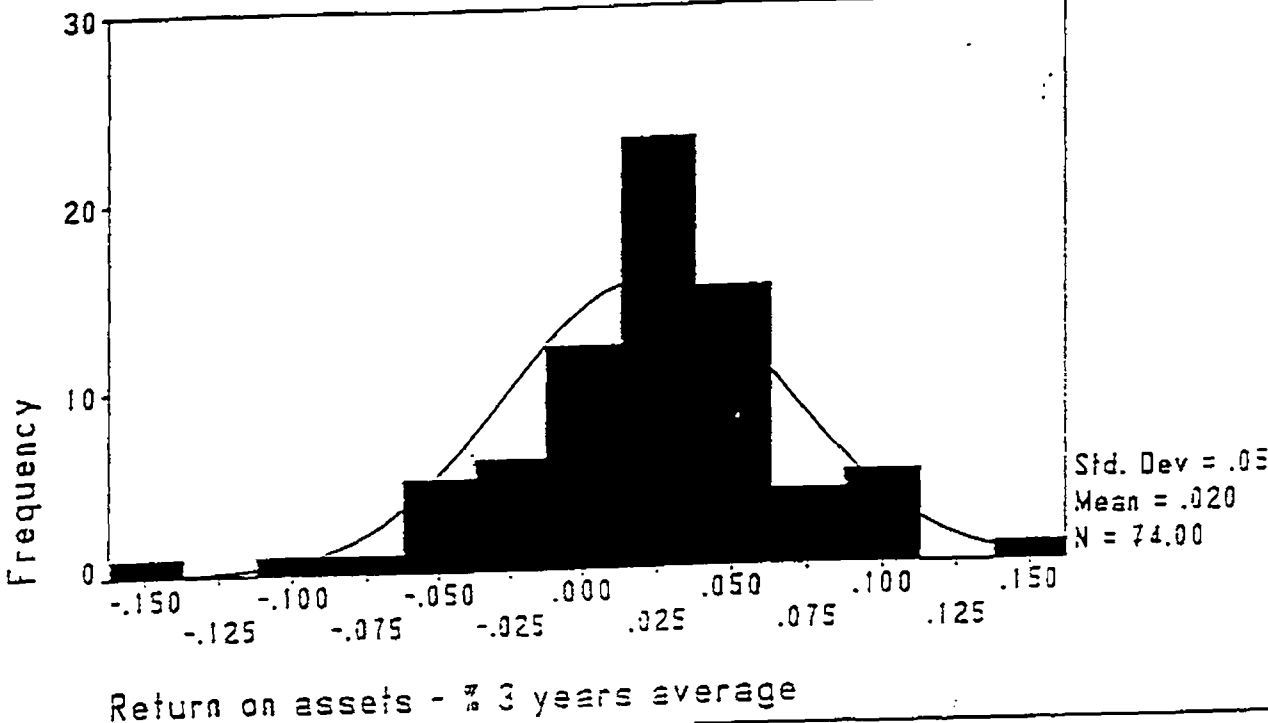
4.1.6. Histogram

Canada: return on assets ratio (5 yrs avg.)



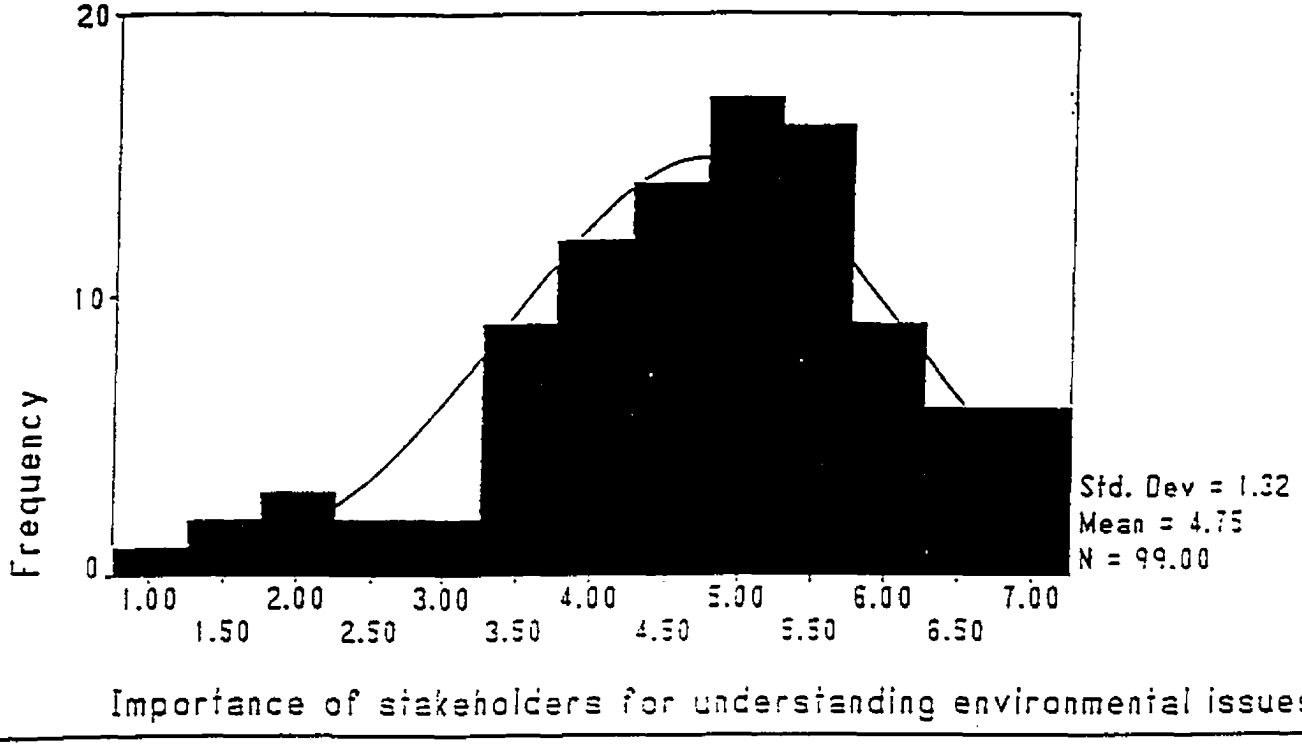
4.2.6. Histogram

U.S.: Return on assets ratio (3 yrs avg.)



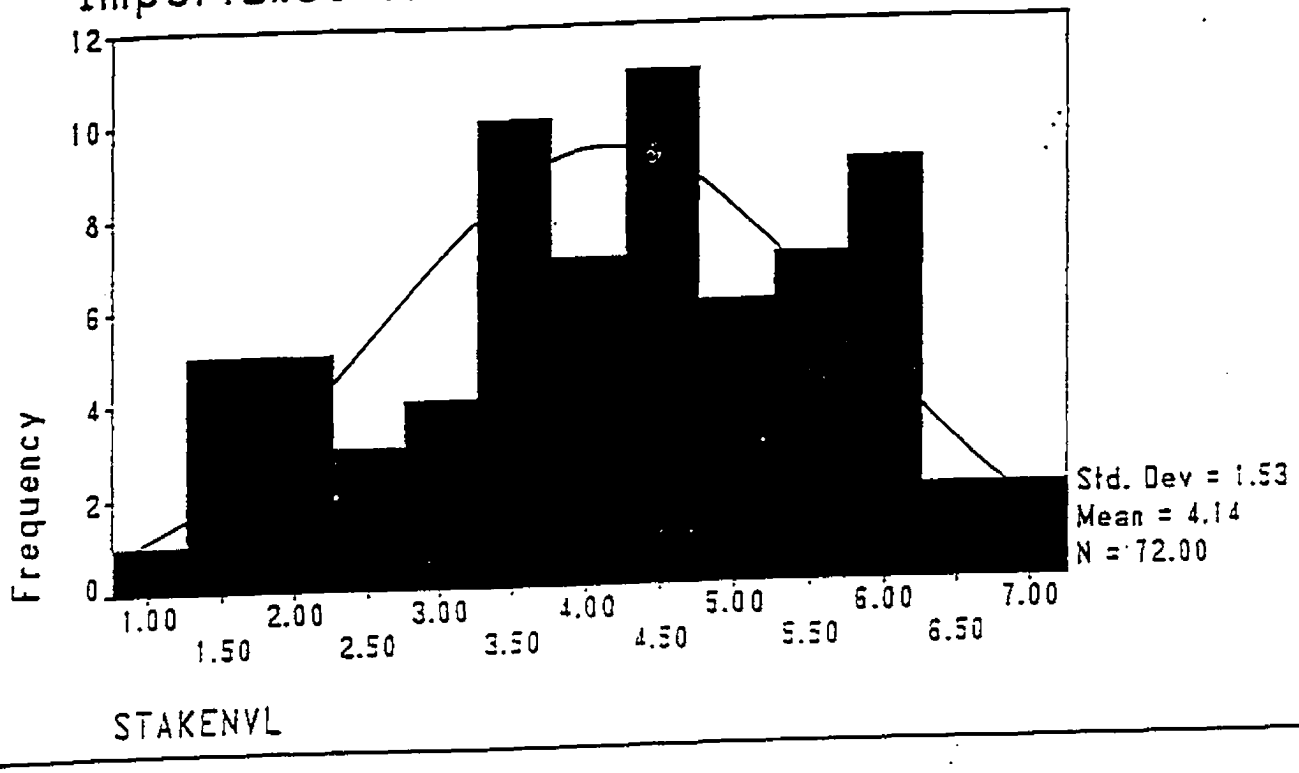
4.1.7. Histogram

Canada: Importance of enval. stakeholders



4.2.7. Histogram - U.S.

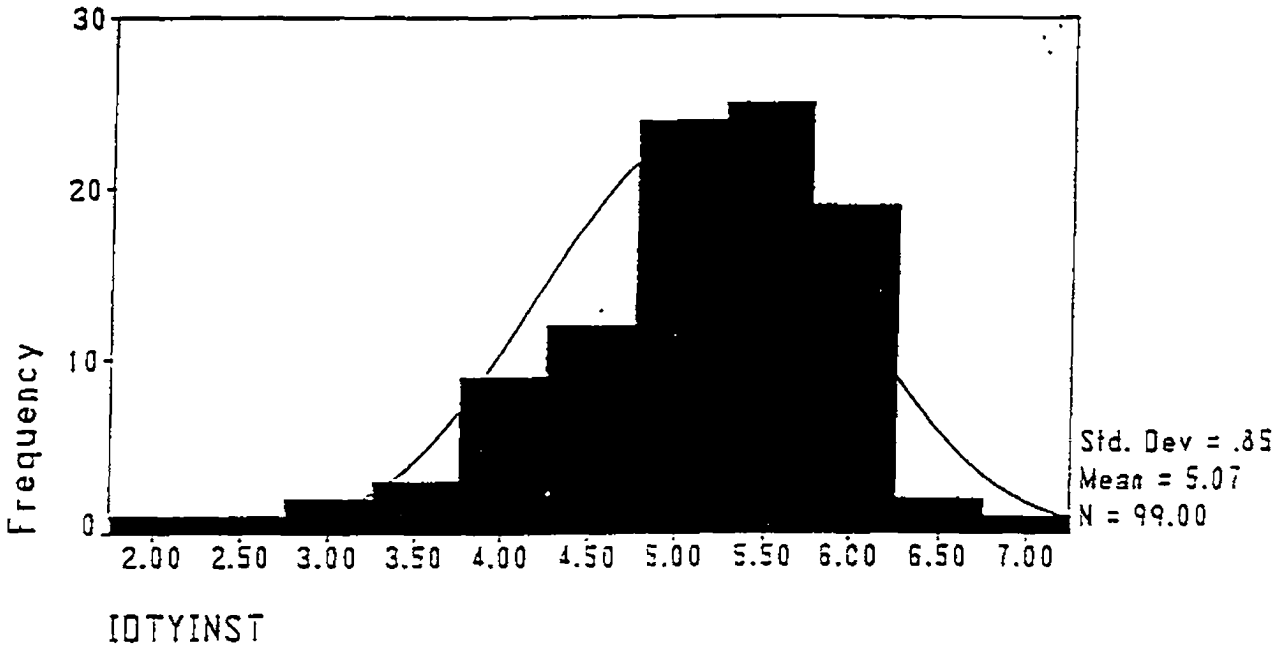
Importance of environmental stakeholders



