THE INFLUENCE OF CHANGE IN ORGANIZATIONAL SIZE, LEVEL OF INTEGRATION, AND INVESTMENT IN TECHNOLOGY ON TASK SPECIALIZATION

DISSERTATION

Presented to the Graduate Council of The University of North Texas in Partial Fulfillment of the Requirements For the Degree of

DOCTOR OF PHILOSOPHY

By

Jack E. Tucci, B.B.A., M.B.A.

Denton, Texas

August, 1996
THE INFLUENCE OF CHANGE IN ORGANIZATIONAL SIZE,
LEVEL OF INTEGRATION, AND INVESTMENT IN
TECHNOLOGY ON TASK SPECIALIZATION

DISSERTATION

Presented to the Graduate Council of The
University of North Texas in Partial
Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

By

Jack E. Tucci, B.B.A., M.B.A.

Denton, Texas

August, 1996

Major changes in organizational structural paradigms have been occurring. Recent journal articles propose that the older philosophies of expanding organizations and increasing internal specialization are no longer viable means to enhance competitiveness as espoused in earlier journal articles. Downsizing, rightsizing, and business process reengineering have all been used as methods of accomplishing organizational work force reduction (OWFR) and enhancing organizational posture.

It has been established that as organizations grow, specialization increases. Causes for OWFR have not been established nor have effects upon structure been studied. Previous structural factor studies have focused upon organizations engaged in end-game strategies done during periods of internal and economic growth. This study evaluates the impacts of OWFR and its relationship to the structural factor of specialization during a non-munificent economic period.

Three independent variables, dis-integration, change in the number of employees, and change in technology, were used as measures to determine whether specialization decreased when organizations downsized. The dependent variable, specialization, was obtained through a pre-tested questionnaire. The three independent
variables were obtained using the Compustat data base as a secondary source of
information. The Compustat data was verified using data from Compact Disclosure.

Questionnaires were mailed to fifty-one fully integrated oil companies. Forty
were returned after three mailings yielding a response rate of seventy-eight percent.
The unit of analysis for the data collected was the firm. The data were analyzed using
multiple regression to determine the strength of the relationship between the variables.
Results indicate a significant relationship between two of the independent variables
and the dependent variable: dis-integration and specialization and change in the
number of employees and specialization. Findings were insignificant for the third
independent variable and the dependent variable: change in technology and
specialization. Analysis of the quantitative results and the qualitative responses of the
participants show that dis-integration and a change in the number of employees are
both useful for measuring structural change for organizations engaged in organizational
work force reduction.
ACKNOWLEDGEMENTS

More often than not, great accomplishments are often attributed to a single individual's effort. However, actual facts about any accomplishment clearly indicate that opportunity and the efforts of a great number of individuals are probably the greatest reason for success. It is for this reason that I want to thank the individuals who supported me during my research project. If it were not for them, I would not have reached this milestone in my life.

The pilot study phase of this research project would not have been possible without the assistance of the President of Shell Pipe Line Corporation, Robert C. McMahon. He helped during the initial phase of the pilot project in the development of the concept of forced delegation. Also contributing an effort in the pilot study phase with Shell Pipe Line were Jill McHenry-Dereese and Morris Kohinke. Jill McHenry-Dereese and Morris Kohinke were invaluable because of their efforts to distribute, collect and return the pilot study questionnaires. Bruce Boudin from the Shell Oil NORCO Complex was gracious in coordinating, distributing, and returning the questionnaires from that facility. Both Jill, Morris, and Bruce have my most heartfelt thanks for their efforts and input.

My committee was essential because of the skills they brought to the dissertation process. Carl Swanson was indispensable with approaching the dissertation with a gestalt perspective, Barbara Hassell with her keen eye for research and writing skills, William Brookshire for his analytic and statistical abilities, and Barbara Coe for her words of encouragement and her ability to help me conceptualize this project a year before it took form. Gratitude also goes to three faculty members at the University of Texas - Permian Basin for their guidance, Thomas Schafer, Eugene Nini, and Waylon Griffin. Martha Cook, a scholar of the English language also merits my gratitude for her guidance. Dr. Samuel Cappel, with Southeastern Louisiana University also deserves a hearty thanks for providing research time and copying expenses to complete the dissertation. Samuel is a friend indeed.

I want to thank both my parents, Jack L. and Mary L. Tucci, and my Father and Mother-in-law, W. Russell and Betty J. Butler for their moral and financial support. Most important to the success of this research project were my immediate family members. Financial sacrifices and hardships were not unfamiliar terms for my son and daughter; Shelby and Michelle. Countless hours worked by my family made possible the pages that you are reading. The greatest support I received came from my wife. Without complaint, many sacrifices were made to accomplish this goal. I have never met a more selfless person. Thank you, Sheryl Leann.
TABLE OF CONTENTS

LIST OF ILLUSTRATIONS ....................................................... vii

LIST OF TABLES. ................................................................. ix

GLOSSARY ....................................................................... xi

Chapter

1. INTRODUCTION ............................................................... 1
   Background ................................................................. 1
   Purpose of the Study ................................................... 8
   Statement of the Problem ............................................... 10
   Theoretical Foundation ................................................ 11
   Sample Selection ....................................................... 19
   Significance of the Research ......................................... 23
   Methodological Overview ............................................. 24
   Chapter Summary ....................................................... 24

2. LITERATURE REVIEW ................................................... 26
   Overview ........................................................................ 26
   Organizational Work Force Reduction ............................... 27
   Construct Variables. .................................................... 47
   Research Hypotheses ................................................... 67
   Chapter Summary ....................................................... 71

3. METHODOLOGY ............................................................... 74
   Sample ........................................................................ 74
   Questionnaire ............................................................. 81
   Procedure ..................................................................... 93
   Statistical Method ....................................................... 94
   Chapter Summary ....................................................... 96
### LIST OF ILLUSTRATIONS

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>General research model</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>Model of OWFR factors</td>
<td>6</td>
</tr>
<tr>
<td>3.</td>
<td>Rightsizing</td>
<td>30</td>
</tr>
<tr>
<td>4.</td>
<td>Downsizing</td>
<td>36</td>
</tr>
<tr>
<td>5.</td>
<td>Business process reengineering</td>
<td>42</td>
</tr>
<tr>
<td>6.</td>
<td>Structural contraction</td>
<td>51</td>
</tr>
<tr>
<td>7.</td>
<td>Hypotheses</td>
<td>68</td>
</tr>
<tr>
<td>8.</td>
<td>Steps of the study</td>
<td>75</td>
</tr>
<tr>
<td>9.</td>
<td>Modified model of OWFR factors</td>
<td>120</td>
</tr>
<tr>
<td>10.</td>
<td>U.S. consumption - production of oil</td>
<td>149</td>
</tr>
<tr>
<td>11.</td>
<td>Production decline in Louisiana (oil)</td>
<td>150</td>
</tr>
<tr>
<td>12.</td>
<td>Production decline in Louisiana (gas)</td>
<td>151</td>
</tr>
<tr>
<td>13.</td>
<td>Change in drilling activity (wells vs. permits)</td>
<td>152</td>
</tr>
<tr>
<td>14.</td>
<td>Crude oil and gasoline prices</td>
<td>153</td>
</tr>
<tr>
<td>15.</td>
<td>Number of oil industry employees</td>
<td>154</td>
</tr>
<tr>
<td>16.</td>
<td>Residual plot - dependent variable</td>
<td>189</td>
</tr>
<tr>
<td>17.</td>
<td>Studentized residual plot</td>
<td>190</td>
</tr>
<tr>
<td>18.</td>
<td>Residual plot - dis-integration</td>
<td>192</td>
</tr>
</tbody>
</table>
19. Residual plot - change in the number of employees. .......................... 193
20. Residual plot - change in technology .............................................. 194
21. Residual plot against observation number. ...................................... 195
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Aston study</td>
<td>14</td>
</tr>
<tr>
<td>2. Time analysis of OWFR.</td>
<td>28</td>
</tr>
<tr>
<td>3. Rightsizing</td>
<td>29</td>
</tr>
<tr>
<td>4. Rightsizing by journal.</td>
<td>32</td>
</tr>
<tr>
<td>5. Downsizing</td>
<td>35</td>
</tr>
<tr>
<td>6. Downsizing by journal.</td>
<td>37</td>
</tr>
<tr>
<td>7. BPR by journal</td>
<td>44</td>
</tr>
<tr>
<td>8. Sixteen specialized tasks</td>
<td>52</td>
</tr>
<tr>
<td>9. Specialization measures and methods</td>
<td>56</td>
</tr>
<tr>
<td>10. Reduced specialization proponents</td>
<td>56</td>
</tr>
<tr>
<td>11. Size as an imperative</td>
<td>59</td>
</tr>
<tr>
<td>12. Variable characteristics</td>
<td>99</td>
</tr>
<tr>
<td>13. Correlation analysis</td>
<td>100</td>
</tr>
<tr>
<td>14. Results table</td>
<td>101</td>
</tr>
<tr>
<td>15. Specialization changes</td>
<td>117</td>
</tr>
<tr>
<td>16. Common terminology</td>
<td>124</td>
</tr>
<tr>
<td>17. New specialization matrix</td>
<td>127</td>
</tr>
<tr>
<td>18. Jobs outsourced by two or more companies</td>
<td>137</td>
</tr>
</tbody>
</table>
GLOSSARY

*Asset parsimony* is a concept whereby everything within the organization is looked at as being an asset to be used towards the generation of profit. This concept is further extended from hard assets such as plant and equipment to soft assets such as employees. These assets are reduced after an evaluation to a point that maximizes production and efficiency.

*Business process reengineering* is a method by which managers, often with the aid of consultants, review the processes within the organization. This review is then used to plan how to reorganize the company based upon processes rather than specialization by tasks, generally resulting in the layoff of workers.

*Downsizing* is a method by which an organization reduces the size of the organization in two ways. The first is a reduction in the number of employees. The second type is in the implementation of downsizing. Replacing a mainframe computer system with a smaller mini-frame computer system is an example of such an approach.

*End-game strategy* are strategies adopted by companies during the mature to decline phase of their life-cycle. End-game strategies vary, but are most evident when companies engage in either mergers or divestment of non-essential or non-core activities.

*Exempt and non-exempt employees* are terms used to describe the difference in the way employees are classified by federal law concerning overtime and other working requirements. Typically exempt employees are referred to as white collar employees while non-exempt employees are referred to as blue collar employees.

*Fully integrated* is a term used to describe the complete integration of all factors producing, gathering, refining, and marketing crude oil and its associated products. To be fully integrated, a company must be integrated both backward and forward.
Intelligent agents is a term used to describe various methods of automating processes used in the production, transportation, or refining of crude oil. Intelligent agents are used in labor intensive work environments where the work is repetitive.

Network organization is an organization of independent companies that form an alliance on the behalf of the primary company in the manufacturing of a good or the providing of a service. Each of the independent contract companies are often referred to as nodes.

Node is used to describe a company that provides a specialized service for another firm. This same company can and often provides this same service to several companies concurrently and is, therefore, a component of several network organizations.

Outsourcing is a method by which management contracts portions or segments of the work process or specific work items to outside companies. The employees that formerly performed the outsourced task are often terminated as part of an organizational work force reduction.

Qualitative is used to describe research methods using accepted methodologies for observing trends or commonalities between data sets and/or open ended questions from questionnaires and interviews. Ethnographic and content analysis are two of the more common procedures used to analyze attitudes, changes in culture, and trends in society. These methods were employed during the pilot study phase and during the data analysis.

Rightsizing is an attempt by an organization to equalize or to match the output of the organization with the demand by consumers and the work force through layoffs or natural attrition.

White Collar - Blue Collar: see exempt and non-exempt employees.
CHAPTER 1

INTRODUCTION

Background

In the last decade, America has witnessed a significant change in the work force that has not been seen since the Great Depression. The concepts of downsizing, rightsizing, restructuring, and business process reengineering (hereafter referred to as Organizational Work Force Reduction or OWFR) have emerged as management's latest attempts to gain a comparative advantage in a highly competitive global economy.

Much of what we know today about OWFR has focused on (1) the reasons why firms have chosen to embark on OWFR and, to a lesser extent, (2) the effects of OWFR on the organization, particularly with regard to changes in employee behavior and performance. In essence, much of the research literature on OWFR has surveyed the competitive forces that motivated firms to downsize or rightsize, etc. and/or the successes of such OWFR efforts in terms of favorable work force and/or financial performance. Figure 1 identifies some of the key research that has been published regarding OWFR input and output factors. As can be seen, little has been done to research the effects of OWFR upon organizational structure (Harrigan 1988).

This does not suggest that the research literature is not replete with studies on organizational structure, beginning with Alfred Chandler's (1962) seminal study that
<table>
<thead>
<tr>
<th>Reasons</th>
<th>Applications</th>
<th>OWFR</th>
<th>Influences</th>
</tr>
</thead>
</table>
strategy comes before structure. Much of what we know today about organizational structure is based on studies of firms increasing in size during long periods of favorable economic growth (Fayol 1949, Ford and Slocum 1977, Greiner 1972). The limitation of this past research becomes obvious when it is realized that firms using OWFR to improve their competitive position are better characterized as firms in the mature phase of the industry life cycle, that are doing business in saturated markets with minimal growth opportunities (Ben-Ner 1988, Feinstein and Matthews 1990).

Neither the size, age of the firm, nor industry type have offered much protection from this competitive phenomenon. IBM has laid off more than sixty thousand employees since 1990, with changes in technology being cited as the causal factor (Pearce and Robinson 1994). The textile industry alone lost more than 400,000 jobs due to global competition that resulted in U.S. jobs moving to foreign locations (Kjellberg 1991, Reich 1993). Thus, in the midst of all the popular press and anecdotal research on OWFR, few scientific studies have quantified the changes occurring in organizations when such firms decrease in size under unfavorable economic conditions.