4.1.8. Histogram

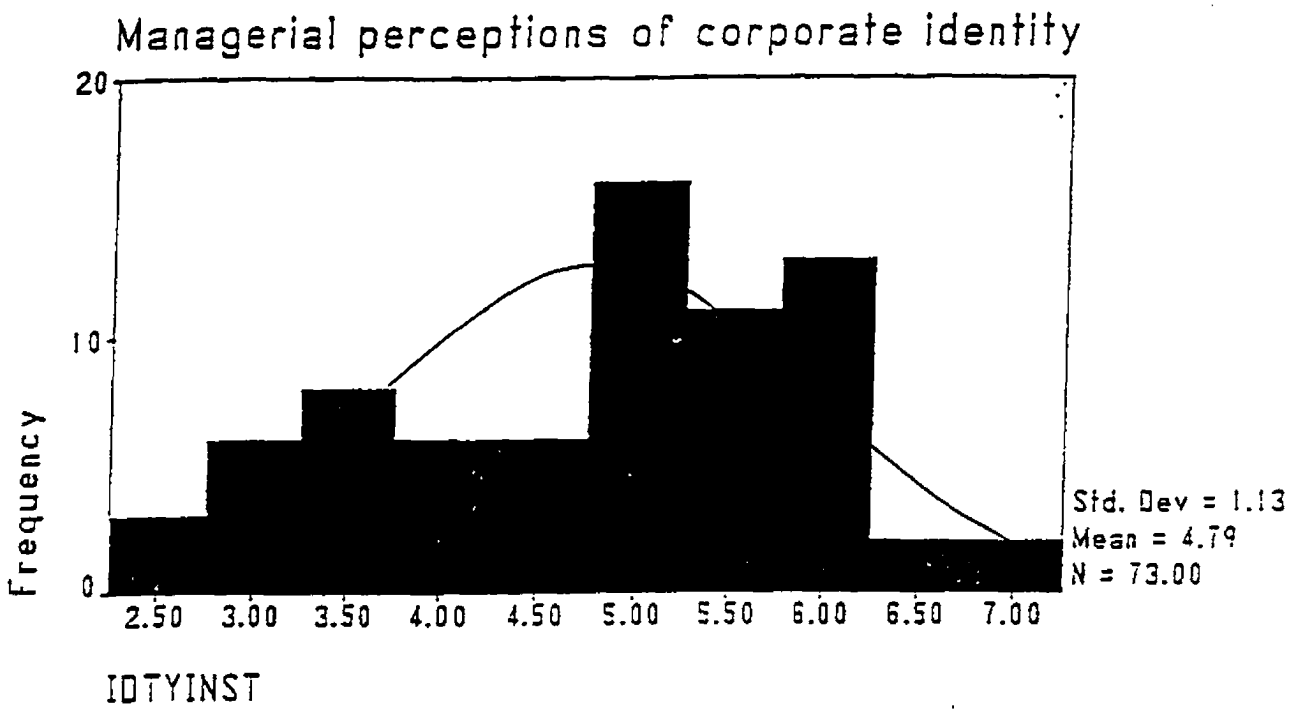
Canada: Institutional Identity

Managerial perceptions of corporate identity



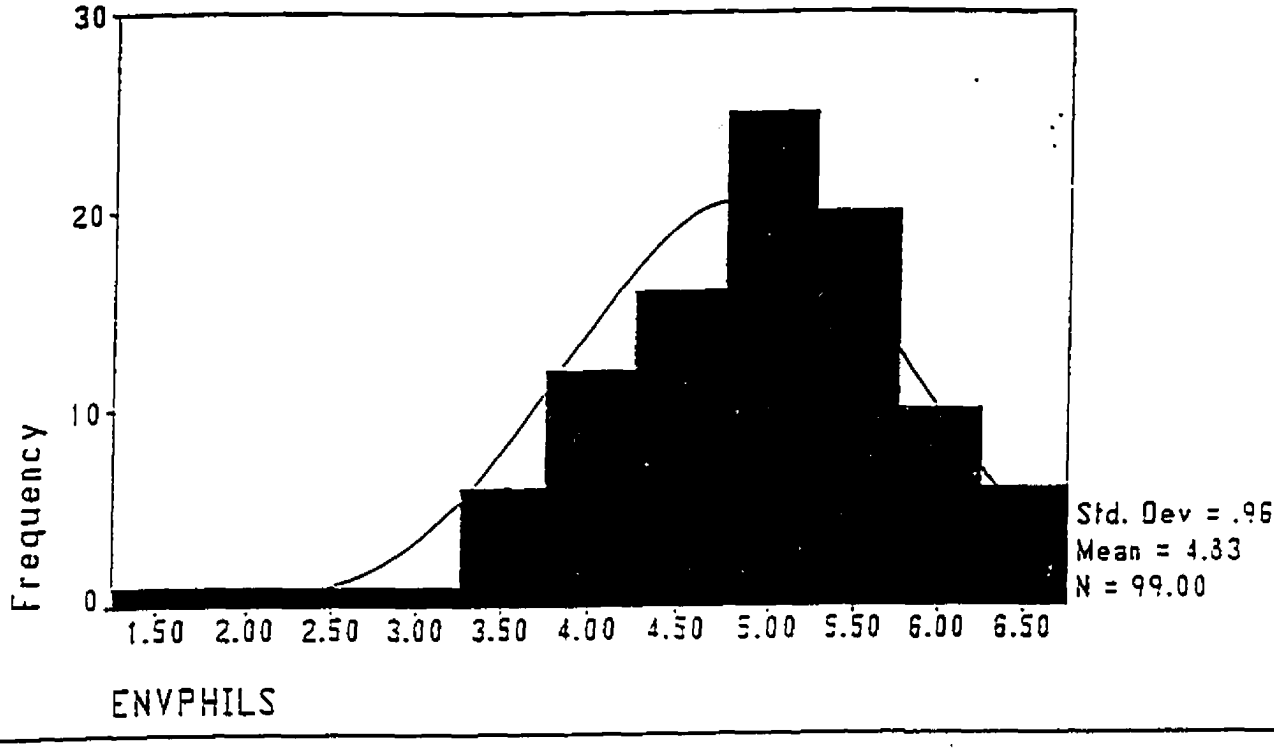
4.2.8. Histogram

U.S.: Institutional identity



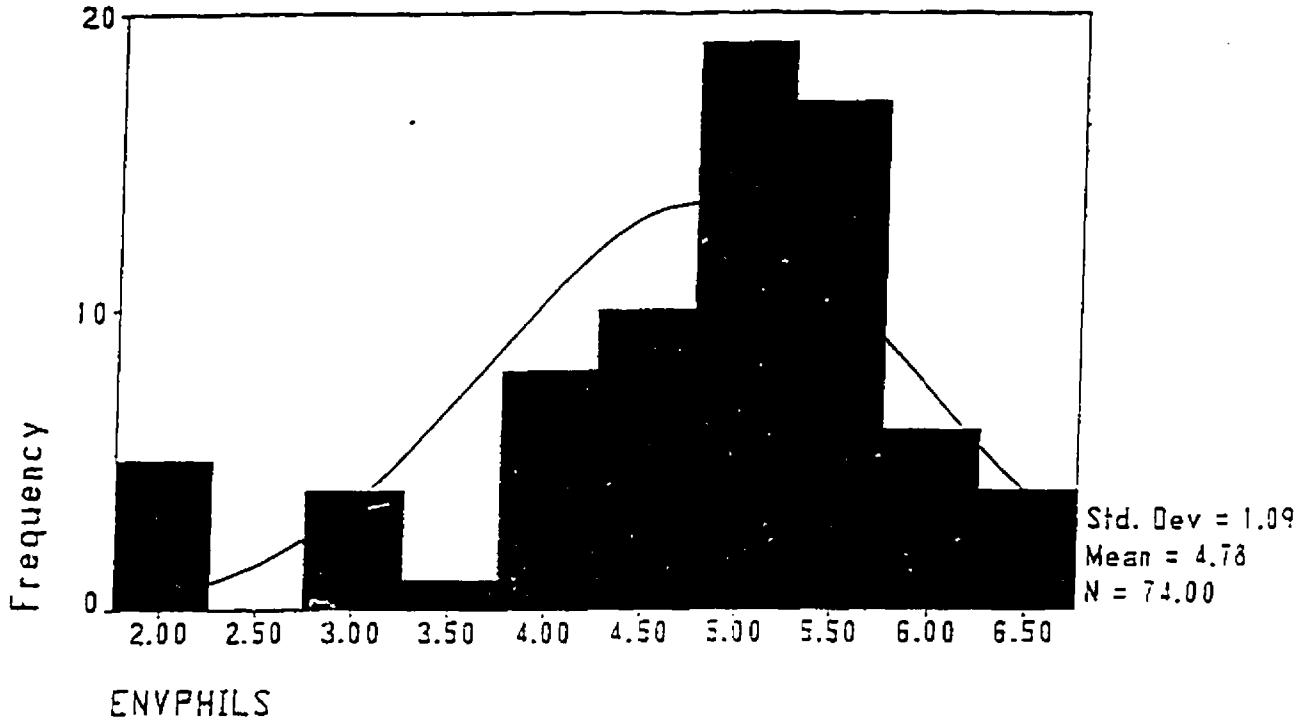
4.1.9. Histogram

Canada: Org. environmental philosophy



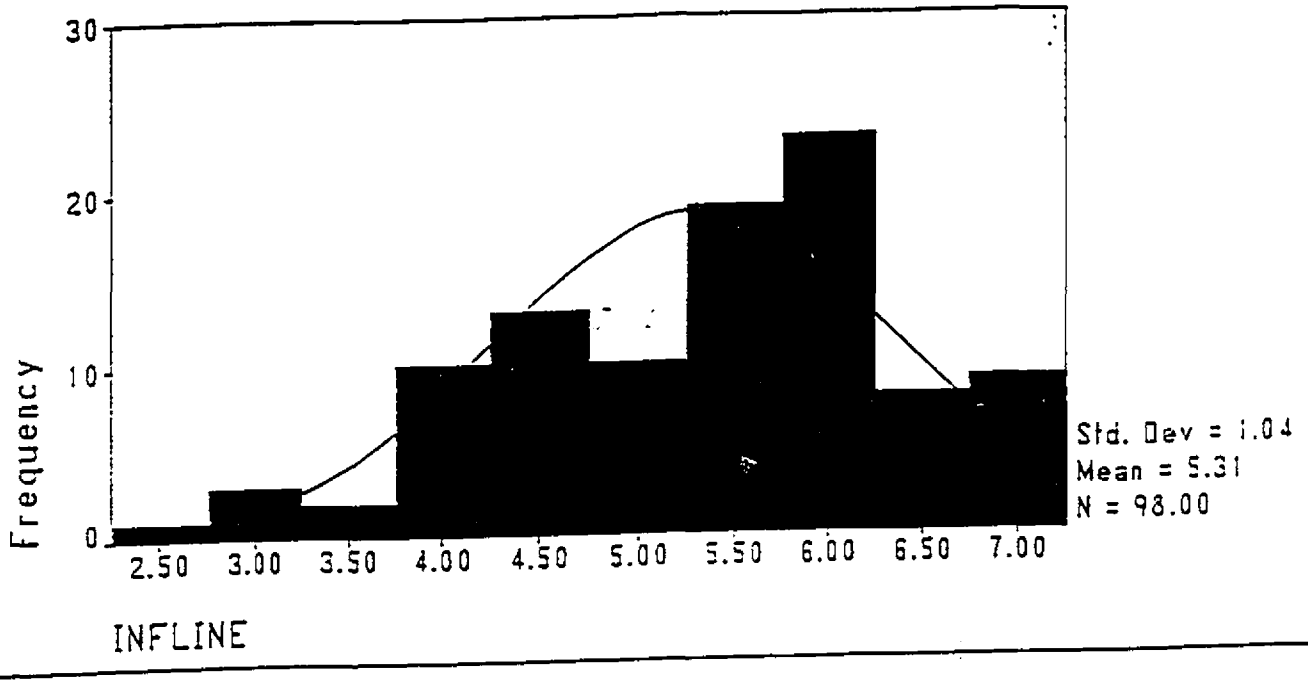
4.2.9. Histogram - U.S.

Organizational environmental philosophy



4.1.10. Histogram

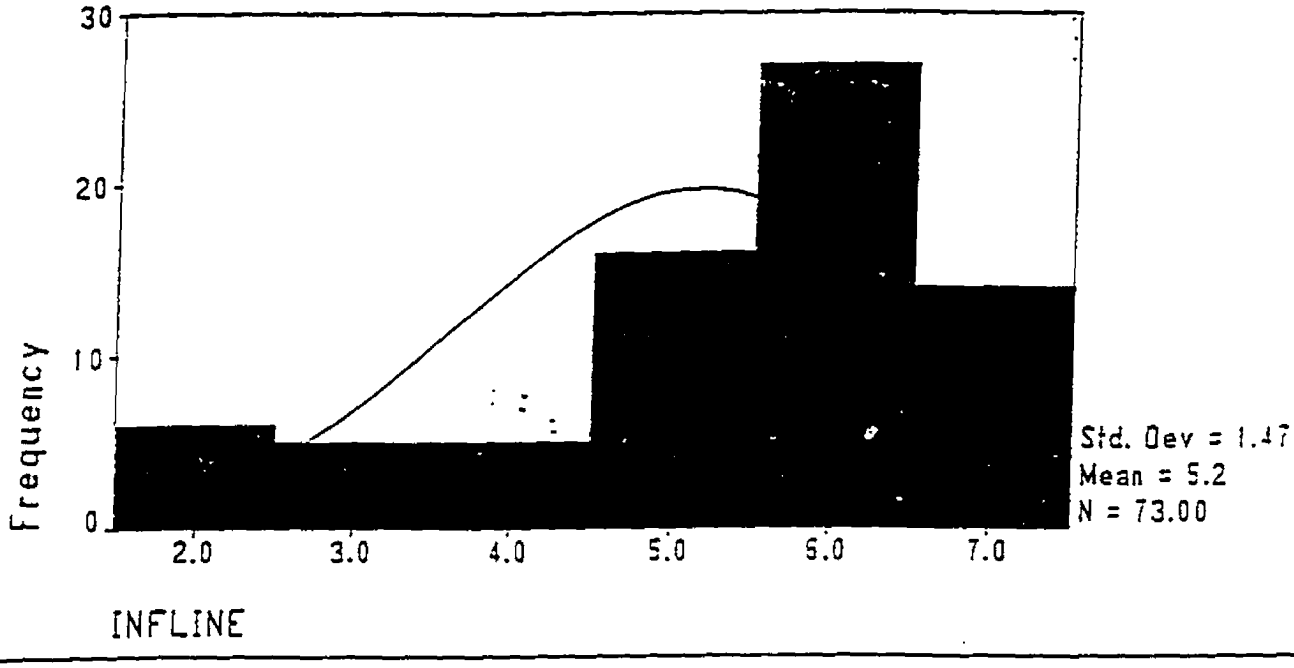
Canada: Influence of line managers in environmental decisions



4.2.10. Histogram - U.S.

Line manager influence

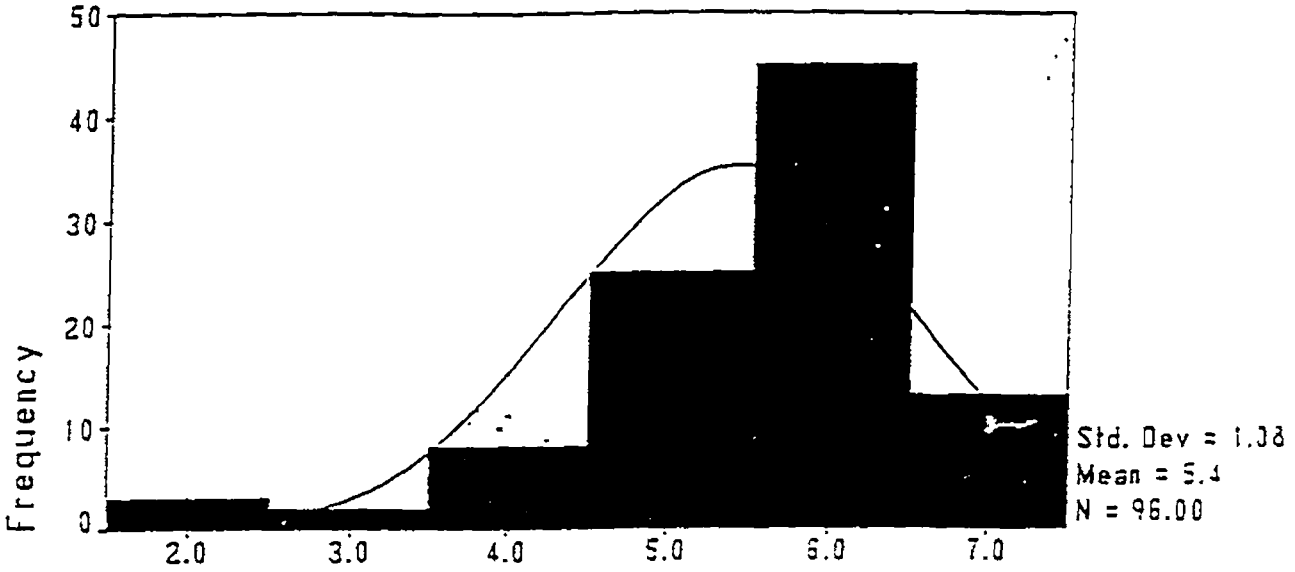
in environmental decisions



4.1.11. Histogram

Canada: Co-operation between line and staff mgrs.

in knowledge creation on natural environment

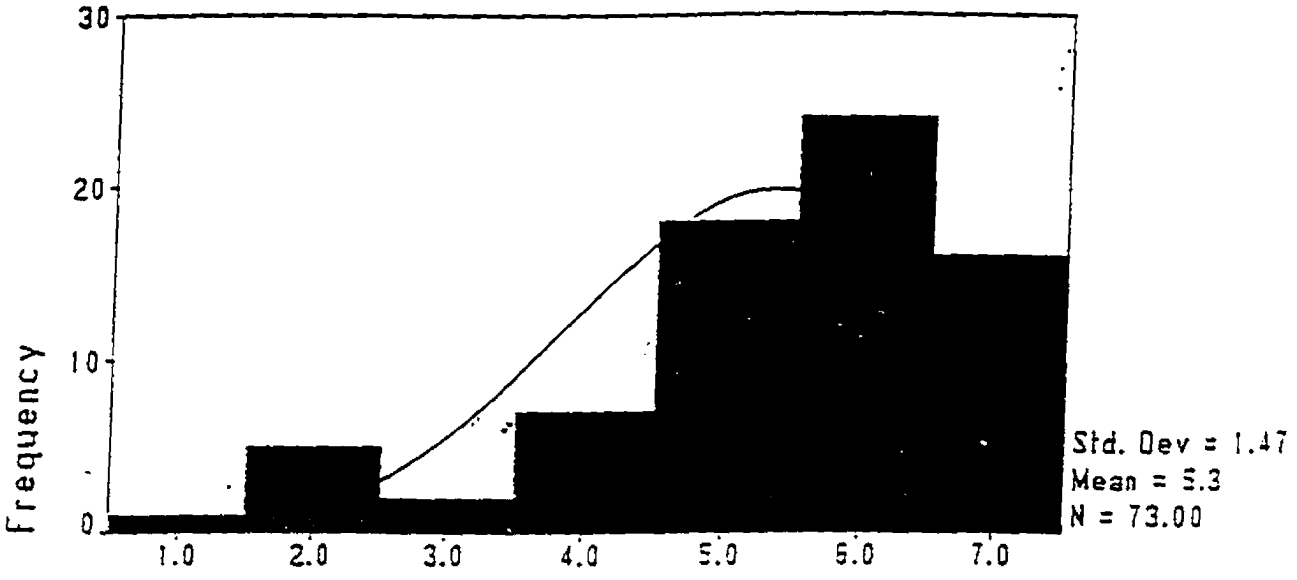


22(e). Influence - cooperation between line and staff managers on env.

4.2.11. Histogram - U.S.

Co-operation between line/staff managers

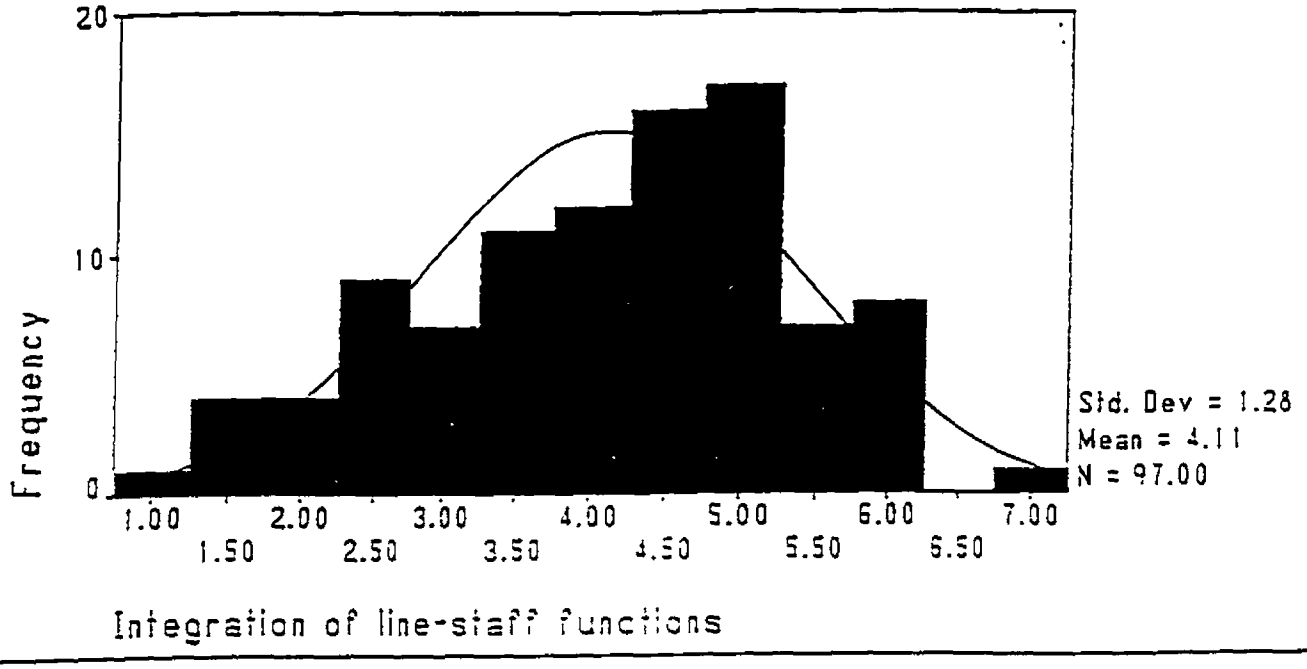
knowledge creation on business/natural environment



22(e). Influence - cooperation between line and staff managers on env.