Importance of the Proposed Research

The importance of understanding organization structural issues under unfavorable as well as favorable competitive conditions is paramount to researchers because it provides a better understanding of how organizations structure themselves regardless of where they are in the industry life cycle. Moreover, practitioners need to
understand both the long- and short-term effects of their decisions to resize or restructure their organizations (Burns and Wholley 1993). Increasing the level of understanding by practitioners is essential if managers are to better the organization (Barnard 1938).

The significance of understanding the changes that have taken place in organizational structures during the past decade should not be understated. In the past, the need for a fit between strategy and structure (Chandler 1962) was a dominant theme in organizational studies. The merger of Chevron Oil Corporation and Gulf Oil Corporation in 1984 marked the beginning of a new era whereby old philosophies about structure and strategy have been more easily challenged (Hammer and Champy 1993; Tushman, Newman, and Romanelli 1986).

Since 1984 mega-mergers, buy-outs, and hostile takeovers have been one of the more prevalent topics in the practitioner literature. As a result of these aggressive buy, merge, and liquidate policies, combined with a downturn in the economy, many companies have been forced to reconsider their competitive stance. A previous method of maintaining an organization’s competitive position in a sluggish economy was to rely on the momentum accumulated during prosperous times to carry the firm through such a downswing. The intensity of foreign competition, the increase in saturated markets in the United States, long periods of marginal economic growth (Walton and Rockoff 1994), and the investment demands of stakeholders have forced management to consider new alternatives to sustain higher levels of performance.

Figure 2 illustrates the relationship of organizational structure to other key
management concerns, with a focus on those areas that are the subject of this study. Each functional area in the firm depends, either directly or indirectly, on the structure of the organization which, in turn, depends on the number of employees in the work force at the firm level (Child 1973, Lal 1991, Minzberg 1979). Previous studies involving changes in organizational size have focused on changes in structure during periods of growth. Figure 2 indicates that the factors used to measure changes in the organizational structure during periods of growth should also be used during periods of contraction.

Definition of Organizational Work Force Reduction

The need to consider new organizational structure alternatives has forced managers to either proactively or reactively adapt or restructure the organization's work force to meet the challenges in the environment (Butler 1990). Whether the OWFR decision was proactive or reactive has generally determined the terminology used in the literature to describe the nature of the work force reduction.

Three commonly used terms to describe the methods that have been used to change or enhance organizational performance have become prevalent as organizations have attempted to become more competitive. They are downsizing, rightsizing, and business process reengineering. The goal of each of the three methods is to better match the number of employees with the required work of the firm.
Figure 2 -- Model of OWFR factors
Although each describes a different environment in which the work force reduction might be accomplished, the purpose of each is to find the optimal number of employees to efficiently accomplish the required work. Organizational work force reduction, therefore, is part of the process generally undertaken by business to maximize assets and minimize expenditures.

If a company is reacting to the forces in the market and has experienced several quarters of poor financial performance, it may reduce the number of employees through a downsizing effort (Daft 1992). Similarly, companies that have merged with other organizations often find themselves with duplicate staffing and choose rightsizing as a term to reflect their reaction to overstaffing. In both cases, firms are reacting to environmental conditions (McCoy 1991). The decision to downsize or rightsize is further complicated by the question of which employees are to be terminated? For example, in previous recessions, the furloughed employee make-up has changed significantly from blue collar to white collar (Fitzgerald 1991, Mandel 1990, Overman 1991). Since most practitioner literature is replete with information that middle-level management has been the hardest hit during the employee layoffs under investigation, data regarding the make-up of the layoffs was obtained in the questionnaire (Heyman 1987, Moskal 1988, Podgursky and Swaim 1987, Raelin 1987).

Business process reengineering is a relatively new term that describes the process managers use to reevaluate the way business is done. Business process reengineering is similar to downsizing and includes such actions as reduction in work force, geographical redistribution of personnel and resources, refocus on the value-
chain with special interest on the needs of the customer, and the optimal match of work force capacity with the amount of work required to meet business needs. Business process reengineering is a proactive response to the environment that involves a total redesign of the business (Hammer 1990), and generally includes the layoff of a portion of the firm's employees.

From a population ecology perspective, the method chosen by the firm, whether proactive, as in business process reengineering, or reactive, as in downsizing or rightsizing, is not viewed as an important research issue in examining the impact of OWFR on organizations. The fact that business firms are trying to emulate each other through OWFR is considered to be the critical issue (Milliman, Von Glinow, and Nathan 1991). This research attitude is shared by many population ecologists; consequently, their studies of organizational adaptation to the environment reflect this logic (Singh, Tucker, and House 1986). For the purpose of this study, the focus was on OWFR, that is the percentage change in the number of employees, percentage change in the level of integration, and percentage change in technology and not on whether the method chosen was proactive or reactive.

Purpose of the Study

This research accomplished the following four objectives.

1. To use accepted and available research methods to investigate the effects of OWFR upon the structure of the organization during periods of unfavorable environmental conditions.
2. To extend previous growth theory research to provide a better understanding of the macroenvironmental effects upon organizational structure during periods of decline.

3. To give a more complete understanding of how organizations / businesses operate by complementing the current organizational theories based on growth with research focused on organizations during periods of contraction.

4. To provide information that will be useful later in establishing the strategy-structure link by illustrating the effects of planned business process reengineering as opposed to the reactionary methods of downsizing or rightsizing.

In contrast to previous studies on organizational structure research, which were based solely on organizational growth during periods of economic growth, this study focused on firms in a mature industry that are operating in a marginal economic climate (Brimelow 1989). It is anticipated that these firms should exhibit different structural characteristics from those experienced by organizations operating in a favorable growth economy (Lawler 1990). If this is the case, the results of this research can be used in subsequent studies to determine whether the structural characteristics identified in this study are common to firms in other industries undergoing resizing in an unfriendly economic environment.

The results of this research can provide non-growth, market-saturated firms or industries a basis for developing better organizational structures that permit these firms to cope with the apparent discontinuities created by the restructuring of the organization and the resulting displacement of workers (Tomasco 1992, 1987; Redford 1987).
Statement of the Problem

This study investigates the relationship between organizational work force reduction and organizational structure. Growth theory explains that, as companies grow, organizational configurational factors such as specialization increase (Greiner 1972, Mintzberg 1979). As organizations increase in the number of employees, specialization inherently creates niches filled with individuals who perform highly specialized functions. The rate of growth in the organization is proportional to the rate of growth in specialization within the industry (Lorsch 1970, Lawrence and Lorsch 1969).

Growth theory research intuitively suggests that, as organizations engage in OWFR, specialization should decrease and the rate of reduction should be proportional to the rate of decline in specialization within the industry. The problem with OWFR is that little data or evidence exist to disprove this instinctive philosophy which asserts that changes in the organizational structural factor follow the downsizing process. The question that needs to be addressed is this: Is there a configurational structure change in an organization that is undergoing work force contraction?

The focus of organizational work force reduction is incomplete in many other facets. Of primary concern are the interactions between organizations and their environments, especially during the periods of marginal economic growth and saturated market conditions (Lawler 1991). Whether organizational resizing is undertaken as a proactive or a reactive measure, there is a need to understand the relationship between organizational structure and employment levels.
Theoretical Foundation

Many companies have reacted to the changes in competition and the economy through the development of tactical plans that modify the organization to make it more organic and adaptable to the dynamic environment (Daft 1992). Still, little research has focused on organizations during periods of decline (Harrigan 1983).

Previous studies utilizing the concepts of task specialization within industry as a tool for efficiencies of scale have focused only on growth within the industries in particular during periods of growth in the economy in general (Blau et al. 1976, Hall 1968, Khandwalla 1973b, Kimberly 1976, Pugh et al. 1968, Reimann 1973, Woodward 1965). The presumption of the ability to sustain continuous growth in any industry or economy may be fallible. Societies with the potential for immense industrial growth often experience sustained periods of marginal economic growth (Dunn 1991, Malabre 1994). These periods of marginal economic growth place great stresses upon organizations due to decline in demand for their goods and services.

The literature covering organizational work force reduction can be broken into three distinct areas of concern, which allows for a brief overview of the suggested reasons for the reduction in work force. These three areas are economics (marginal economic growth), technology (use or increase in use of technology), and management (decision to change strategic direction) (Ashburner 1990, Daft 1984, Fry 1982, Keats and Hitt 1988, Malabre 1994). These three areas have been studied in previous research and were not used in the course of this study. A review of the research based on these variables, however, reveals that the impact of OWFR on the structural
configuration of the organization has not been fully studied.

The environment in which the independent variables exist provides two essential elements for this study. First, it supplies the foundation for the development of the research questions. Second, it provides the context for the relationship between the research questions and the independent variables.

Research Question

The following research question was developed from an analysis of the OWFR research done to date. Before the research question is offered, brief definitions of the dependent variable are necessary in order to provide a basic understanding of the relationships between OWFR and each of the structural variables. These definitions can be found in Mintzberg's 1979 work, The Structuring of Organizations. A more comprehensive assessment of the dependent variable can be found in the Dependent Variable section.

Specialization is the most common method used for describing the division of labor into simpler tasks. It should not be confused with vertical specialization since vertical specialization describes the separation of the performance of the work and the administration of the work. A review of the literature concerning OWFR reveals that little, if any, research specifically used organizational structural variables in determining whether work force reduction changes the structure, as asserted by many of today's consultants (Champy 1995, Hammer and Champy 1993, Johansson et al. 1993, Kaesle 1990, Sirkin and Stalk 1990). From this supposition, the following
research question is presented as a framework from which the hypotheses were
developed.

Do the different methods of organizational work force reduction
(OWFR) influence the organizational structure as measured by a change in specialization?

Research hypotheses were developed using this question and are discussed in greater
detail in chapter 2.

Dependent Variable

The dependent variable used in this study is represented by the measurable
structural configurational attribute of specialization. This structural configuration
attribute, which defines structure, was primarily developed in the Aston Studies of the
1960s. The Aston study originally found six variables used to describe the structure
of an organization. These six variables were: specialization, standardization,
formalization, centralization, vertical span, and traditionalism. Later investigations by
1972, Miller 1986, Reimann 1973) confirmed the usefulness and reliability of this
structural configurational variable. This variable has been widely used to measure the
differences between organizations because it represents a specific structural
characteristic of organizations (Kieser 1989).

The previous studies, using all six variables, have found that specialization
provided a high degree of reliability in predicting the other five variables. Because of
this high degree of correlation only the measure of specialization was used in this
study (see table 1). Table 1 was based on the information published by the Aston group studies (Pugh et al. 1968).

Table 1. -- Aston Study

<table>
<thead>
<tr>
<th>Scale Number</th>
<th>(from Aston Study) n = 46</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>52.00</td>
<td>Specialization and Standardization</td>
<td>= .76</td>
</tr>
<tr>
<td>53.00</td>
<td>Specialization and Formalization</td>
<td>= .57</td>
</tr>
<tr>
<td>54.00</td>
<td>Specialization and Centralization</td>
<td>= -.64</td>
</tr>
<tr>
<td>55.43</td>
<td>Specialization and Vertical Span</td>
<td>= .57</td>
</tr>
<tr>
<td>56.00</td>
<td>Specialization and Traditionalism</td>
<td>= -.36</td>
</tr>
</tbody>
</table>

Eliminating the other five variables found in the Aston study allowed for a shorter questionnaire. It was hoped that a shorter questionnaire encouraged individuals who may be reluctant to answer a longer questionnaire. Making the questionnaire as simple as possible, while still obtaining the needed information, should help reduce non-response bias (Lambert and Harrington 1990).

Specialization is just one of the key criteria identified by Mintzberg (1979) in the evolution of organization structure. The change in specialization measures not only the degree to which the work of the employee is specialized prior to and following downsizing, but also represents structural changes within the organization. Adam Smith defined specialization as;

"the 'division of labor' to increase productivity and involves the ability to improve in dexterity by doing only one task" (Smith 1937).
The ability to minimize the number of tasks allows the managers to develop specialized skills to oversee distinct and complex functions that are generally professional in nature. Hammer and Champy (1993) argue that specialization is a holdover from the days of technologies and integrated management systems and is not applicable in today's competitive environment.

Organizational growth is accompanied by more specialization (Blau et al. 1976, Pugh et al. 1969a). The purpose for analyzing a change in specialization is to determine if resizing during periods of decline is opposite to that found during periods of growth. Because of the nature of full integration in mature industries, specialization is a determinant of organizational design and structure (Miller and Droge 1986, Pugh et al. 1968). A change in the structure of an organization should not only reflect a change in strategy, but also should be measurable. To gauge the effect of this theory, measures of specialization were identified, compared, and correlated to organizational work force reduction. If business process redesign does, in fact, work as Hammer (1990) suggests, specialization and the other structural variables should be reduced, along with a corresponding decrease in the number of employees. Specialization was used because it exhibited the greatest potential for capturing the type of change organizations are undergoing in OWFR (Hammer and Champy 1993).

Independent Variables

Three measures of organizational reduction were used in this study in an effort to capture any change in the structural configurational variable of specialization. The
three types of reduction are (1) organizational employee size (Ford and Slocum 1977, Moskal 1992); (2) organizational dis-integration size measures (Harrigan 1983, 1988; Langley 1992), and (3) technology size measures (Bamberger, Bacharach, and Dyer 1989; Miller et al. 1991). The change in each one of the three independent variables is done by taking pre- and post-OWFR measurements. The three independent variables are outlined in the next three subsections.

The study of organizational change has been well tested during periods of growth (Leifer 1989). The key variable used by previous studies has been that of absolute change in the number of employees (Baker and Cullen 1993; Child 1973; Dalton, Lawrence, and Lorsch 1969; Kimberly 1976; Lal 1991; Miller 1986; Pugh et al. 1964/1965). The use of a single measure of size is inadequate for organizations that are resizing. Companies may resize in a number of ways. Harrigan (1983) pointed out that organizations operating in the mature phase of the life cycle may choose to dis-integrate. Dis-integration as an end-game strategy reduces the number of employees through the selling of unneeded assets to outside companies. Again, OWFR may simply be accomplished through mass layoffs without the selling of assets.