4.1.12. Histogram

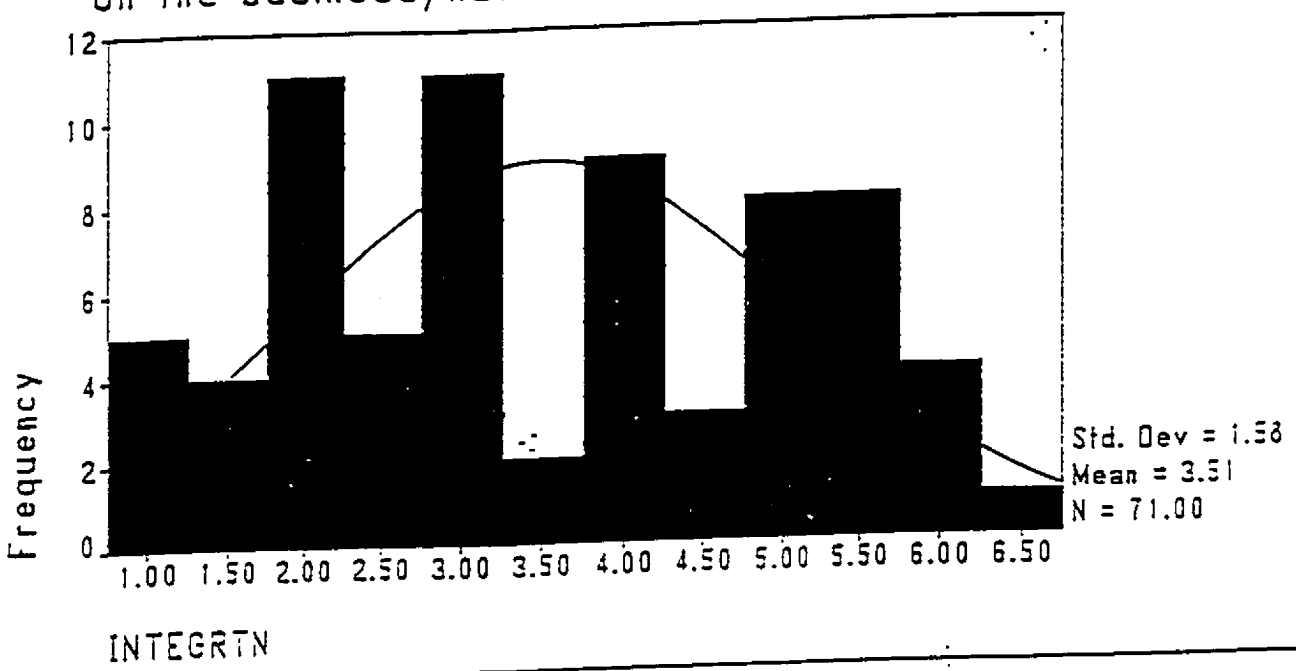
Canada: Integration devices between line and staff managers



4.2.12. Histogram - U.S.

Integration devices - line/staff managers

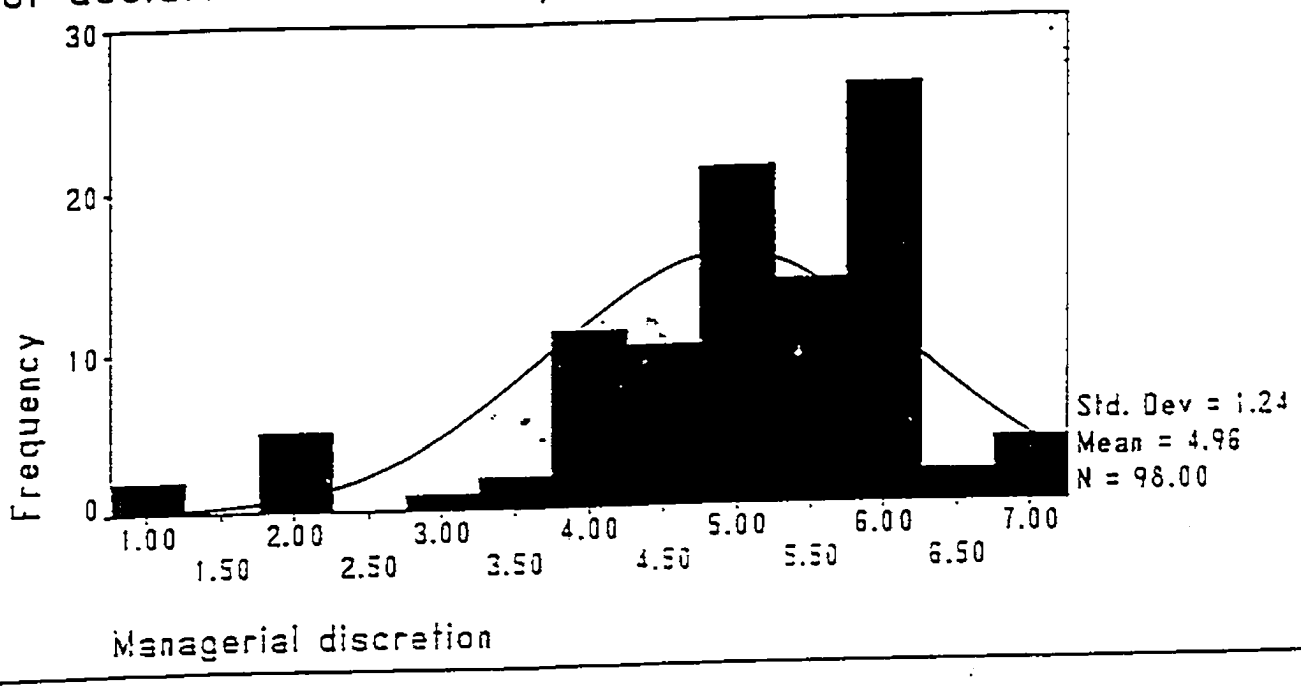
on the business/natural environment interface