**Employee Size-Change Measures**

Previous growth studies have used absolute size of the organization and age of the firm as variables influencing the organizational structure configuration (Hickson, Pugh, and Pheysey 1969; Kimberly 1976; Pugh et al. 1968). Age and size typically
have been associated either as limiting or as enhancing a firm's ability easily to change strategy or structure (Chandler 1990; Inkson, Pugh, and Hickson 1970). Because the study requires all firms to be in the mature phase, as suggested by Harrigan (1983), the age of the firm does not become a factor. The change in size was measured using the percentage of change in absolute number of employees for each company during the 1987 to 1993 time period.

**Dis-integration Size-Change Measures**

Besides reducing the number of employees through either natural attrition or involuntary layoffs, changing the number of employees may also be accomplished through the use of dis-integration. Dis-integration is generally accomplished by the selling of certain under-performing or non-essential assets. Langley (1992) likes to use the term asset parsimony when reengineering the organization with an eye toward reduction.

Harrigan (1980, 1983, 1988), a pioneer in the study of organizational decline, identified certain alternative end-game strategies when the competitive climate is not favorable for growth. To measure the level of dis-integration, the percent change in dollar value of assets from 1987 to 1993 period was used for this study to coincide with the change in size independent variable.

**Technology Size-Change Measures**

Technology and how it affects the structure of organizations has received considerable attention (Aldrich 1972, Alexander and Randolph 1985, Beyer and Trice
1979, Child 1984, Fry 1982, Huber 1990, Miller and Droge 1986, Zmud 1982). A review of the literature revealed that both process technology and information technology can have a dramatic impact upon structure. In the most recent literature covering the impact of technology, it is the use of both process and information technologies that is making the most dramatic changes within organizations.

New manufacturing techniques combined with on-line engineering, often called concurrent engineering, are playing a major role in manufacturing companies (Best 1993, Freedman 1993). The use of concurrent engineering allows for the elimination of the older paper method of design-redesign. The new method permits engineers to directly interact with the manufacturing system to make immediate changes. The worker in this environment is required to have a broader base of skills and is considered to be more of a generalist than a specialist. These generalists can take responsibility for the full production cycle (Coates, Jarratt, and Mahaffie 1989; Mullin 1993).

Automation through the use of intelligent agents can automate routine tasks, freeing time for individuals to reduce anomalies. This type of automation requires workers who are familiar with more than one specific aspect of the manufacturing process (Cherry 1989). As the level of technology increases, even more complex functions can be automated, removing the need for specialists in the organization to focusing upon one specific task (Lopes 1993). To measure the level of change in technology, the use of research and development expenditures for the 1987 to 1993 time period was used. The database containing the information about R&D
expenditures also includes product development dollars. Included in the questionnaire for this study are two questions specifically concerning the process/information technologies and product development expenditure ratios.

Sample Selection

Sample Characteristics

Kathryn Rudie Harrigan (1983, 1988) studied organizations that were experiencing decline. Each of the industries used in the end-game strategy studies had the four following characteristics: maturation, highly integrated, diversified, and divisionalized. A fifth characteristic, internationalization, is added to better represent the current competitive environment faced by organizations today. All five of these characteristics are discussed below.

Maturation

Although Harrigan's (1983, 1988) studies focused on end-game strategies, she found that industry maturation was a major factor. Maturation typically exists when companies have been in business long enough to produce a shake-out period where weaker competitors have been eliminated. This was found to be true for Harrigan's (1983) study. As a defining factor for this study, generalizability should be improved with the inclusion of this factor.

Integration

Integration is a necessary element because of the economic advantages enjoyed
by fully integrated companies. The more integrated a company is, the less it depends on third parties for resources. Integration allows for consistencies in this study to be compared to other studies where conditions may not be the same (Harrigan 1983).

Diversification

The ability to diversify and minimize cyclical economic swings is a strength in any industry. Internalization of subsidiaries historically has provided market entry barriers that few market challengers have mastered. For this study, the industry selected not only achieved vertical integration but related horizontal integration as well.

Divisionalization

Most companies undergoing business-process redesign generally have divisions (Hammer and Champy 1993). Many managers' decisions about the organization's ability to adapt to its environment may be limited by the divisional structure. The inability to adapt to the new competitive global environment gives credence to Chandler's (1962) theory that structure follows strategy. The divisionalized form employed by major oil companies may limit their ability to adapt to another organizational structure form. Differing reasons and procedures were used to justify and undertake organizational resizing, but the end results were similar because of throughput requirements and the reasons found in population ecology theory.

A fourth constraint upon sample selection, not considered in Harrigan's (1983) earlier study that may explain the inconsistency across her population, is
internationalization. The data for her study were obtained during the early 1980s, which was a period of growth and may have insulated those companies from being forced to make end-game strategic decisions.

Internationalization

Internationalization provides the opportunity to evaluate the impact of change of foreign operations upon the domestic organization. The inverse should also be available for future analysis since some of the respondents' operations are headquartered in foreign countries and the impact of domestic (United States) operation organizational changes can impact the foreign-controlled organizations.

The transference of resources from the host country to the home country is common to the subjects under consideration. Reorganization of the domestic organization because of changes in the international market provides another factor for change (Negandhi, England, and Wilpert 1981). This impetus for change adds a new dimension to the organization for those organizations operating in an international arena that includes some saturated markets (the U.S. in particular).

Target Population

The industry selected for this study met the following five characteristics:

1. **Mature**—The companies were in the mature stage of the industry life-cycle. These companies have been found to be more prone to undergo OWFR.

2. **Fully Integrated**—The industry selected made efforts to control the risks in their environment as a strategy by forward and backward integration. The literature suggests that these industries are more likely to resize.
3. **Divisionalized**—The companies have had or have each of the integrated parts of the business divided into divisions.

4. **Diversified**—Each of the companies have related horizontal diversification that would allow a company multiple opportunities to restructure, resize, and dis-integrate.

5. **International**—The companies all have international operations. This one factor was unique in that it distinguished the companies that used end-game strategies from those that did not.

The computer, aircraft manufacturing, steel, oil, and defense industries meet the above requirements. The participants selected for this study were from the oil industry, which not only meets all of the above criteria but also has been an integral part of the overall economic well-being of the industrialized world (Schumpeter 1947).

Through the use of Compustat PC Plus, fifty-one fully-integrated oil companies were found to fit the criteria outlined above. Appendix A lists these companies and also gives an overview of the current state of the industry and the business environment. It should be noted that six of these companies used in this study account for nearly 90 percent of the world market share (Sampson 1975). These six companies are Royal Dutch Petroleum/Shell Oil, Exxon, British Petroleum, Mobil, Texaco, and Chevron (Gulf Oil was purchased by Chevron in 1984). The characteristics given above were necessary so that control for comparison and generalizability could be maintained (Blau and Scott 1963). Although fifty-one oil companies were used, the inclusion of the above six enhanced the robustness of the study.
Significance of Research

The findings of this study not only expanded the knowledge pertaining to organizational change, but also contributed to the general body of knowledge by identifying effective strategies for industries in declining and/or saturated economies. As previously noted, empirical research has been focusing on growing organizations in relation to specialization (Blau et al. 1976, Hall 1968, Pugh et al. 1968, Reimann 1973). Almost all of the past research was conducted using organizations during periods of economic growth. This research extended the findings of past research using the same accepted structural measures for organizations undergoing structural change, but was specifically targeted at organizations undertaking OWFR. This research was specifically targeted at organizations that (1) were in saturated markets, (2) had little, if any, opportunity for growth and, (3) were restructuring to cope with the marginal economic and intense competitive conditions (Melcher, Burrows, and Smart 1991).

Because of the lack of study of organizations in decline, little is known about what can be done to facilitate the changes (Harrigan 1980). Robert Duncan (1972) suggests that, until the parameters of the organization are understood, the interrelationships of strategic decisions and the corresponding structures which they yield will be obscure. Only through a complete understanding of the organization and strategy-structure interrelationships during times of both prosperity and economic decline can the development of useful strategies be formulated. The purpose of this research is to contribute to such an understanding.
Methodology Overview

The objectives of this study were twofold. The first was to measure changes in organizational structure in an effort to validate assumptions made about the organizational work force reduction. The second was to test the hypotheses on the relationship between changes in the number of employees, changes in the level of integration, and changes in technology, in relation to organizational structure. A questionnaire was mailed to fifty-one fully integrated oil companies to collect the needed data to meet these two objectives. The questionnaire included questions on specialization as well as qualitative factors that gave both depth and texture to the independent variables. Multiple regression was used to measure the relationships between the independent and dependent variables.

Chapter Summary

Organizational resizing as practiced in the late 1980s and early 1990s through downsizing, rightsizing, and business process reengineering is not consistent with accepted established empirical research on organizational structure. Because of this inconsistency, changes in specialization were measured and correlated to the performance of the chosen sample population. Determination of the impact of resizing upon the structural configurational variable was needed in order to provide a starting point in the development of a more complete strategy-structure paradigm.

This study contributes to the development of a foundation of knowledge relating to organizations operating in static markets. Growth strategies may not be the
most appropriate strategies for organizations in static markets. Jay Forrester (1971) suggests that the long-term trend for all world markets will be that of saturation by the mid-to-late 1990s. Options, such as the need to expand into less developed countries may prevent many multinational corporations (MNC's) from investing in the immediate future until appropriate strategies can be developed for all phases of the business cycle and life cycle of the organization.
CHAPTER 2

LITERATURE REVIEW

Overview

The literature review is divided into four sections. The first section provides an overview of the research that has been done on organizational work force reduction (hereafter called OWFR). This first section is composed of three parts: rightsizing, downsizing, and business process reengineering. Each of these three subsections contains, where appropriate, the reasons for resizing, the ways the resizing is accomplished, and the results of resizing. This information is presented in chronological order. The review of OWFR provides a foundation for the study of organizations reversing their internal structural growth paradigms.

The second section discusses the literature relating to the construct variables. The construct variables used in this study come from the organizational change literature that focused on structural change. Although the previous literature utilized these same constructs for studying organizational growth, they have proven both reliable and valid in studying structural change due to OWFR. The construct variable section is composed of four parts. The first part broadly discusses structural configuration. The second part examines the literature concerning the dependent variable that is used for this study, the structural configurational variable of specialization. The third part includes the literature pertinent to the three independent
variables, their history, and their reliability. Each of the measures of organizational size-change agents is discussed as to its relevance to this study as established by earlier research. The traditional structural measurement of absolute number of employees is presented and analyzed as well as the changes brought about by organizational dis-integration and changes in technology. The fourth part discusses alternative explanations for changes in specialization.

The third section contains the research hypotheses. The hypotheses in the third section are categorized by independent variable. Also included in this section is a hypothesis table that includes past findings that focusing on organizational expansion as well as the proposed hypotheses for this research project that focuses on organizational work force reduction. The fourth section summarizes the chapter.

Organizational Work Force Reduction

The following section is divided into three parts covering the three primary applications used to accomplish organizational work force reduction: rightsizing, downsizing, and business process reengineering. Each part contains an overview of both the quantitative and anecdotal observations of how work force reduction has been accomplished by these three methods. Using qualitative analysis procedures, each area was analyzed to determine the emerging themes present in each application.

The qualitative parameters used to classify each of the articles were based upon two criteria. The first criterion was the type of journal. The second criterion was ranking based on the number of articles relating to one of the three types of OWFR:
downsizing, rightsizing, or business process reengineering. A review of the literature also reveals the temporal nature of the OWFR phenomenon itself (Bromiley, et al. 1988). An evolution of a sort has emerged that has changed the way managers use their human resources. Each of the following categories of articles highlights the time sequence and reason for being. Continual anecdotal reporting of mergers, downsizing, and business process reengineering makes this study relevant. Table 2 illustrates when rightsizing, downsizing, and business process reengineering were introduced as management concepts and the total number of references found in the literature search referring to each type of resizing.

Table 2. — Time Analysis of OWFR

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rightsizing (79 articles)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Downsizing (238 articles)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Business Process Reengineering (252 articles)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Because of the significant time period occurring between the beginning of the three methods of organizational contraction, the motivating factors and the results achieved, if any, could be different. Nevertheless, the impact upon the structure should be understood when organizational contraction occurs.
Rightsizing

Rightsizing is a term most often used to describe the procedure for matching the number of employees with the long-term plans of the organization for work to be performed. The literature, in most cases, uses rightsizing to describe the process of laying off redundant positions after a merger or hostile takeover. Often, evaluations are performed to determine what the optimal staffing requirements are for the present work (Beer 1985). Once the optimal staff size has been determined, a systematic process of layoffs, reassignment, and restructuring takes place. Table 3 illustrates the distribution of articles by journal type, number of journals, and the number of articles. Figure 3 shows the distribution of articles by journal type over the 1990 to 1995 time period.

Table 3. -- Rightsizing

<table>
<thead>
<tr>
<th>Journal Type - breakdown</th>
<th>Number of Journals</th>
<th>Number of Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Information Technology</td>
<td>27</td>
<td>50</td>
</tr>
<tr>
<td>Human Resource Management</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Financial - Accounting</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Insurance - Real Estate</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>News (anecdotal)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>54</td>
<td>79</td>
</tr>
</tbody>
</table>

Cameron (1991) found, more often than not, that excess staff from redundant positions were terminated without any consideration for unfulfilled opportunities
within the organization. Compounding the problem of poor performance, leveraged buyouts exacerbate problems for the already debt-laden companies during a recession (Hanna 1988, Wren-Lewis and Eastwood 1987). This makes it easier for managers to justify the staff reductions during turbulent times. Changes in information technology can occur in two different ways. The first is the rightsizing of the information system. The second is the resizing of the number of programmers, analysts, and computer maintenance personnel required to operate the system (Rowley and Smiley 1991, Seracevic 1991). The focus of this study is concerned with the latter, the reduction in personnel.

Global competition is one of the primary reasons for this recent phenomenon (Ansoff 1987). As more competitors enter the market through merger and acquisition, with the rate of growth remaining constant, it takes little time for the market to reach saturation (Freeman 1991). At this point, competition changes focus from growth through marketing to competition through price competitiveness (Melcher, Burrows, and Smart 1991). Recent examples are the RJR-Nabisco merger and the diversification of Anheuser Busch into the Eagle Snack Venture by which the new product lines almost immediately saturated the snack food market.

A more in-depth analysis was performed to compare the journal type with the content of each article. Table 4 refines the preceding figure by classifying the articles by topic as specifically relating to the rightsizing phenomenon. These four topics are: motivating factors (MF), organizational contraction processes (OCP) (instructions), results achieved (RA) and outsourcing (OUT).
As an example of changes being forced on a corporation, Frito-Lay had to reevaluate its available opportunities. Reorganization through layoffs was necessary in order for the company to remain profitable while attempting to become more competitive.

Table 4. — Rightsizing by journal

<table>
<thead>
<tr>
<th>Journal Type</th>
<th>Motivating Factors</th>
<th>Contraction Process</th>
<th>Results Achieved</th>
<th>Outsourcing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management *</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Information Technology **</td>
<td>27</td>
<td>5</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>Human Resources</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Finance and/or Accounting</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Insurance and/or Real Estate</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>News (anecdotal)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>TOTAL</td>
<td>41</td>
<td>8</td>
<td>20</td>
<td>10</td>
</tr>
</tbody>
</table>

* Two of the thirteen articles were focused on material asset rightsizing.
** 70 percent (35 of 50) of the Information Technology articles were focused on changing the size of the computer system from a mainframe type system to a shared LAN type system.

This strongly supports Hammer and Champy's (1993) argument for change, but not necessarily for decreases in specialization. The environmental turbulence caused by these external forces caused changes in the strategies used by these corporations (Ansoff 1987, Duncan 1973, Lant and Mezias 1990). Reactions to this turbulent environment are varied, but management's philosophy is that this turbulent period will
pass, and that things should return to normal once the recession is over.

The major problem in the 1987-1994 recession is the number and type of cutbacks in staff (Cameron 1991). The challenge of overcoming the negative consequences, however, often outweighs the benefits of staff reductions. The net reduction in organizational effectiveness may not be seen by the company until a recovery is underway and the available talent pool is being used for reactionary measures rather than proactively meeting the needs of the customer. The decline in output of the individual should be expected during times of staff reduction (Albrecht 1987). Having fewer people often means that less is accomplished done because of lack of (human) resources. Additionally, as long as the company's bottom line does not improve and there are continual threats of termination, there is a decline in both morale and productivity (Overman 1991). The past practices of voluntary rightsizing, which replaces the older (expensive) employees with younger (cheaper), must be reviewed (Warner 1991).

Reviewing the corporate structure is necessary to determine if the recessionary environment overcomes the organization's strategy for future success (Brown 1991, Daft and Weick 1989). A review of the strategy must also be accompanied by a realistic review of the organizational structure itself. The determination of a congruence between the strategy and the structure is crucial if effectiveness is to be maintained (Argyris 1985). Key issues, such as a centralized or decentralized structure, may mean the difference between being a market leader, follower, or surviving at all (Robbins 1983).
Downsizing

Downsizing is a broad generic term describing layoffs or terminations of scores of employees. Downsizing has been attributed to several events both internal and external to the organization. Miller (1990) suggests that there has been a divergence by management from using realistic environmental scanning. They have instead relied on past skills to carry them through and that this divergence is the root cause of downsizing. Because executive management relied on past successes, they were often unwilling to change. This lack of change builds rigidity into the structure. Only after a financial disaster occurs does management either change its philosophy or bring in new management to help reorganize the company to aid its adaptation to the new world environment.

Articles relating to downsizing were classified in the same manner as those in the section on rightsizing. This analytic approach yielded results similar to the rightsizing analysis, except that there were fewer information technology articles. This may be due in part to the use of downsizing as a term before the speculated cause of increased efficiency through computer use was suggested.

A major difference from the business process reengineering analysis is the subject matter of the information technology articles. Many of these articles (34 out of 42 found in information technology journals) focused on downsizing the present mainframe computing capacity and putting the computing power on the desk of the user (see table 5). Mainframes are primarily be used for databases and data exchanges between the individuals in the firm. Microsystems, such as those sold by SUN, were
examples of the types of computers used to accomplish downsizing from a mainframe. Figure 4 illustrates the distribution of articles on downsizing by journal type, the number of journals, and the number of articles. Figure 4 shows the distribution of articles by journal type for the 1990 to 1995 time period.

Table 5. -- Downsizing

<table>
<thead>
<tr>
<th>Journal Type - breakdown</th>
<th>Number of Journals</th>
<th>Number of Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management</td>
<td>34</td>
<td>102</td>
</tr>
<tr>
<td>Information Technology</td>
<td>19</td>
<td>42</td>
</tr>
<tr>
<td>Human Resource Management</td>
<td>4</td>
<td>38</td>
</tr>
<tr>
<td>Financial - Accounting</td>
<td>8</td>
<td>27</td>
</tr>
<tr>
<td>Insurance - Real Estate</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>News (anecdotal)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>78</strong></td>
<td><strong>238</strong></td>
</tr>
</tbody>
</table>

The newer technology, Local Area Network (LAN), is being used to track quality that enables managers to make decisions for improvement or cost cutting through reduction in personnel based on accurate, real time information. Computer technology was also cited as providing the company with a customer profile enabling the company to maintain a customer focus through improved services (Cox 1988). This allows sales/marketing managers to evaluate the number of sales personnel required to sell a given number of products, based on volume and buying habits. The information provided by the computers also allowed companies to track costs through intensive review and analysis of opportunities for cost reductions. Finally, the
Abstract Analysis / 1990 - 1995

Number of Articles

Figure 4. -- Downsizing
computer technology provided the company with paths for active data interchange permitting management to keep abreast of changes both within and outside of the company and minimizing the need for staff analysts to track data and build reports for upper-management decisions (LaPlante 1990/1991).

A more in-depth analysis was performed to compare the journal type with the content of each article. Table 6 refines figure 4 by classifying the articles by topic as specifically relating to the downsizing phenomenon.

Table 6. -- Downsizing by journal

<table>
<thead>
<tr>
<th>Journal Type</th>
<th>Motivating Factors</th>
<th>Contraction Process</th>
<th>Results Achieved</th>
<th>Outsourcing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management</td>
<td>13</td>
<td>35</td>
<td>37</td>
<td>17</td>
</tr>
<tr>
<td>Information Technology</td>
<td>7</td>
<td>8</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>Human Resource</td>
<td>2</td>
<td>15</td>
<td>18</td>
<td>3</td>
</tr>
<tr>
<td>Finance and/or Accounting</td>
<td>2</td>
<td>15</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Insurance and/or Real Estate</td>
<td>1</td>
<td>5</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>News (anecdotal)</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>28</td>
<td>83</td>
<td>102</td>
<td>25</td>
</tr>
</tbody>
</table>

The topics for table 6 have been broken into four categories: motivating factors (MF), organizational contraction processes (CP instructions), results achieved (RA), and Outsourcing (OUT). In contrast to the rightsizing articles, there was little focus on asset downsizing.

Another cause of organizational structural changes through downsizing is found in technological advances in industry (Kuhn 1970). As evidenced in many
management textbooks (Daft 1992, Holt 1990, Mintzberg 1979) the rate of change in technology has been tremendous and greatly influences the structure. As technology advances in each field, there is pressure to keep pace with the change (Burke and Hornstein 1972). Product obsolescence is only one facet in the onward rush of technology (Clark and Abernathy 1985, Jelinek 1979, Burns and Stalker 1961, Schumpeter 1934).

Opportunities for helping companies make the necessary structural transition are best achieved when employees who would normally be displaced are now used in new job specializations. The tasks of matching human resources and skills to job requirements and location are challenging yet profitable for the company (Harris 1991). As job requirements change and jobs are eliminated in favor of new, combined positions can be filled with individuals who can perform multifunctionary tasks. This is in contrast to the specialist, who according to theory, will work more efficiently if confined to a single task than will a person who changes tasks frequently.

Recessions force individuals to be more resourceful, and, with the average level of personal computer experience on the increase, the need for internal consultants will continue to decline. As a result of increasing technological proficiency by computer users, productivity is enhanced through intensified communications with staff personnel and greater use of staff brainpower to meet customer’s needs (Denn 1991). Questions being asked by end users have focused more on how to transfer data between programs rather than that of program operation itself (Buckler 1990). In comparing the cost of contract labor with that of retaining company personnel, many
managers opt for the contractor because of the total cost of continuing the relationship with the company employee.

Part of the downsizing phenomenon can not only be attributed to changes in manufacturing technology, but in the marketing function as well. The changes brought about by improved channels of communication and the need to lower costs are challenging some industries to reevaluate their marketing strategies. Niche marketing has greater impetus during a recession because of the ability to adapt to and satisfy the consumer using personalized service (Dent 1991). In fact, OWFR may be the reaction of some managers to an adoption of a niche strategy in which broad product lines are no longer demanded by consumers. The ability to adjust to a changing market demand is a determinant in defining a corporation's ability to compete in a global market (Ansoff 1990). Changes in market demand encourages management to adjust staff accordingly to be globally competitive.

Telemarketing and consumer profile databases allow for the target marketing of a vast array of products used by the same social class of individuals regardless of product line (Otis 1991). Communication is still at the heart of the marketing program (Hardy 1991). Changes in the methods of communication are evolving with advances in technology. Telephones, computers, fax machines, and even the Internet are beginning to lead the way in covering the prospective client base, reducing the need for the traditional face-to-face sales force. This reduced need for the human element in communication gives strength to the managerial argument that the downsizing of the organization is necessary.
Another facet affecting the decision for firms to downsize concerns the legal ramifications of targeting higher salaried employees. These employees are typically those with seniority who are in a protected age group. These same employees are seen by other companies as potential assets. The ability to deal with a third-age (50 and older) employee population whose wealth, skills, and health provide ready assets for many companies looking for ways to fill shortages in the high skilled labor pool is a new resource option not previously available (Lewis and McLaverty 1991). Efforts by the Internal Revenue Service to discover evasion of payroll taxes through the use of contract employees may limit the flexibility of some employers (Stern 1991).

Industrial organizational relationships also change the perspectives of management and unions when engaged in the bargaining process. In downsizing employees tend to shift their focus from salary and benefits to job security. Management's dilemma is to shift the staff's focus from their job fears to the company mission (Denn 1991). This shift in perspective compels management to make an effort to convince the employees that they are not to blame for any intermediate failures inherent in the downsizing process. Management's reevaluation of their own position within the company will tend to impede their ability to help the company reach its full potential. Managers may want to reevaluate the security of their present job and search for a new position with less risk and more security (Hersh 1991).

Outsourcing computer services is another strategy used by corporations to enhance the organization's ability to service the customer while lowering costs. The ability to shift the information management system from in-house to an outside service
company allows the contracting company to focus on the core business rather than on internal management (Palframan 1991). Individuals need to master a broader range of skills to minimize the impact of changes in information technology (LaPlante 1991).

Personnel reduction for MIS companies must be done carefully so that only the fat is removed from the company. Cutting into the muscle and bone can be damaging to the company, affecting morale and productivity (Freedman 1991). Diversification of MIS companies into marketing provides the needed expansion to help these companies balance business demands from recession to prosperity. Many opportunities exist for the MIS entrepreneur to diversify and to manage customer and/or data mailing databases (Robbins 1983).

Business Process Reengineering

Of primary interest to this study is the concept of reengineering the organization. The term reengineering was coined in 1990 by Michael Hammer of the Harvard Business School. The concept of reengineering focuses on doing business in a totally different way whereby the specialization is on the process of the business, not on the individuals. This is accomplished by designing data systems, communication systems, and formalized procedures that negate the need for specialists within the company. Figure 5 illustrates how the journals and topics on this subject were distributed. Primary qualitative findings demonstrate that most articles relating to business process reengineering have focused on information technology.
Abstract Analysis / 1990 - 1995

Figure 5. -- Business process reengineering
Secondary findings indicate that total overhaul of the organization without regard to current business practices is recommended by 25 percent of the articles. Another 25 percent believe that an incremental process, combined with a focus on particular strategic business units, works best. The remaining 50 percent believe that information technology is the key to eliminating inefficiencies in serving the customer.

Most of the articles about business process reengineering were written by journalists or consultants who were either reporting or advertising successes. Few articles discussed the structural implications of business process reengineering or followed an acceptable research framework in validating observations. Table 7 gives a percentage breakdown by industry undergoing business process reengineering.

The claims for success when BPR has been used as a tactical tool have been questioned (Gleckman 1993, Beer, Eisenstat, and Spector 1990). All of the articles have focused on only three areas as compared to the four areas for both rightsizing and downsizing. These three areas include motivating factors, anecdotal descriptions about how to accomplish BPR, and results achieved. For this reason, there is little value in analyzing these articles in depth.

A more insightful look at the BPR process is achieved by looking at the numerous books available. One of the most often cited works is by Hammer and Champy (1993); in which Michael Hammer coined the term business process reengineering. Hammer and Champy (1993) suggest that the key to engaging in BPR is the utilization of an integrated information system. A high-quality information
Table 7. -- Business process reengineering by journal

<table>
<thead>
<tr>
<th>Journal Type - breakdown</th>
<th>Number of Journals</th>
<th>Number of Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Technology</td>
<td>19</td>
<td>122</td>
</tr>
<tr>
<td>Management</td>
<td>26</td>
<td>45</td>
</tr>
<tr>
<td>Engineering</td>
<td>6</td>
<td>19</td>
</tr>
<tr>
<td>Insurance</td>
<td>7</td>
<td>16</td>
</tr>
<tr>
<td>Banking</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Accounting and/or Finance</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Oil and Gas</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Human Resource</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>TQM, JIT, and/or Quality</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Utilities</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Real Estate</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>News (anecdotal)</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>TOTAL</td>
<td>81</td>
<td>252</td>
</tr>
</tbody>
</table>

system is used by the organization to map the work processes to effectively reengineer the organization, not by function, but by the business processes as the customer sees the company.