4.1.13. Histogram

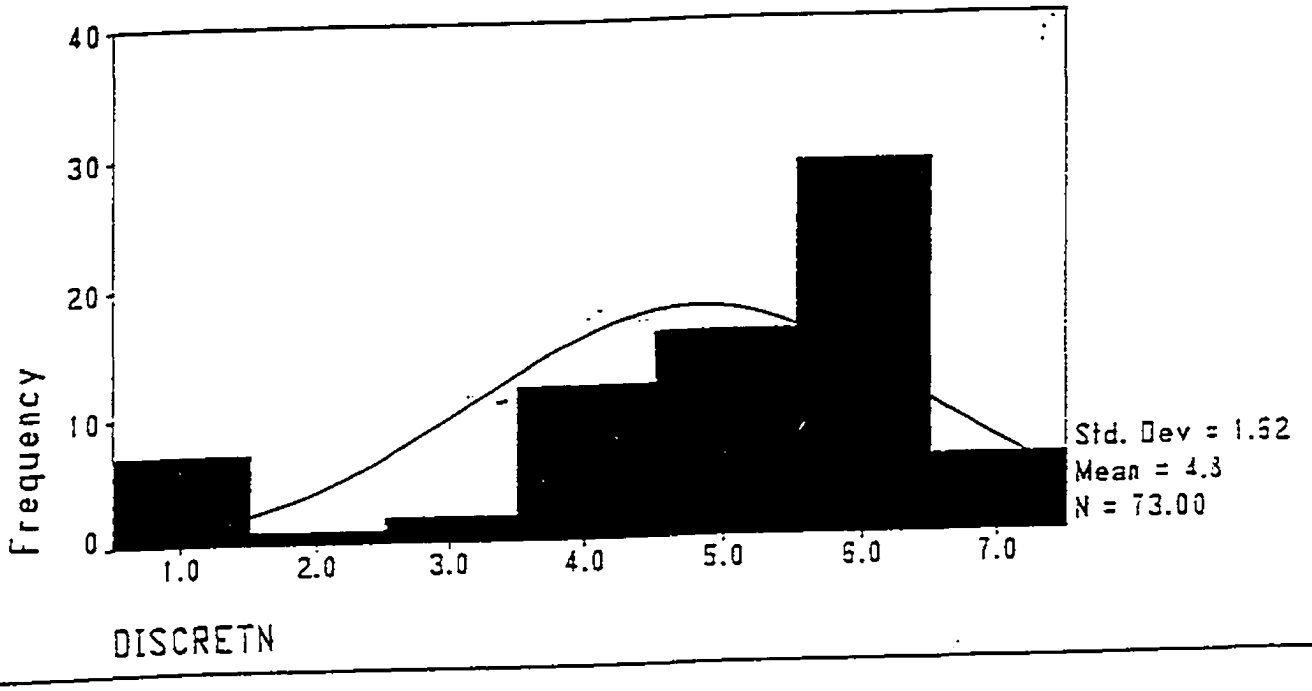
Canada: Managerial Discretion

for decisions on business/natural environment interface



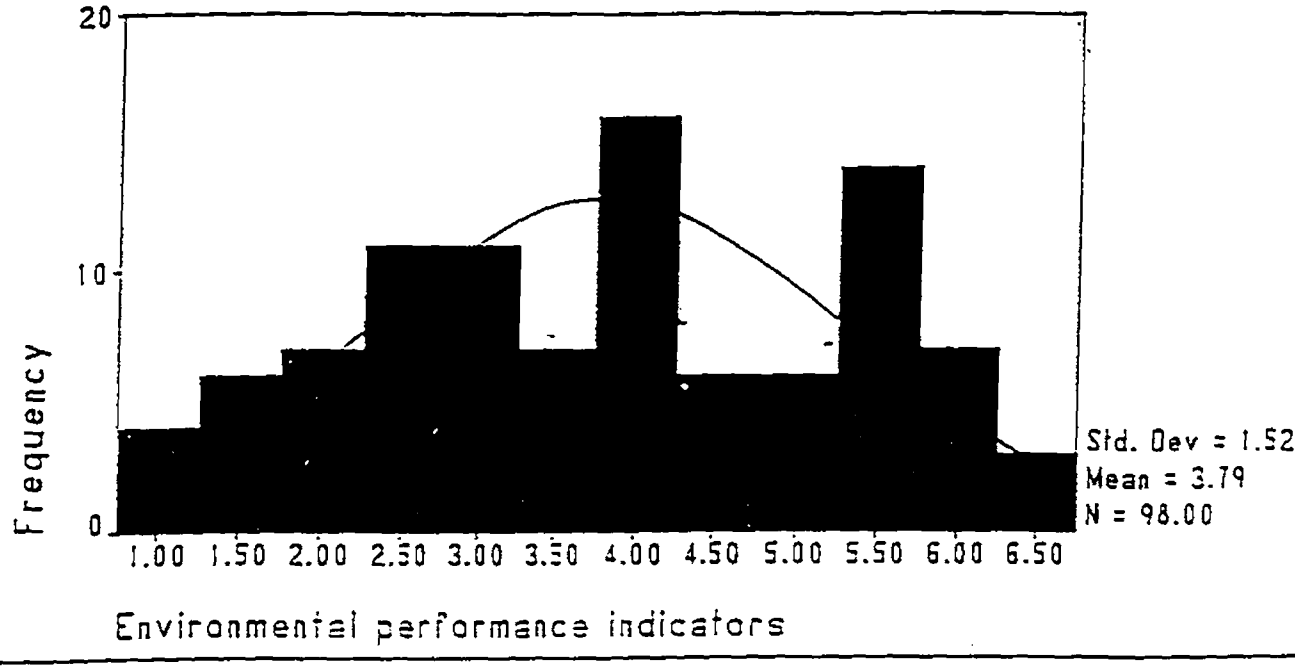
4.2.13. Histogram

U.S.: Managerial discretion in environmental decisions



4.1.14. Histogram

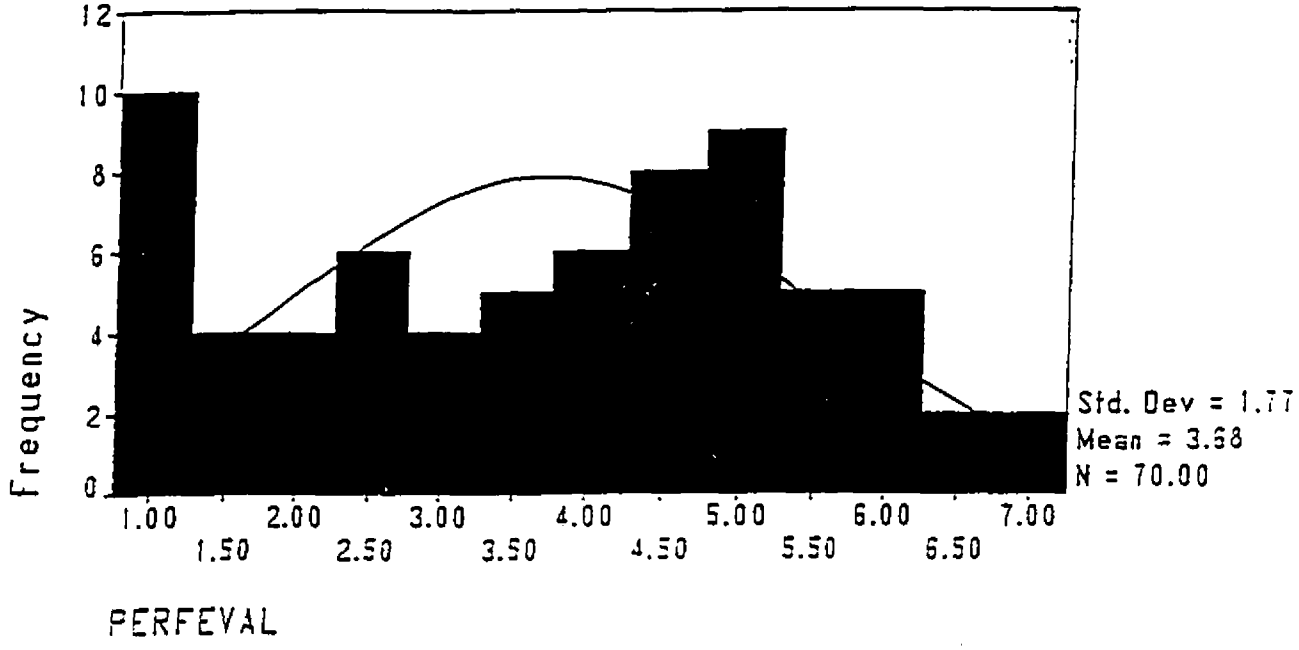
Canada: Use of environmental indicators in employee control systems



4.2.14. Histogram - U.S.

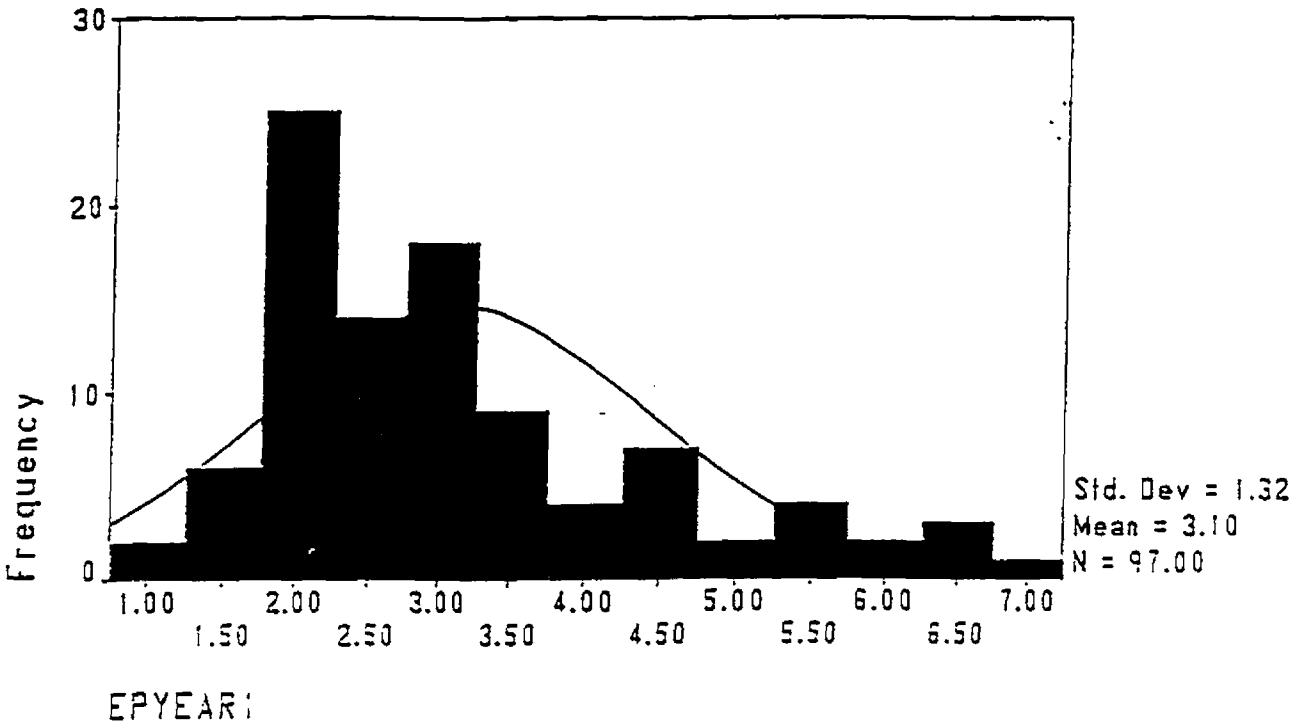
Use of environmental performance indicators