Over 50 percent of the articles focusing on business process reengineering did so with an information systems perspective (LaPlante 1991). Efforts to control cost during a recession also forced more charge-backs to the end users of networks for program support (Salamone 1990). Because of system design, costs remained constant, but the distribution of those costs was more evenly spread among all the
users within the company. This redistribution allowed for closer monitoring, control, and charge-backs among the various operating units affecting business process reengineering decisions.

Summary of OWFR

Downsizing, rightsizing, business process reengineering, restructuring, and outsourcing are all popular terms used to describe ways to rejuvenate the organization (Greenstein 1991, Hoplin and Hsieh 1990). Nonetheless, each of these tactical processes to rejuvenate the work force have shown little, if any, success in bringing about the desired or projected changes of improved organizational performance (Baggerman 1993, Lissy 1993, ). It has been estimated that between 50 and 75 percent of business process reengineering projects fail (Stewart 1993).

The major findings of the analysis of the three methods of rightsizing, downsizing, and business process reengineering are three-fold. First, information technology is an important prerequisite for accomplishing the contraction of the organization. The process of bringing the information closer to the decision maker has given opportunities to shrink the organization as never before. Second, all functions in the organization have been affected in the contraction process. Each of the functional areas are now linked with the newer LAN systems, enabling managers to obtain accurate information more quickly. Third, because of the ease of information flow, the distinct lines of responsibility and authority have become blurred.

The literature about OWFR provides the foundation for the categorization of
the independent variables. The OWFR literature revealed that these three categories are: (1) reduction in the number of employees, (2) dis-integration, and (3) changes in technology. The reduction of employees was accomplished through both planned and unplanned layoffs, terminations, voluntary severances, and early retirements. The dis-integration was accomplished through the selling or closing of non-essential subsidiaries, strategic business units, divisions, or an increase in the level of outsourcing that accompanied the closing of a department. Changes in technology were predominantly accomplished in two ways. The first was through the purchase or utilization of smaller computers operated in local area networks (LAN's) or mini-frame usage. Automating a plant or operating facility through the installation of process logic controllers (PLC's) was the second means by which technology was employed to downsize a company.

A lesser finding, in some respects, is the negativity associated with the terms and actions of organizational contraction. Downsizing, rightsizing (implications of being wrongsized), outsourcing (inadequateness), and reengineering are negative terms. Usage and implementation of these terms in the organization may explain why low morale, feelings of insecurity, problems with theft, and poor employee performance emerge after any of these events (Denn 1991, Freedman 1991, Overman 1991, Reshef 1988).

Most surprising, and probably one of the more important findings in the review of the literature, was the lack of research concerning organizational contraction in comparison to the literature done on organizational growth. Many theories on
competitiveness in the organization are contingent upon the strategy-structure relationship (Ansoff 1988, Chandler 1962, Daft 1984).

Construct Variables

This section is divided into three parts. The first section broadly discusses structural configuration. The Structural Configuration section sets the stage for the introduction of the dependent variable. The second section covers the dependent variable represented by one measure of structural configuration: specialization. The third section covers the three independent variables: change in number of employees, change in level of integration, and change in technology, as described by the literature.

Structural Configuration

The percentage change in number of employees best represents the degree of structural stress which a company has undergone and provides the link between the strategy/structure paradigm (Chandler 1962, Greiner 1972). Reinforcing the strategy/structure paradigm is the relationship of structure and organizational change, described by Minzberg (1979) as the outcome of adaptation.

As organizations grow over time, they tend to become more formalized and centralized (Alexander 1983). Centralization does not foster creativity nor allow for the necessary adaptation required in a turbulent environment (D. Miller 1991). Again, reference is made to Larry Greiner's 1972 model of the periods of evolution and revolution. From a strategy/structure perspective, four fundamental forces impact structural change; they are crises of leadership, autonomy, control, and red tape. Larry
Greiner also raised the issue that there was a fifth, unidentifiable, crisis that would occur, but as of 1972, it had yet to be seen as evidenced by a structural change. Kathryn Rudie Harrigan in 1986 suggested that, during their process of growth, organizations reach certain limits. These limits, in Griener's terms, would be the fifth crisis. The crisis would be the immediate inability to adapt to a non-growth market. This fifth crisis forces an organization to adopt Harrigan's end-game strategies if it is to remain competitive. Change in structure and a movement toward generalization and away from specialization was recommended by Hammer and Champy (1994) in addition to the end-game strategies suggested by Harrigan.

The age of the organization has a great impact on its structure. The older the organization, the more the structure tends to become formalized. The organizational structure also reflects the age of the founding industry, which tends to validate both Greiner (1972) and Harrigan's (1988) philosophies about maturing organizations. The size of the organization also determines the formalization of behavior (Child 1973). As discussed earlier, when organizations become too large for informal channels of communication, there exists a need to standardize work, performance, and outputs for efficiency's sake. This growth encourages and fosters the concept of work specialization and the efficiencies inherent by performing a specific duty or task.

Managerial style also affects the structure of the organization. The more autocratic the managerial style, the more centralized the structure becomes (L. Miller 1989). The opposite also holds true for the corporation that operates within a dynamic environment that demands a work force composed of many employees with technical
expertise. This type of environment pushes the organization into an organic state in which flexibility is the norm in dealing with less than ideal circumstances.

Frame breaking is another term that describes what happens to organizational structure during periods of revolution (Tushman, Newman, and Romanelli 1986). The five pulls within the organization, that is, to professionalize, centralize, balkanize, collaborate, and standardize, are forces that help an organization adapt to the changing environment from an internal perspective. Understanding the five pulls upon the structure helps in comprehending the intricacies of the forces that drive internal structural change (Mintzberg 1979). Each of these five pulls depends on the structural configurational factors as keys for implementing organizational structure changes.

Events or changes external to the corporation also play a significant role in how corporations decide or are driven to make structural changes. Limited growth capabilities for an organization can be caused by several factors. Limits on needed resources or limits in the number of buyers due to a saturated market are only two constraints upon a corporation (Ansoff 1987). Limited markets force organizations to reevaluate strategies to determine which strategy works best in the environment in which they find themselves operating (Ansoff 1990). It is necessary for an organization to adapt if it is to emerge successfully after a recession. Structural rigidity also occurs over the period of evolution that a company enjoys during the absence of frame-breaking technology (Tushman, Newman, and Romanelli 1986). The literature suggests that OWFR can occur three ways: vertical, horizontal, or a combination of vertical and horizontal layoffs. Vertically, an organization can dis-
integrate by selling a part of the organization. Horizontally, it can reduce the work force by eliminating a level within the organization or incorporating both vertical and horizontal methods to accomplish OWFR. These methods are illustrated by pyramids representing organizational structure in Figure 6. The “a” pyramid represents a company that has eliminated an organizational level(s). The “b” pyramid represents a company that has eliminated a department, section, division, or a strategic business unit. Changes in either the vertical or horizontal division should result in a change in specialization and is discussed in the following section.

**Dependent Variable - Specialization**

Specialization was introduced in the 1960s by the Aston Studies as a variable that reliably helped in providing a needed dimension of organizational structure (Pugh et al. 1968, 1969b). This variable was part of their effort to define key elements in the structure and formation of the organization. The Aston study began in early 1963 with a long qualitative process of gathering information from managers that was unique to each of their business structures. The first of these components was structuring of activities, which was defined as specialization (Pugh et al. 1964-1965). A questionnaire was developed from the qualitative analysis about specialization of employees by tasks across all organizations. This questionnaire accounts for 65 percent of the variance when measuring for specialization (Miller and Droge 1986, Pugh et al. 1968).
Figure 6. -- Structural connection

Representing horizontal connection
Organizational Pyramid "p"

Representing vertical connection
Organizational Pyramid "e"

Department or division
De-inscription or division

Vertical and horizontal methods of OVRP
Specialization is a term used commonly both as a research variable and as a managerial term to describe how jobs or tasks can be broken into greater detail. As a research variable, it is an effective measure of how tasks are divided and classified into narrow domains on the micro-level by individuals or on the macro-level by divisions (Blau et al. 1876; Caufield 1989; Miller et al. 1991). Specialization, as a measure, is based upon a scoring of sixteen activities or tasks that are clearly distinguishable from one another. These sixteen tasks are found in table 8. A specialist, therefore, is an individual whose full-time job assignment falls into one of those sixteen functions found in table 8. The uniqueness of this measure is its dependence on the size of the organization. Child (1973) found a strong correlation between organizational size and the level of specialization within the organization.

Table 8. -- Sixteen specialized tasks

| Public Relations and Advertising |
| Sales, Distribution, and Servicing of the Output |
| Transportation of Raw Materials and Finished Product |
| Selection, Placement, and Retention of Employees |
| Training of Employees |
| Monitoring Environmental Impact of Operations |
| Purchasing of Materials for the Company |
| Maintenance and Construction |
| Accounting and Invoice Processing |
| Control of Work Flow and Assignments |
| Quality Inspection of Materials and Output |
| Assessing and Devising Ways of Production |
| Devising New Equipment, Processes, and Output |
| Development and Carrying Out of Administrative Procedures |
| Resolving Legal Matters for the Company |
| Marketing Research |
The benefits of using the functional or task oriented measure of specialization as provided by past studies is that it provides a well defined, repeatable measure that is comparable across companies (Blau et al. 1976; Caufield 1989; Child 1973a; Pugh et al. 1969). The functional or task measure of specialization is superior in terms of reliability to another measure of specialization, division of labor. Division of labor is commonly measured by counting the total number of job titles within a company (Blau and Schoenherr 1971). Although the division of labor measure is easily performed, it is susceptible to problems of redundancy when counting positions across a company and especially when a company is divisionalized. Researcher bias could impact the results since interpretation is required when measuring and comparing the division of labor specialization score across a sample of companies.

The benefits of the division of labor measure of specialization is that it does not require the respondents to a survey to classify or define roles within the organization. It has been found that once the limitations of the division of labor measure have been overcome, the two measures of specialization are highly correlated (Caufield 1989; Miller et al. 1991).

Task or functional specialization critics cited two types of problems when using this measure. The first is sensitivity to the size of the organization. The second is that it depends on too broadly defined task definitions (Ford and Slocum 1977). The limitations of the task measure of specialization should be minimal for this study since comparisons of differences in specialization will only be done within each company, not between companies. Nevertheless, other methods of obtaining a specialization
measure such as counting the number of sections, divisions, or worker units in a company have the same limitations (Blau et al. 1976).

Regardless of which measure of specialization is chosen to be used in the study, the method of gathering the data must also be chosen. Two methods have been found to be both accurate and efficient for obtaining the data. The first method is the questionnaire. Both interviewing and mail questionnaire methods have been used successfully (Miller et al. 1991; Pugh et al. 1968). The second method, although more costly, is to use organizational charts to gather the data. To use the organizational chart method, the researcher counts the those positions as defined in the Pugh et al. (1968) studies (Sathe 1978). Regardless of procedure, questionnaire or organizational chart, the measurement technique chosen has had little, if any, effect on the results of past studies (Caufield 1989; Miller et al. 1991; Sathe 1978).

The measure of specialization was developed by Bakke in 1959 in a study of the generalized descriptions of the activities found in all organizations. It has been found that these measures are adequate in describing the specialization of tasks in all types of organizations, including industrial, commercial, retail, public, and otherwise (Pugh et al. 1969). Although the primary focus of specialization is the division of labor within the organization, of interest to this study is the distribution of the sixteen potential job assignments that best represents the ways duties have been typically assigned in the past. The unique qualities of specialization and the representation of the needed work-flow assignments allow for the useful comparison of organizations. More importantly for this study, the earlier findings state that as organizations grow
and mature, they tend to have a higher degree of specialization. Determination of whether the opposite holds true is important. That is, as companies reduce the work force, does the measure of specialization, in fact, decrease?

Specialization is one of the key criteria outlined by Mintzberg (1979) in the evolution of the organization. Typically, growth is accompanied by more specialization. The purpose of this study is to find if the reverse is true and what impact it has upon the performance of the organization. Typically, the companies that are larger or more integrated appear to resize more readily than smaller companies. This is consistent with prior research by Porter (1980), who believes that company strategy is highly correlated with its size. Although this concept is contested by Lewis and Thomas (1990), it may be based more on which factors are chosen and manipulated for the study rather than on the methodology employed.

The forces upon the organization are reflected by changes in the measurement of the organizational configuration. The forces for change, when accounted for during the resizing process, provide valuable information for both researchers and practitioners in understanding organizational change. The literature most often uses the structural configurational variables or specialization, standardization, formalization, vertical span, centralization, and traditionalism as the dependent variables because they can be consistently measured and have proven accurate in reflecting changes in the organization.

Because previous research has found that the measure of specialization has such a high degree of correlation with the other five variables, specialization is used
alone as the measure for determining the impact of OWFR. Because of this relationship, it was not surprising that other structural studies have focused on only one or two of the characteristics of structure when measuring change (see table 9).

Table 9. — Specialization measures and methods

<table>
<thead>
<tr>
<th>Single Structural Measure</th>
<th>Specialization (Bakke 1959)</th>
<th>Division of Labor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walsh and Dewar (1987)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zmud (1982)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Because of changes brought about by OWFR, minimization of task specialization is the target of many practitioners and researchers (Dent 1990, Dupuy 1991). Some even advocate elimination of specialists within the organization altogether (see table 10) (Zeleny et al. 1990).