in employee control systems



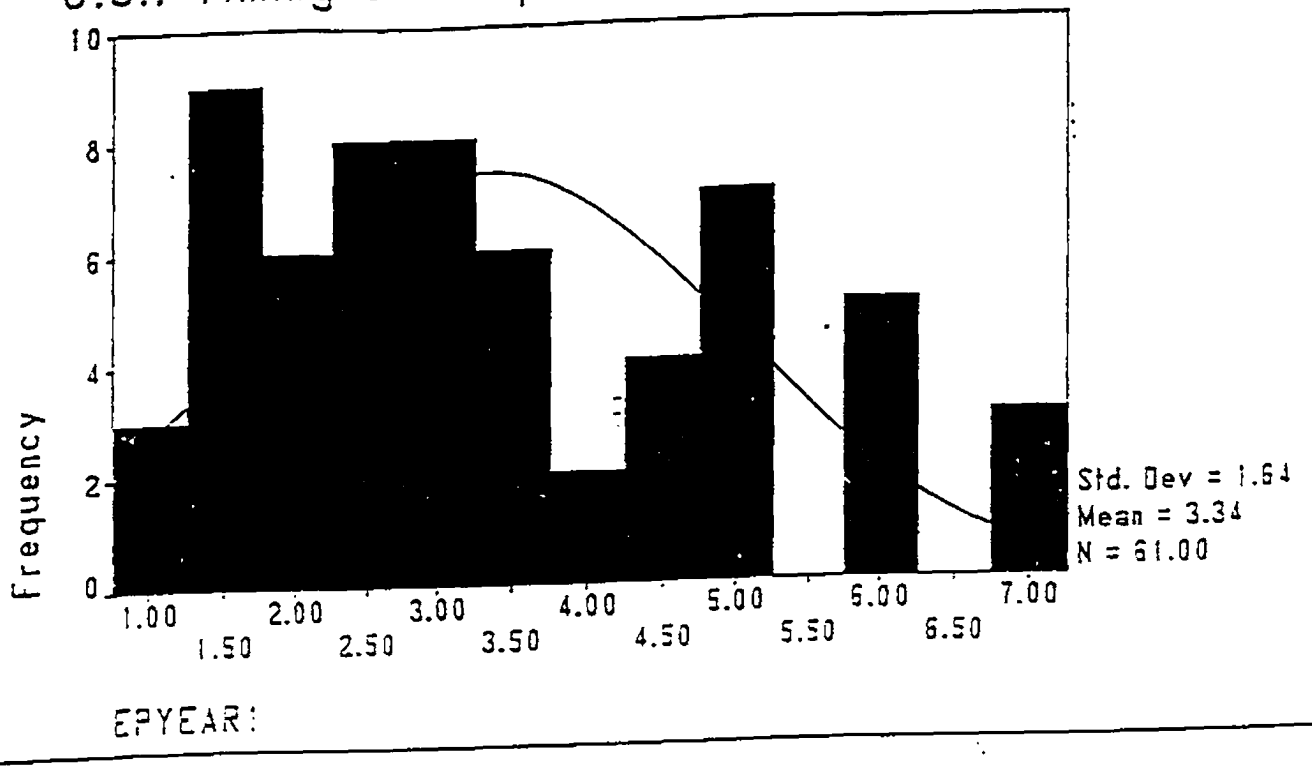
4.1.15. Histogram

Canada: Timing of response in isse lifecycle



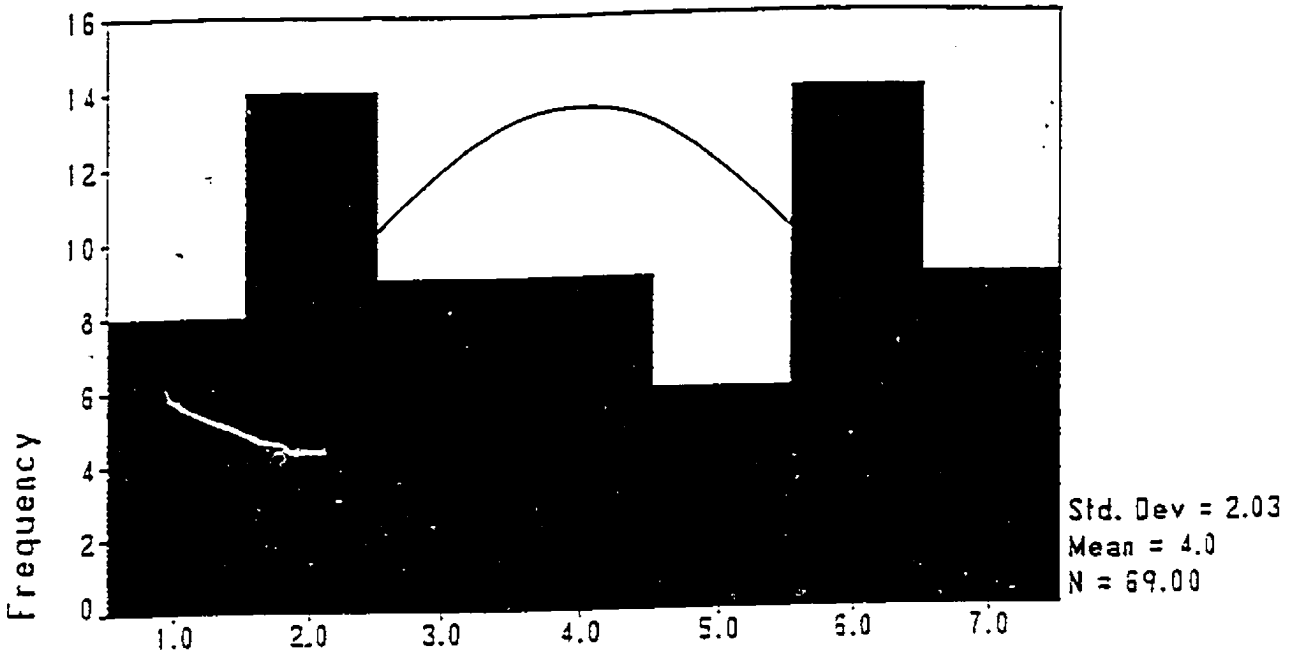
4.2.15. Histogram

U.S.: Timing of response in issue lifecycle



4.2.17. Histogram

U.S.: Company size

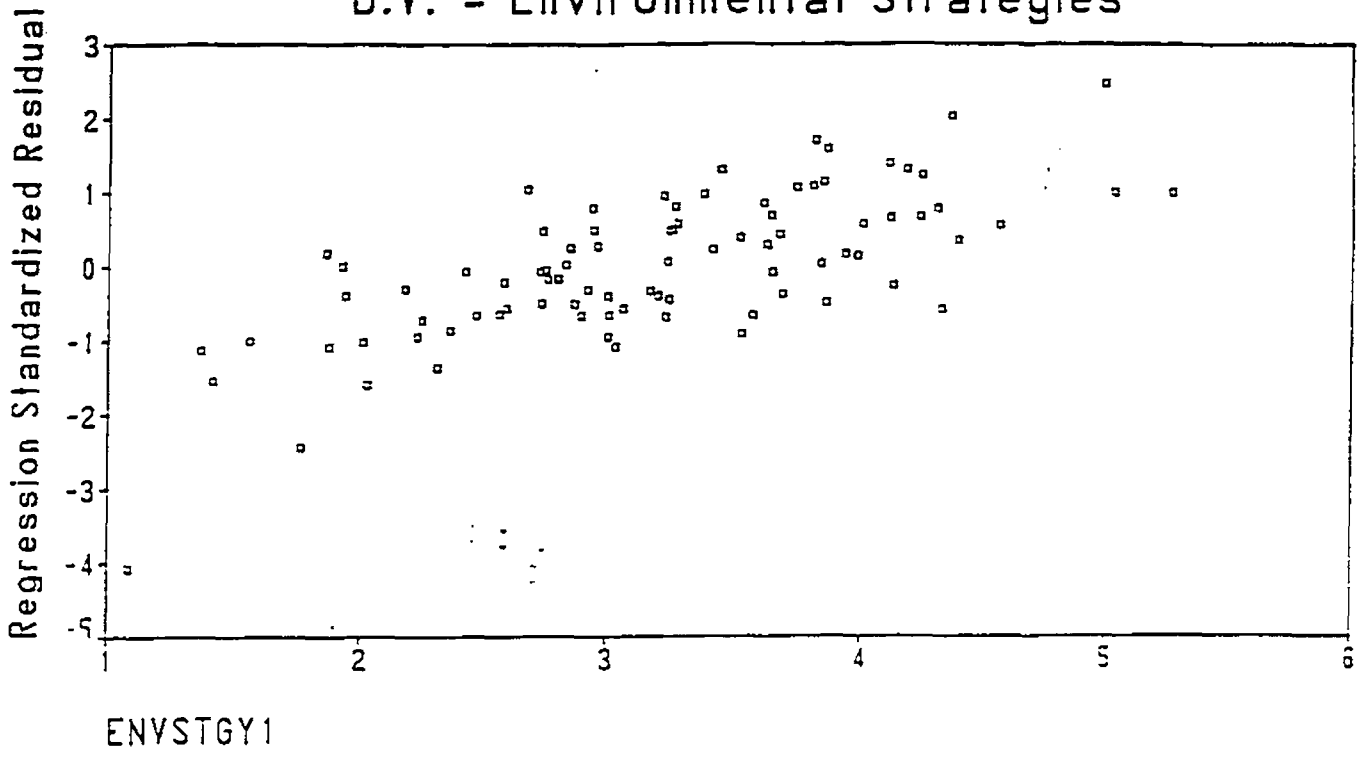


27(d). Approximate total annual sales revenues

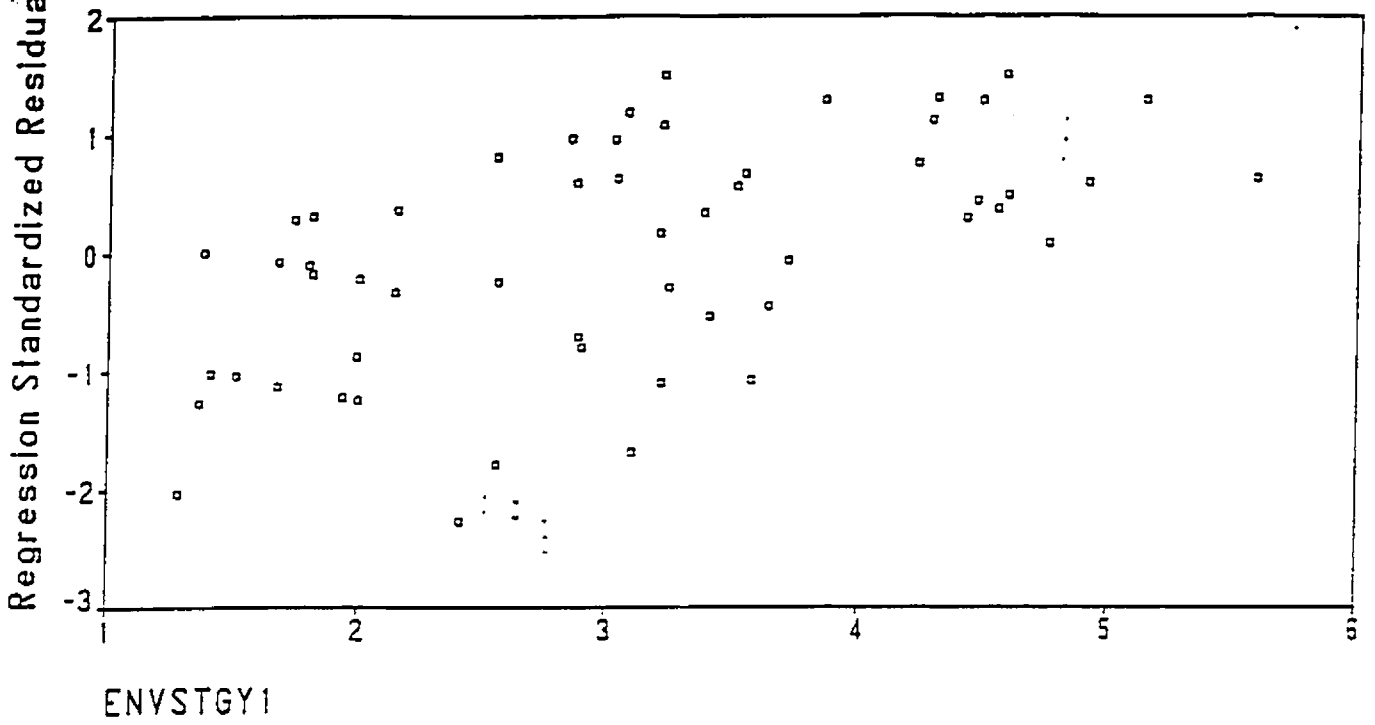
Appendix 5

Scatterplots of values of dependent variables over standardised regression residuals

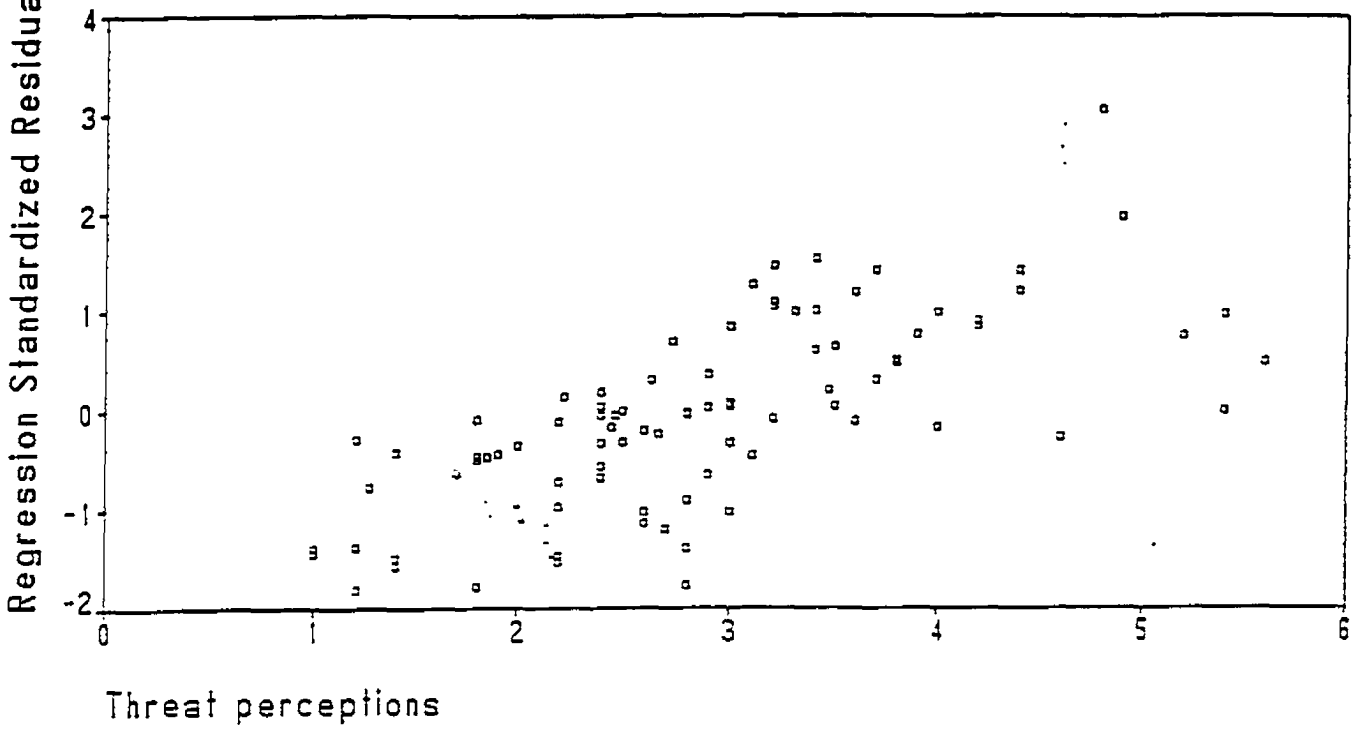
5.1.1. Scatterplot - Canada
D.V. = Environmental Strategies



5.2.1. Scatterplot - USA
D.V. = Environmental Strategies

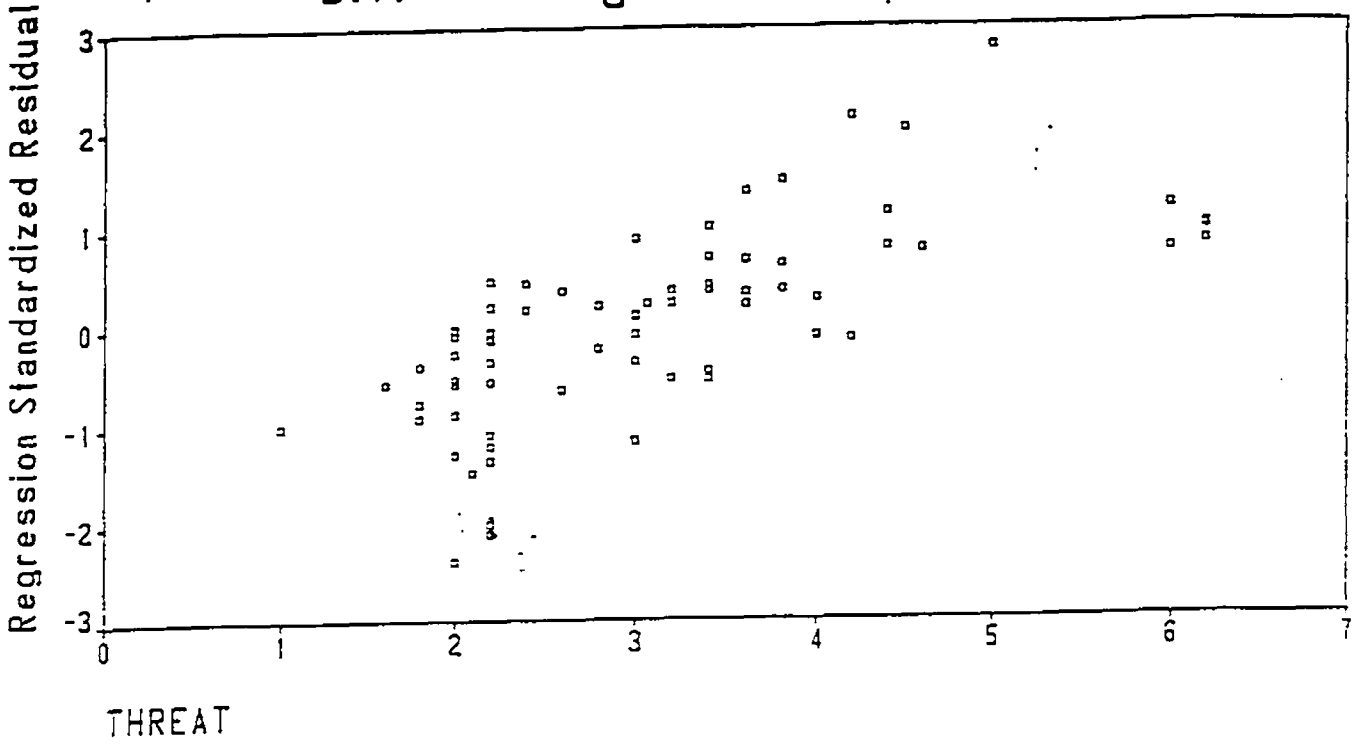


5.1.2. Scatterplot - Canada
D.V. = Managerial interpretations

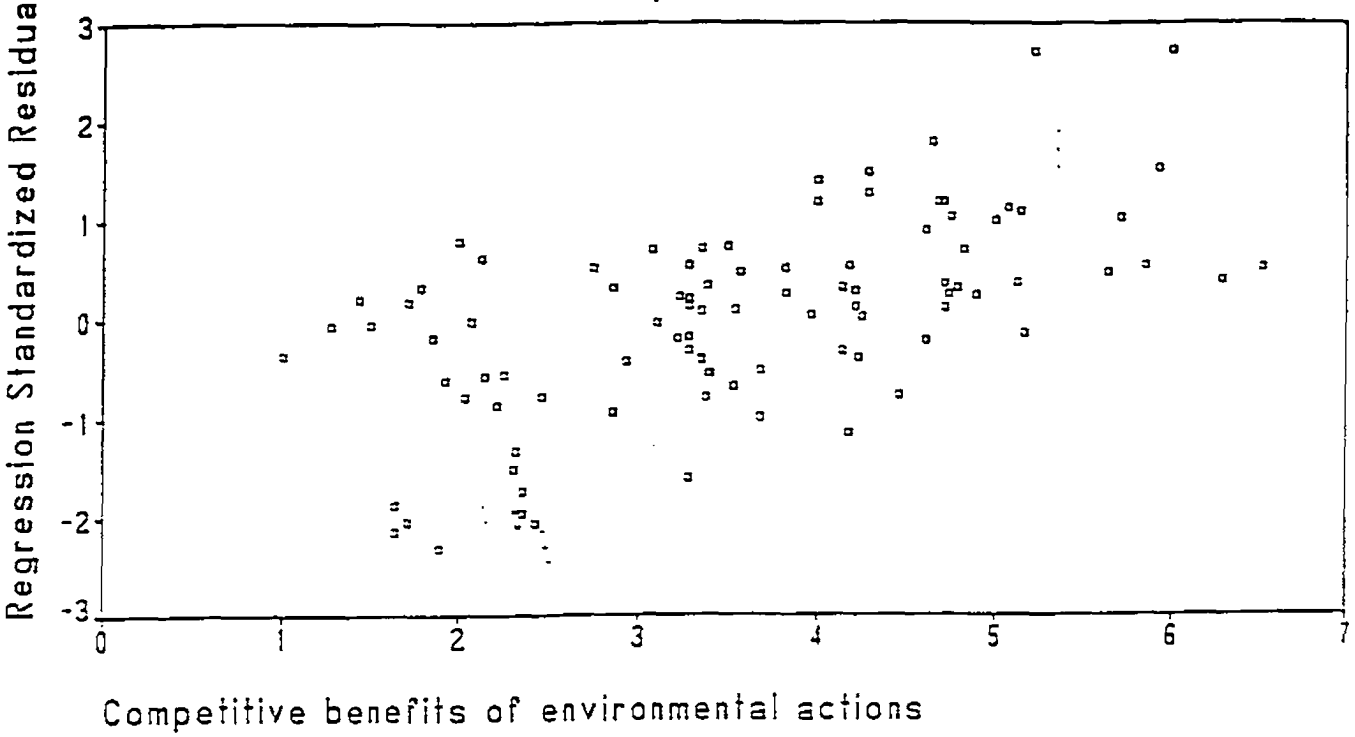


5.2.2. Scatterplot - USA

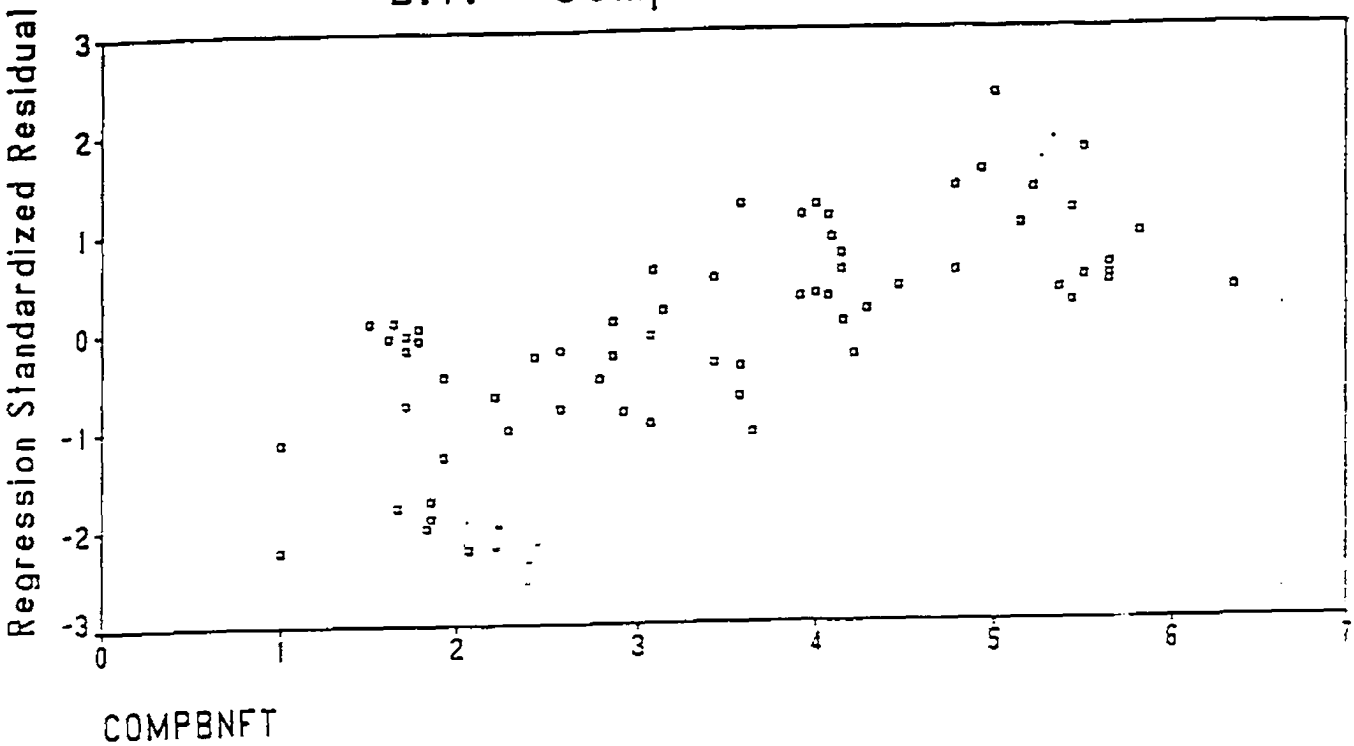
D.V. = Managerial interpretations



5.1.3. Scatterplot - Canada
D.V. = Competitive benefits

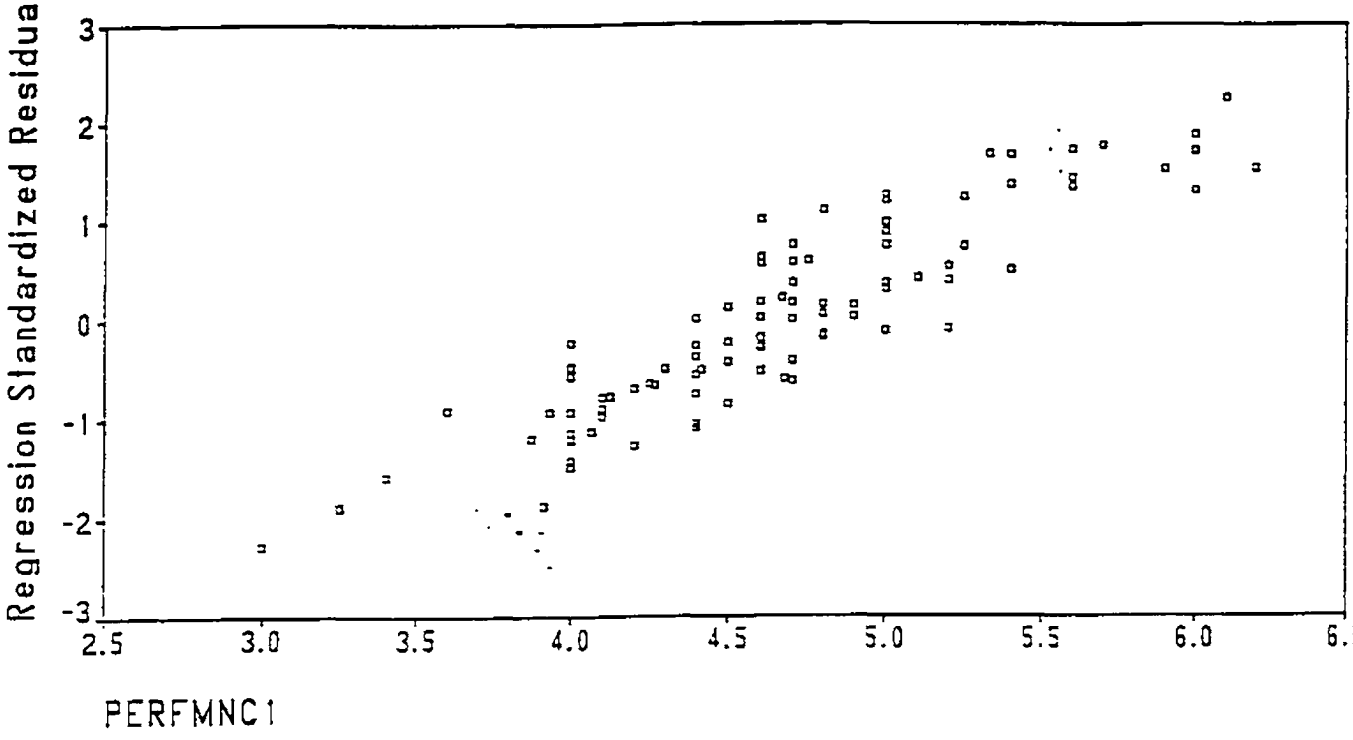


5.2.3. Scatterplot - USA
D.V. = Competitive Benefits