Table 10. — Reduced specialization proponents

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dupuy (1991)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dent (1990)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zeleny et al. (1990)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hammer (1990)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hammer and Champy (1993)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Independent Variables

Growth theory explains that, as companies grow, changes in the structural configurational variables such as specialization occur (Greiner 1972, Mintzberg 1979).
To understand the significance of structural changes in organizations, it is imperative to use the same variables to measure changes in structure during periods of organizational contraction as were used during periods of expansion. The three methods by which an organization may reduce the work force are reviewed in the following section. These three methods are change in the number of employees, change in level of integration, and change in the level of technology employed.

**Change in the Number of Employees**

As an organization grows through an increase in the number of employees, specialization inherently creates niches filled with individuals who perform highly differentiated functions (Child 1973). The rate of growth in the organization is proportional to the rate of growth in specialization within the industry (Lorsch 1970, Lawrence and Lorsch 1969).

Because change in organizational size as measured by the number of employees has been one of the most consistent factors in organizational structure research, it was used as one of the three primary variables for determining the effect on structure. Change in size measured only by the change in the absolute number of employees may be misleading. In fact, the reduction in personnel during the present recession has differed drastically from previous recessions (Jaffee et al. 1991, Kern 1987, Long and Warner 1987). A greater percentage of employees laid off during the recession were white collar workers coming from the professional ranks (Ladner 1990, Mandal 1990, Moskal 1992, Whigham-Desir 1993).
Because of the number of layoffs of exempt personnel during the time period in this study was greater than in the original Aston study (Pugh et al. 1968), other factors were included to provide greater insight into the OWFR phenomenon (Kolsky and Trice 1992). Percentage change in the number of employees was used as the first independent variable measure. Other questions in the survey that concerned organizational strata information were included as well (Warwick and Liniger 1975). The questionnaire included questions about the strata in context of executive management, middle management, and supervisory positions; exempt staff and non-exempt personnel. Use of these factors shed light on what specific levels in the organization were most affected. This gave a better opportunity to determine whether contraction significantly affects structure and, if it does, at what level is the impact the greatest.

Using the total number of employees in an organization as a measure of organizational size is an accepted measure (see table 11). Nevertheless, there are several potential problems when using the numerical count of employees to represent organizational size. First, accounting for part time staff may bias the measurement if not done consistently across the sample under study. Second, if efficiency is part of the overall study counting the overall number of employees could bias results since this same number would be used twice. Since efficiency is not part of this study, this threat to statistical validity is minimized. Blau and Schoenherr (1971) found that organizational size is the most important condition affecting the structure of organizations. It has been found that as size increases, the affects on the other
structural variables increase, although at a decreasing rate (Blau 1970).

Hickson, Pugh, and Pheysey (1969) extended the original Aston study and found that size to be a major determinant of structure. This finding was supported by subsequent studies of organizational size and change (Child and Mansfield 1972).

Table 11. -- Size as an imperative

<table>
<thead>
<tr>
<th>For the use of Size as an Imperative</th>
<th>Against the use of Size as an Imperative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blau and Schoenherr (1971)</td>
<td>Argyris (1972)</td>
</tr>
<tr>
<td>Child (1973)</td>
<td>Mayhew et al. (1972)</td>
</tr>
<tr>
<td>Child and Mansfield (1972)</td>
<td>Hall, Haas, and Johnson (1967)</td>
</tr>
<tr>
<td>Ford and Slocum (1977)</td>
<td>Inkson, Pugh, and Hickson (1970)</td>
</tr>
<tr>
<td>Hickson, Pugh, and Pheysey (1969)</td>
<td></td>
</tr>
<tr>
<td>Khandwalla (1977)</td>
<td></td>
</tr>
<tr>
<td>Kimberly (1976)</td>
<td></td>
</tr>
<tr>
<td>Marsh and Mannari (1989)</td>
<td></td>
</tr>
<tr>
<td>Meyer (1972)</td>
<td></td>
</tr>
<tr>
<td>Miller and Friesen (1984)</td>
<td></td>
</tr>
<tr>
<td>Pugh et al. (1969)</td>
<td></td>
</tr>
<tr>
<td>Robbins (1978, 1993)</td>
<td></td>
</tr>
</tbody>
</table>

Larger organizations have greater specialization scores and other structural attribute measures than smaller competitors. A causal study using longitudinal data confirmed that positive change in size (growth) preceded an increase in specialization (Meyer 1972). Meyer (1972) reached the conclusion that the changes were unidirectional and established that size caused structure.

Although Blau's (1970) size imperatives have withstood close scrutiny, there are those who criticize the use of size as a determinant (Mayhew et al. 1972). The challenge presented by the opponents of the size-structure paradigm focused on the
mathematical certainty that as an organization grows, provided that structural constraints such as standardization of work, centralization, and geographical dispersion of work remain constant, it is almost a certainty that the structural variables are predetermined in their relationship. Another larger, more broad-based study provided additional support for the opponents of the size-structure paradigm (Hall, Hass, and Johnson 1967). This larger study encompassing different sizes and types of businesses found statistical significance for the size-structure relationship, however, there were enough anomalies to question these earlier results. Regardless of the researcher, it has been found that there is wide-spread support for the use of the numerical count of employees as a measure of organizational size (Robbins, 1983).

Change in the Level of Integration

A company may be able to reduce the number of employees by the disintegration of parts of the company through divestiture (Harrigan 1983, 1988). Divestiture can be accomplished through the selling of a subsidiary of a conglomerated business or a strategic business unit. Harrigan characterized dis-integration as end-game strategies that mature organizations undertake in order to achieve one or more of several goals. Dis-integration can also be accomplished by consolidating certain divisions, abolishing certain products, and further eliminating redundant positions.

Divestment, as suggested by Langley in 1992, is an excellent way for oil and gas companies to reach an optimal number of producing properties. This divestment, as part of a dis-integration plan, allows a company to focus only those areas in which
production faces a reduced threat of legal, environmental, operational, and financial issues. Along with these external environmental issues are the human resource issues of selecting only those personnel who are critical to the operations of the remaining facilities. All other non-essential positions that had built up over time could either be contracted or eliminated entirely. The elimination of non-essential operating personnel offers another possibility for measuring the decrease in specialization.

Dis-integration through outsourcing certain types of work that was previously done in-house is another method by which a company may reduce the number of employees (Hoplin and Hsieh 1990, Messmer 1992). Outsourcing also provided a means by which an organization may dis-integrate certain internal parts of the organization and introduce flexibility into the organization. An example is the outsourcing of the human resource management position within the company (Selter 1993). This allows the company to recount the number of positions within the organization and to exclude the human resource manager's position from the employee count. This action reduces the specialization score.

Uniformity of levels of integration within a single organization has not been found to be true since different departments of an organization focus on different parts of the environment (Lawrence and Lorsch 1967). The difference in focus changes over time since factors in the environment change. Some changes are readily adopted by existing departments while at other times, the changes allow for the dissolution of certain parts of the organization since their primary function is no longer needed. According to Lawrence and Lorsch (1967) this is a direct reaction to perceived
changes in certainty and uncertainty concerning the environment. An example are the changes in the reliability of raw material supply to the oil industry as reported by Langley (1992), which in-turn caused a change in strategy, in which domestic production operations were sold and imported crude used as a replacement. Perceptual changes in certainty-uncertainty levels outside the organization influences managements' decision making process in changing the level of integration within the company (Tosi, Aldag, and Storey 1973).

It has been found that higher levels of integration generally contribute to higher levels of organizational performance (Lawrence and Lorsch 1967). This finding conflicts with Hammer and Champy's (1993) proposal that companies should streamline operations and minimize the number of horizontal departments within the organization. The level of integration required to be successful may be dependent on the type of industry and the level of uncertainty that industry faces (Downey and Slocum 1975).

Other researchers have found that the level of integration is a valid measure of organization since firms vary by the level of investment required for operations. Capital intensive industries tend to have higher levels of integration than companies with lower capital demands (Fouraker and Stopford 1968, Salter 1970, Stewart 1970). The integrated form has been found to be strongest in companies exhibiting machine bureaucracies (Mintzberg 1979). The greater the level of closed operations, the greater the level of integration (Dyas and Thanheiser 1976). As stated before, much if not all previous research focused on periods of growth and did not address issues of OWFR.
Change in Technology

Another often cited cause of organization configurational change is change in technology (Alexander and Randolph 1985, Aldrich 1972, Miller et al. 1991). Increases in process and/or information technology has emerged from the literature as a dominant method resulting in employees being laid off (Due 1992). Two types of technology that emerged in the review of the literature have an impact on this study. Both process and information technologies are generally used to accomplish OWFR. Information technology and the improvement of that technology have allowed for both process and communication improvements (Anthes 1993, Brown 1993, Van Kirk 1993).

Improvements in information technology are found mainly in the area of the shift from centralized computing (mainframe usage) to distributed computing. This has had a profound impact upon management's ability to look at the corporation with a fresh perspective (Hammer 1992). This perspective includes the view towards linking each of the processes in the value chain that were once independent and making them interdependent (Pine and Pietrocini 1993). This interdependency allows for the virtual organization to be made up of teams (Coleman and Van Aken 1991). These teams independently make on-line adjustments as necessary to meet customer's requirements (Grayson 1991). This can be accomplished in a manufacturing environment through the introduction of concurrent engineering (Best 1993, Freedman 1993, Mills 1993). The virtual organization, using generalists who shift from responsibility to responsibility in task accomplishment, fits well with Orton and Weick's (1990) loosely
coupled systems concept.

Concurrent engineering has made the older paper-driven method of engineering changes obsolete. The strategy of utilizing new software together with the automation of the manufacturing hardware, that was previously labor intensive, has been found to be effective (Bennett and Forrester 1991). These changes in the internal parts of the organization are seen as changes in specialization as more individuals become generalists. In this new process orientation, process teams (generalists) take responsibility for the full production cycle (Mullin 1993). The primary motive for the introduction of the concurrent engineering is the reduction in cycle time (Jurczyk 1993).

Automation can occur in several different areas in the organization and will have an impact on the way an organization does business (Davenport and Short 1990). Automation of work-flow processes appears in the literature as a more discriminating term used to describe how both information and process technologies are being combined (Rifkin 1993). The concept of automated task handlers is changing the way organizations competitively operate in the global environment. The use of intelligent agents or automated task handlers reduces the organization's demands upon workers (Lopes 1993). The intelligent agents can perform a multiplicity of tasks and are generally limited to repetitive work-flow tasks, but they can be programmed to handle more complex functions. As of 1994, fewer than 10 percent of the work flow management packages could accommodate more complex functions (Rasmus 1994). As intelligent agent packages increased in use, there was a change in the structure of
some organizations where work flows were redistributed (Manion 1991). For this reason, the combination of process and information technology variable is valuable to this study. As the use of process/information technology increases, it was expected that level specialization decreases.

Summary of Independent Variables

Including the original Aston Study (1968), theories on organizational size together with the dis-integration and technology measures gave reason to develop three distinct categories of measuring structural change. Because of the possibility of restructuring the organization through employee layoffs, through dis-integration, and through changes in technology, this provided three measures of OWFR: organizational employee size change measures (Moskal 1992, Ladner 1990, Child 1973, Pugh, et al. 1968); dis-integration size change measures (Harrigan 1983, 1988, Langley 1992); and technology size change measures (Miller, et al. 1991, Ayoubi 1981, Blau and Schoenherr 1971).

These three measurements account for the alternative changes within the firm in respect to the reorganization of structure. The problem with organizational work force reduction is the lack of data or evidence to disprove the instinctive philosophy that a decrease in the organizational configuration variable follows the contraction process. Previous studies utilizing the concept of specialization within industry as a tool for efficiencies of scale have focused on growth within the industries, in particular during periods of growth in the economy in general (Blau et al. 1976, Hall 1968,
Kimberly 1976, Pugh et al. 1968, Reimann 1973, Woodward 1965). The use of these change measures adequately identified the impact of work force reduction on specialization.

**Alternative Explanations**

Possible alternative explanations for the change in the dependent variable, specialization, are offered here. Two possible explanations for decreasing specialization are turbulent environments and declining incomes. The anecdotal literature suggests that environmental turbulence is a major cause of organizational adaptation (Chandler 1990, Kumar 1990). The adaptation to a turbulent environment may cause a decrease in the number of employees or a change in the structure to become more organic (Daft 1992). Hypotheses testing using an environmental turbulence variable would be complex since the definition of turbulence changes as factors such as the number of competitors within and industry, rate of technological change, changes in governmental regulation, and changes in global competition are introduced (Ansoff 1987, 1990, Chandler 1990, Clark and Abernathy 1985, Daft 1992, Due 1992, Kumar 1990).

The anecdotal literature also suggests that lower sales, revenues, lagging financial performance caused by excessive debt, and the bankruptcies, or threat of bankruptcies can cause organizations to reevaluate their structure and reorganize in an effort to obtain a more efficient (lower cost) organizational structure (Daft 1992; Davidson et al. 1993; Reiss 1991). Nonetheless, the use of data of this type is
moderated by the options management might choose to offset these type of problems. Management may respond in numerous ways including, but not limited to, elimination of a product or product line, the assumption of more debt until economic conditions improve, or the use of a merger and acquisition strategy. Each of these moderators could potentially negate the capturing of a change in specialization through the use of a declining income variable one of these alternatives were selected. Rival hypotheses for the alternative explanations and superiority of the constructs and hypotheses are presented in chapter 5 under the section entitled Discussion of Potential Alternative Hypotheses.

**Research Hypotheses**

The research question presented in chapter 1 was answered by testing the hypotheses presented in this section. Each of the hypotheses used the constructs established in the organizational growth (change) literature that focused on structural change. The difference between this and prior studies is the construct variables were used to measure contraction in the organization rather than growth.