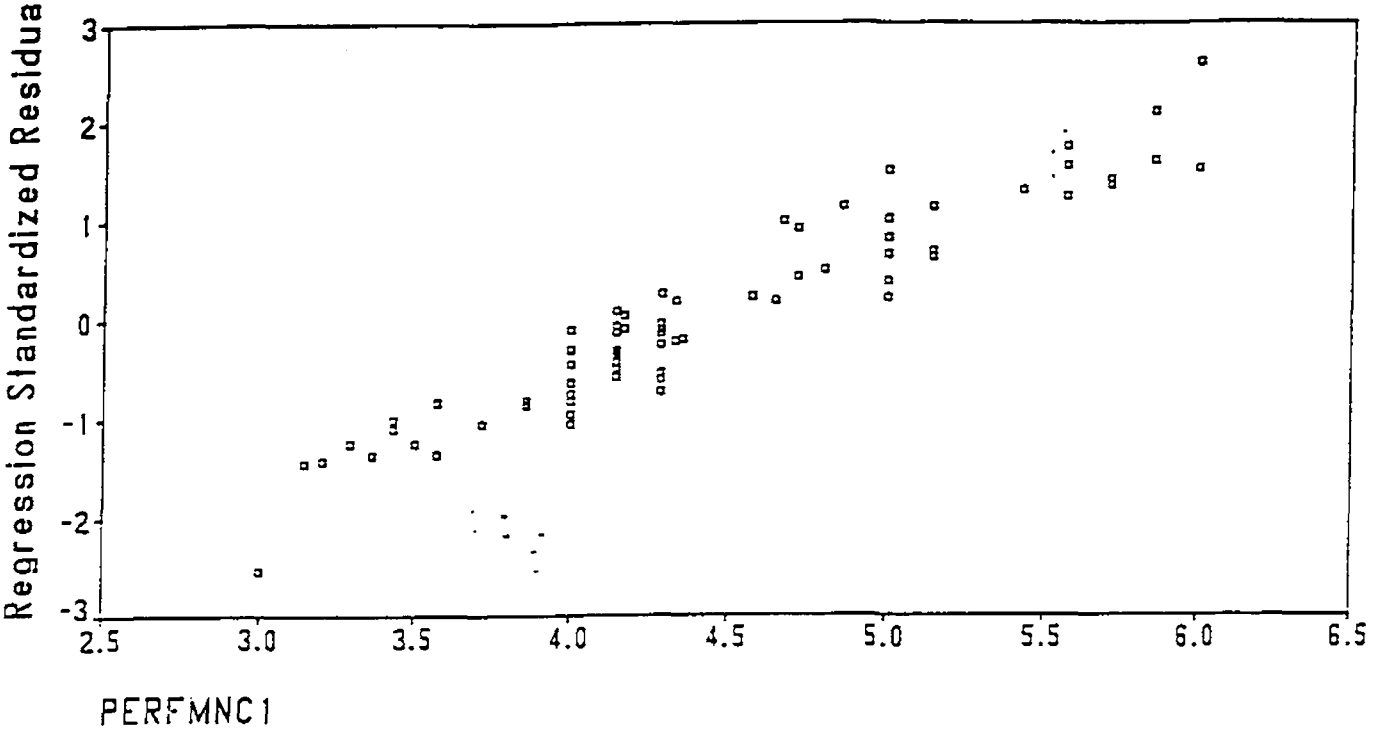
5.1.4. Scatterplot - Canada

D.V. = Firm Performance



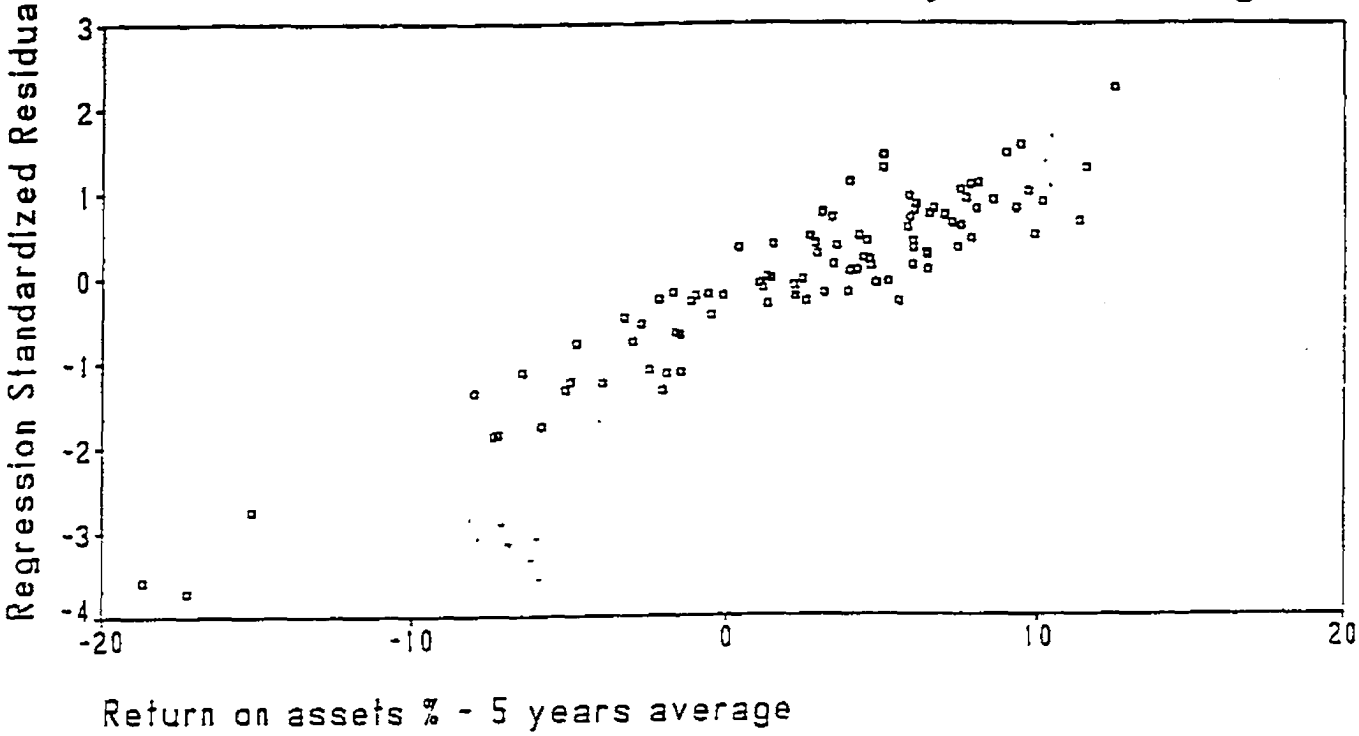
5.2.4. Scatterplot - USA

D.V. = Firm Performance



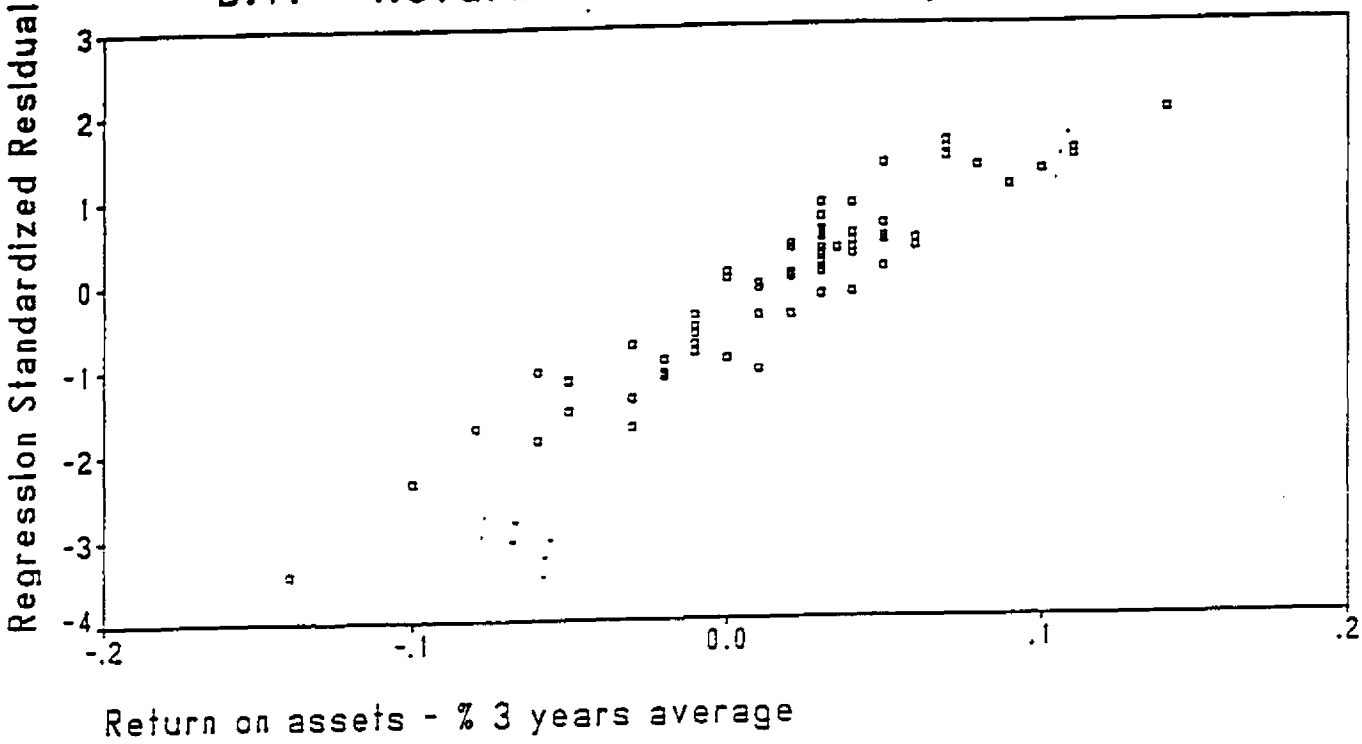
5.1.5. Scatterplot - Canada

D.V. = Return on assets % - 5 years average



5.2.5. Scatterplot - USA

D.V. = Return on assets - 3 years avg. %



5.2.6. Scatterplot - USA

D.V. = Stakeholder relationship strategies