Figure 7 gives an overview of past hypothetical relationships and the current hypotheses used for this study. The hypotheses that have already been tested in previous studies, represented in the shaded boxes, were tested under periods of growth (Lawrence and Lorsch 1969, Lorsch 1970, Pugh, et al. 1968). The hypotheses in unshaded boxes are used in this study to provide the parameters for testing the relationships of the variables during periods of OWFR.
Overview of Hypotheses and Relationships

Structural Variables

<table>
<thead>
<tr>
<th>AGE of Organization</th>
<th>Specialization</th>
<th>Formalization</th>
<th>Standardization</th>
<th>Vertical Span</th>
<th>Centralization</th>
<th>Traditionalism</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Absolute Size: Large Companies</th>
<th>Specialization</th>
<th>Formalization</th>
<th>Standardization</th>
<th>Vertical Span</th>
<th>Centralization</th>
<th>Traditionalism</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Absolute Size: Small Companies</th>
<th>Specialization</th>
<th>Formalization</th>
<th>Standardization</th>
<th>Vertical Span</th>
<th>Centralization</th>
<th>Traditionalism</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Absolute Change in Size: Growth</th>
<th>Specialization</th>
<th>Formalization</th>
<th>Standardization</th>
<th>Vertical Span</th>
<th>Centralization</th>
<th>Traditionalism</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

| Decline in Size, % chg in # of Emp | -              | -              | -               | -             | -              | -              |
| Dis-integration, chg in $ assets  | -              | -              | -               | -             | -              | -              |
| Change in Mfg. or Process Technology | -              | -              | -               | -             | -              | -              |

Shaded boxes represent those areas previously researched. The area surrounded by the heavy black box is the focus of this study.

Figure 7. -- Hypotheses
The hypotheses broach the issue of the relatedness of the independent variable measures of change in the number of employees, change in the level of integration, and change in technology with the dependent variable measure of specialization. A review of the growth literature and the research contained in the literature review suggests the following hypotheses, classified according to the logical breakdown of sources of structural change found in the independent variable section.

Because of the possibility of an organization's utilizing more than one procedure to accomplish OWFR, the three independent variables (change in number of employees, change in level of integration, and change in technology) were analyzed independently and in conjunction with each other and the dependent variable (specialization). The inclusion of all possible combinations of independent variables for analysis yielded seven hypotheses.

The first hypothesis was tested using the measure of organizational size as represented by a change in the number of employees with the dependent variable, specialization. It has been established that there is a direct positive correlation between the dependent organizational configuration variable (specialization) and the measure of change in organizational size.

_Hypothesis 1: Specialization should decrease after the organization has experienced a decrease in the number of employees._

The second hypothesis was tested using measures of dis-integration accomplished through divestiture of parts of the company. It has been established that
there is a direct positive correlation between the dependent organizational configuration variable (specialization) and the measure of dis-integration.

_Hypothesis 2: Specialization should decrease after the organization has experienced dis-integration._

The third hypothesis was tested using measures of change in technology as reflected by expenditures of money directed to either manufacturing process and/or information technology research and development.

_Hypothesis 3: Specialization should decrease after the organization has experienced an increase in investment in either information or manufacturing technology._

The fourth hypothesis represents the possibility that a company may reduce the number of employees through a combination of layoffs and changing the level of integration through divestiture of parts of the company.

_Hypothesis 4: Specialization should decrease after the organization has experienced a decrease in the number of employees and has experienced dis-integration._

The fifth hypothesis represents the possibility that a company may reduce the number of employees through a combination of layoffs and the use of changes in technology accomplished by the acquisition of new computer systems and/or the automation of manufacturing facilities.
Hypothesis 5: Specialization should decrease after the organization has experienced a decrease in the number of employees and an increase in investment in either information or manufacturing technology.

The sixth hypothesis attempts to establish that there is a direct positive correlation between the dependent organizational configuration variable (specialization) and the measure of dis-integration accomplished through divestiture of parts of the company used in conjunction with changes in either information or manufacturing technology.

Hypothesis 6: Specialization should decrease after the organization has experienced dis-integration and an increase in investment in either information or manufacturing technology.

The seventh hypothesis included all three classifications of independent variables since it is feasible to have undergone organizational transformation to such an extent. The seventh hypothesis attempted to establish that there is a direct positive correlation between the dependent organizational configuration variable (specialization) and each of the measures of OWFR.

Hypothesis 7: Specialization should decrease after the organization has experienced a reduction in the number of employees, dis-integration, and an increase in investment in either information or manufacturing technology.
Chapter Summary

The effects of time, global competition, saturated markets, and innovations in computer technology, combined with changed expectations in organizational performance, industry structure, provide a better understanding of the complex interactions inside organization. These changes are reflected in practitioner's willingness to use OWFR as a means to improve organizational effectiveness.

Specialization, the dependent variable in this study, as measured by scoring the number of sixteen functions represented in an organization as described by Bakke (1959) and extended by later researchers has proven to be both a reliable and repeatable measure of organizational structure. This study also used three independent variable measures, change in the number of employees, change in the level of integration, and change in the level of investment in technology.

Change in the number of employees has been supported in several studies as representing organizational size. A majority of researchers favor using the number of employees as a measure of organizational size and also support the supposition that organizational size is an imperative when studying organizational structure. Likewise, the level of integration also plays a significant role in an organization's development over time and is greatly impacted by the industry life-cycle. Technology, especially as it relates to investment in manufacturing or process technologies have been shown to impact the structure of organizations by allowing the automation of processes through intelligent agents. Perhaps one of the more important findings of the literature review is the lack of quantitative research covering organizational contraction and its impact.
on structure as had been done for organizations that have undergone organizational growth.

The changes brought about by change in organizational size, level of integration, and changes in the level of investment in technology allowing management to engage in OWFR has forced both researchers and practitioners to review accepted paradigms about organizational growth. The potential for change in organizational structure is being viewed in a completely different framework than in the past (Forrester 1971).
CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

In this chapter, the research and methodological procedures are presented (Buckley, Buckley, and Chiang 1976; D.C. Miller 1970). The justification for techniques used in this research project are also addressed. This chapter is divided into five sections: sample, questionnaire, procedure, statistical method, and chapter summary. An overview of the pilot study, data gathering, and data analysis phase of the project can be found in figure 8. A detailed coverage of the pilot study can be found in appendix H.

Sample

Integrated oil companies were chosen for the sample. Integrated oil companies are, for the most part, a homogeneous group (Yergin 1991, Sampson 1975). Strategies, leadership turnover, technologies, products, distribution systems, and behavior of these firms are consistent and well known. This enables future researchers to measure differences in subject populations and to develop more clearly defined construct relationships between the independent variables and specialization. More clearly defined constructs may allow for the testing of a cause and effect relationships in the future. The questionnaire also included additional questions designed to give a better understanding of the independent variables (Miller and Droge 1986).
Figure 8. -- Steps of the Study

- **Pilot Study**: May 14 - June 12
- **Development of Final Questionnaire**: June 20th
- **Follow-up Postcards Mailed**: June 30th
- **Receipt of 1st Mailing**: July 3rd
- **2nd Mailing Final Questionnaire**: July 5th
- **Follow-up Postcards Mailed**: July 13th
- **Follow-up Phone Calls**: July 17th
- **Receipt of 2nd Mailing**: August 16th
- **3rd Mailing Final Questionnaire**: August 18th
- **Follow-up Phone Calls**: August 24th
- **Receipt of 3rd Mailing**: August 30th
- **Data Entry**: Sept. 5-8
- **Statistical Analysis**: Sept. 11-15
- **Preliminary results shared with committee**: Sept. 18
- **Qualitative Analysis**: May 14 - Sept. 18
- **Results Recorded**: October, 1995
Oil companies operate in highly competitive markets and are heavily dependent on external raw material suppliers (MacKillop 1988, 1989). In addition, other influences such as the economy or the broad base of companies that have selected different geographic strategies, make them an excellent model. For similar reasons, other studies have also used segments of the oil industry for strategic grouping analyses (Mascarenhas 1989, Mascarenhas and Aaker 1989, Tucci and Sweo 1996). Consistent with those studies, the survey was also administered to a human resource manager in each of the oil companies.

All publicly held integrated oil company business units with data available from the years 1987-1993 were used as the sample. Currently, there are no privately held, fully integrated oil companies. Harrigan's 1980 research into companies experiencing the decline side of maturity in the company life cycle model has shown that the oil industry did not experience any dis-integration up to and including 1980. Since that period, the oil industry has undergone major changes in operations through dis-integration (Langley 1992). Although this dis-integration has been well documented, no research has been done to determine its effects on the structure of those firms within the oil industry.

Companies were selected from the COMPUSTAT database, that had both the 1311 (oil producing) and the 2911 (oil refining) SIC codes listed for the firm. COMPUSTAT is a well-established and used database of company financial records (Carrol, Lewis, and Thomas 1992; Cool and Schendel 1988; Hatten and Hatten 1987). The combination of both the 1311 and 2911 SIC codes better represents those
companies that have integrated oil operations because of the inclusion of both oil
producing and refining operations. This search yielded a database of 58 companies.
The sample was further reduced by eliminating seven companies for which data were
incomplete or redundant. As a result, 51 companies were used in the analysis.
Appendix A lists the companies.

Population Characteristics

The variable selected to best represent structural change was the percentage
change in the number of employees from the previous year. It was calculated by
subtracting each year's number of employees from the number of employees from the
previous year, divided by the previous year's number of employees. For example,
using COMPSTAT data for the 1987 through 1991 time period, these companies
reduced staffing on the average 2.7 percent per year. This represents a net loss of
126,647 employees over that same five-year period.

Previous studies have found mixed results when company size is used as a
factor. The six largest multinational oil firms (Royal Dutch Petroleum, Exxon, Mobil,
British Petroleum, Chevron, and Texaco) appear to be among the most stable industry
members (Sampson 1975). Intermediate size companies such as Amerada Hess,
Phillips Petroleum, Quaker State, and Union Oil of California have comparable
stability. This reinforces the population ecology model in which companies tend to
follow the more successful organizations by emulating their strategies (Lawless and
On the other hand, the smaller independent oil companies held constant or increased their number of employees during the same time period. Industry journals frequently reported sales of oil producing properties by the largest group members to the smaller firms. Industry structure and geographical changes in the oil industry have been well documented (Maciej and Gordon-Stewart 1992). Smaller oil companies have not followed the strategies of the larger companies by adjusting their work force downward over time. Whereas most companies in this study were downsizing due to a strategic reorientation concerning raw material supply, some of the smaller companies were increasing employment through the purchase of the integrated companies (larger companies) selling of United States domestic assets. This is consistent with prior research by Porter (1980), who believes company strategy is highly correlated with its size. Although this concept is contested by Lewis and Thomas (1990), it may be based on which factors were chosen and manipulated for the study rather than on the methodology employed.

The degree of homogeneity in the oil industry plays a significant role in the formation of this industry. For the oil industry segments used in this study, the changes in strategy by the larger companies afforded opportunities for the intermediate and smaller firms to increase assets at a reasonable cost through the purchase of domestic oil properties. The change in strategy for the larger oil companies was to develop other alternative suppliers in addition to importing crude oil through exploration and production contracts in third-world countries (Kjellberg 1991).

Determining the changes in structure possibly can signal both opportunities and
warnings about impending market changes (Kumar, Thomas, and Fiegenbaum 1990). For the oil industry, the change is the transition from acquiring domestic sources of oil through exploration to acquiring oil by purchasing foreign imports. Nevertheless, these same companies, both large and small, continue to make adjustments to keep the market in balance. Market equilibrium, in conjunction with changes in strategic direction, demonstrates that industry structure and performance are determined simultaneously (Baumol 1982).

Sample Size

To determine a suitable sample size for this study, the concerns of error and population representation were addressed. The first concern is that of statistical power, that is the probability of rejecting the null hypothesis when it is indeed false (a correct decision). Accepting the null hypothesis when it is indeed false is a Type II error. The probabilities of these two outcomes are complementary and implies that knowing one outcome is evidence of knowing the other.

The second concern is related to the sampling process itself, since sample size can affect both Type I and II errors. Cohen and Cohen (1983) state that the issues of sample size and statistical power are rarely addressed, but must be addressed if predictive ability and generalization is a desired result. Addressing the issue of statistical power allows the researcher to determine a sample size necessary to attain a level of power (1 - Beta) sufficient to detect a specific Pearson's product-moment correlation (r) (Cohen and Cohen 1983). Because no previous studies questioned
changes in any of the structural variables in static or declining organizations, the
determination of sample size depends on the effect size and the degree of power
desired by the researcher (Cohen 1988). Since pre-post specialization scores have
never been published, there is no basis for population determination. Pre- and post-
structural variable standard deviation determination was done using between-subject
test standard deviation, which substantially inflated the number of subjects needed per
cell.

Cohen (1988) discusses effect size and power as lying along a continuum.
Small, medium, and large effects are three qualitative definitions used to describe .10,
.30, and .50 effect size, respectively. The effect size bears a direct correlation to the
results of previous studies. Since managerial specialization has been studied
previously, the selection of .50 as the effect size helped provide a more discriminating
statistical analysis, resulting in a stronger, more robust study.

The question of power-efficiency is also addressed by the inclusion of power in
the determination of sample size. The effect size selected for this study was .50.
Also, .80 was selected as the definition of power as recommended by Cohen (1988)
for population determination. Based on the information given above (an alpha of .05,
r of .50, and a power of .80) the minimum acceptable sample size needed for this
study would be thirty-seven (Cohen 1983). This is not surprising since many of the
other organizational studies of organizational structure had relatively small samples.
Miller and Droge (1986) study used ninety-six firms, the Aston studies (1968, 1969)
used fifty-two and forty-six firms respectively, Reimann (1980) used nineteen firms,
and Sathe (1978) used twenty-two departments of a multiple line insurance company when using specialization as a structural configurational variable. The ability of the dependent measures to explain high amounts of variance also provides some reassurance. A principal component analysis done during the Aston studies revealed that specialization scales extracted a first-factor accounting of 65 percent of the variance when predicting specialization.

**Questionnaire**

Questionnaires were mailed to company human resource managers in each of the oil companies. The self-administered questionnaire was used to gather information about the number of different types of work assignments in the company. Because downsizing information is nearly impossible to obtain prior to the actual event, a three-part questionnaire was used.

The first part of the questionnaire contains questions concerning the demographic characteristics of the participant and questions covering the defining factors, as outlined in the sections Number of Employee Size Measure and Dis-Integration Size Measures. Number of employees and dis-integration have been cited as having the greatest influence on the decision to make structural changes (Aldrich 1972, Beyer and Harrison 1979, Child 1973, Miller and Droge 1986). These questions were necessary in order to provide a greater insight into the degree of influence of the three independent variables on the dependent variable. Including these factors as independent variables for statistical use at this time was not possible
since no other study has developed any quantifiable measures for inclusion. The inclusion of defining factors for laying the groundwork for the future study of OWFR and how it influences organizations is needed.

The second part of the questionnaire measured pre-OWFR organizational specialization, as found in the company as of 1987. The third part of the questionnaire asked about Post-OWFR specialization positions that are currently found in the company. The second and third parts of the survey were close representations of the Aston survey questionnaire. The only alterations made to the original Aston study questionnaire were to change some of the position titles to better represent the position titles found in the oil industry. Miller and Droge (1986) followed a similar strategy to enhance the understandability of the questionnaire used in their study.

The third part of the questionnaire was color coded using pink paper so that the participants would understand that it was not the same as the second part of the questionnaire. The respondents were specifically informed that it referred to a different time period. The questionnaires were mailed to the job site, where any necessary information to complete the questionnaire was available (Dillman 1978). Pugh et al. (1968) found that this part of the survey explained 65 percent of the variance when measuring specialization.

Precoding the Questionnaire

Precoding of the questionnaire followed the procedures as outlined by the Aston Group (Pugh et al. 1968; Miller 1986). For the first part of the survey, which
contained the descriptive factor questions relating to OWFR, the questions were grouped according to the categorization of the three independent variables (Alreck and Settle 1985).

Scoring the Questionnaire

The procedure for scoring the questionnaire is outlined in this section. Both the dependent and independent variables are reviewed as to how the survey is constructed and scored (Labaw 1980). Included in this section are both quantitative and qualitative questions that gave greater insight into the characteristics of OWFR. The dependent variable is reviewed first, followed by a review of the three independent variables.

Dependent Variable - Specialization

The measure of specialization as defined by the Aston Studies was used as the dependent variable. This measurement of structure by the survey method has proven both effective and reliable (Miller 1986; Miller and Droge 1986; Pugh, et al. 1968, 1969). The measures for this variable were taken directly from either the Pugh et al. (1968) or the Miller (1986) studies. Some of the questions were reworded to make them time relevant, as recommended by Miller (1986).

Specialization was measured by asking sixteen questions about specific, assigned specialist job positions found in most industries. The specialization section of the questionnaire was scaled between one and sixteen. The questions used in the Aston studies were reworded by Miller (1986) to better reflect the change in job titles
since 1968. Miller (1986) found the reliability of the specialization measure to be .80.

The following section of the questionnaire contains sixteen questions used to measure specialization. Each of these items queried the respondents concerning specific roles or assignments held by a full-time employee solely responsible for that function. The following survey represents the measurement of specialization post-OWFR.

The score on this section of the survey was achieved by summing the number of ticks (check marks) for each of the positions. For example, if a company had checked eight of the sixteen positions, that company would receive a score of 8.

Which of the following activities are dealt with exclusively by at least one full time person currently employed in the firm who:

- is responsible for public relations and advertising. [ ]
- is responsible for the sales, distribution and servicing of the output products. [ ]
- is responsible for the transportation of raw materials, semi-finished goods, and final products for the company. [ ]
- is responsible for the selection, placement, and retention of employees for the company. [ ]
- is responsible for training. [ ]
- is responsible for monitoring the environmental impact of our operations. [ ]
- is responsible for purchasing. [ ]
- is responsible for maintenance and construction. [ ]
- is responsible for accounting and invoice processing. [ ]
- is responsible for the control of work flow and assignments. [ ]
is responsible for the inspection and quality of materials, equipment, and output.

is responsible for assessing and devising ways of producing output.

is responsible for devising new equipment, new processes, and different outputs.

is responsible for developing and carrying out administrative procedures.

is responsible for resolving legal matters for the company.

is responsible for marketing research for the company.

The pre-OWFR measure was identical to the survey above except that the directions were to check only those positions that existed prior to 1987. The 1993 (pre-OWFR) score was subtracted from the 1987 score to yield an overall score representing the change in specialization during this time period. In the previous example, where a company had ticked eight of the possible sixteen choices and received a score of 8, then ticked twelve of the possible sixteen choices for the pre-OWFR specialization measure, the resulting score would be 4.

Independent Variables

Measurement of organizational work force reduction methods was accomplished by using three independent variables as suggested by the review of the literature. The three independent variables used to describe OWFR are (1) reduction of personnel through direct layoffs of employees; (2) reduction through dis-integration (asset parsimony); and (3) increase in technology that results in a reduction of personnel. Statistical analysis indicated that the change in the dependent variable
(specialization) was related to two of the three independent variables (change in the number of employees and change in the level of integration.

Measurement of OWFR can be accomplished by calculating the percentage change in the number of employees over time. This change represents the change in the number of employee size measure. The second measure of OWFR was the measurement of change in assets over time, which represents the dis-integration of the company. The change in assets over time represents the dis-integration size measure. The third measure was represented by the percentage change in research and development dollars specifically allocated to either process or information technologies.

Change in number of employees size measure

The percentage change in the number of employees best represents the degree of structural stress that a company has undergone and provides the link between the strategy and structure (Chandler 1962, Greiner 1972). Reinforcing the strategy / structure paradigm is the relationship of structure and organizational change, as described by Mintzberg (1979) as the outcome of adaptation.

The current practice of managing employees as an asset supports considering percent change in the number of employees as an adequate measure of structural stress. Downsizing allows companies to achieve lower costs due to the reduction in payroll needed for the same unit of production. The percentage change in the number
of employees from the post-OWFR period was calculated by the formula:

\[
\frac{(EMP[Y87] - EMP[Y93])}{EMP[Y87]}.
\]

Varying the years would allow for the testing of lead and lag effects upon the organizational structure (Cassutto 1992, Gapinski 1982). The data for the absolute number of employees were easily obtained by using the COMPUSTAT PC database. Leading and lagging the variables from the longitudinal data accounted for structural changes occurring after a previous year(s) decision(s) to lay off employees.

Greer (1984) illustrates well the counter-hiring strategies used to overcome the hindrances of cyclical economic changes. Economic as well as competitive pressures drive the decisions to resize the organization (Greer 1984). Combining performance-related strategic group research with structural downsizing studies adds a unique dimension to the understanding of the dynamics of strategic groupings and how changes in the size of the company are found to be common across an industry.

The ability of the organization to manage human resources is paramount to becoming a low-cost producer and provides one of the best determinants for measuring the effectiveness of organizational work force reduction (Mascarenhas 1989). Changes in human resource deployment over time may be the best variable to use when studying firms that do not have clear or well-structured strategies. Two possible choices exist for the company relative to its human resources. First, the organization can make a proactive choice and manage its employment level. Second, the organization can react to immediate fiscal demands by downsizing. Multiple manipulations of the data using lead/lag configurations may determine which strategy
a company chooses. How employment management practices affect company groupings or the long-run performance of the firms is still to be determined.

The traditional structures used by mature organizations have typically been divisionalized forms, with partial decentralization used to facilitate certain functions such as engineering and accounting. Compounding this is the hierarchical structure. Using Mintzberg's (1979) description of the strategic apex, middle line, support staff, techno-structure, and operating core would present a macro overview of observable structure for this research project. Management, the strategic apex, middle line, and supervisory staff for the operating core are defined as those employees who have responsibilities for the work of others in resource transformation or acquisition processes.

The use of management employees as a descriptive measure is supported on the basis that the downturn in the economy has forced companies to reevaluate those who should be dismissed. Numerous articles illustrate that white collar employees have been the target of most of the companies that have chosen downsizing as a means of coping with the changing environment during the economic recession (Overman 1991). This reinforces the need to encompass the whole organization rather than focusing on labor or the blue collar workers.

In addition to the archival data retrieved from Compustat, several questions were included in the questionnaire that gave greater insight as to which stratas of the organization were reduced. This data were helpful in determining which strata in the organization are changed structurally the greatest by the reduction of personnel during
the time period under study. The defining questions were as follows and represented questions 10 through 15 in the questionnaire.

Since 1987, what percentage of executive level managerial positions have been eliminated?
5% or less  5%-10%  10%-15%  15%-20%  20%-35%  >35%

Since 1987, what percentage of middle managerial positions have been eliminated?
5% or less  5%-10%  10%-15%  15%-20%  20%-35%  >35%

Since 1987, what percentage of 1st line supervisor positions have been eliminated?
5% or less  5%-10%  10%-15%  15%-20%  20%-35%  >35%

Since 1987, what percentage of non-exempt labor positions have been eliminated?
5% or less  5%-10%  10%-15%  15%-20%  20%-35%  >35%

The categorical data were analyzed using multiple regression statistical procedures in determining if certain strata change the dependent variable more so than changes in other strata.

Dis-integration size measure

The selling of non-essential assets, low return assets, or assets which because of logistics, present other opportunities by which a company may reduce employment (Langley 1992). Harrigan's 1988 study of organizations in the mature phase of the life cycle found that dis-integration is often the result of an inability to pursue market-share growth strategies. The selling of divisions, districts, subsidiaries, and strategic business units are indications that companies are utilizing end-game strategies. The measurement of dis-integration can be accomplished by measuring the dollar amount
of assets sold.

The assets sold, measured in dollars, were used as the second independent variable. Achieving a cost advantage may be accomplished through the reallocation of resources or utilization of the concept of asset parsimony (Harrigan 1983). Therefore, asset parsimony may be the driving force behind the downsizing phenomenon. In like manner as the variable change in size, change in integration was done in a percentage format to minimize statistical bias introduced from the inclusion of large dollar value amounts. The formula used for calculating this variable was:

\[
\frac{(\text{Assets}[Y87]-\text{Assets}[Y93])}{\text{Assets}[Y87]}
\]

In addition to the archival data retrieved from Compustat, several questions were included in the questionnaire to gain insight into how the company accomplished dis-integration. The data were helpful in determining how the organization is modified structurally by the reduction of control centers, districts, divisions, subsidiaries, strategic business units, or products offered to either retail or commercial consumers. The defining questions were as follows and represented questions 16 through 24 in the questionnaire.

Since 1987, how many control center consolidations have there been where two or more control centers were combined?

1-3___4-5___6-7___8-9___10-11___

Since 1987, what number of control center consolidations have there been where two or more control centers were combined?

1-3___4-5___6-7___8-9___10-11___

Since 1987, how many divisions or districts has your company reduced in your company or region?

1-3___4-5___6-7___8-9___10-11___
Since 1987, how many subsidiaries has your company reduced through the sale or closing of a subsidiary?

1-3 4-5 6-7 8-9 10-11

Since 1987, how many SBU's (Strategic Business Units, i.e. used for planning and control) has your company reduced through the sale or closing?

1-3 4-5 6-7 8-9 10-11

Since 1987, how many fewer products has your company offered commercial consumers?

1-3 4-5 6-7 8-9 10-11

Since 1987, how many fewer products has your company offered retail consumers?

1-3 4-5 6-7 8-9 10-11

Since 1987, how many new products has your company offered retail or wholesale consumers?

1-3 4-5 6-7 8-9 10-11

The categorical data were also analyzed using multiple regression statistical procedures in determining whether certain ways of dis-integrating changed the dependent variable more than other opportunities.

**Change in technology size measure**

The third independent variable representing an opportunity to reduce the number of employees is the use or increase of the use of technology (Itami and Numagami 1992, Khandwalla 1974, Klatzky 1970, Meyer 1968, Ouchi 1977, Sorge 1989). The increase of automation through technology and the effects on structure have been well documented (Hayes and Jaikumar 1988). The anecdotal reports of robotics and automation replacing workers is a well-known fact (Fry 1982, Hage and
Aiken 1989). For this reason a measure of change in technology was used in this study.

The use of dollars spent on research and development (R&D) is represented by the inclusion of three measures: R&D dollars spent on product development, dollars spent on process development, and dollars spent on information technology (software) development. The dollars spent on process R&D (manufacturing technology) and information technology R&D best represent the use or increase in use of technology for the selected manufacturing industry. Since these dollars are totaled together in the database, some questions in the questionnaire concerned the percent distribution of dollars spent on product R&D in comparison to the percentage of dollars spent on either process or information technology R&D. The calculation of the percentage change in technology R&D expenditures over time was as follows:

\[
\frac{(((R&D[\text{Y87}]) \times (\% \text{ technology R&D expense}))-((R&D[\text{Y93}]) \times (\% \text{ technology R&D expense})))}{((R&D[\text{Y87}]) \times (\% \text{ technology R&D expense})))}}
\]

The following questions were used to determine the percentage of R&D dollars for each of the years under investigation.

What percentage of Research and Development dollars in 1987 was spent solely on product research (not process, information, or software research)?

0-5%  5-10%  10-20%  20-30%  30-40%  40-50%  
50-60%  60-70%  70-80%  80-90%  90-100%  
What percentage of Research and Development dollars in 1993 was spent solely on product research (not process, information, or software research)?

0-5% 5-10% 10-20% 20-30% 30-40% 40-50%

50-60% 60-70% 70-80% 80-90% 90-100%

The instructions directed the respondents to call an associate in the R&D department or division to obtain this information if it unavailable to them directly.

Procedure

The research design method chosen for this study is composed of two parts: qualitative and quantitative. Using both methods in the past has provided more robust and reliable studies (Fielding and Fielding 1986, Jick 1979). The first part was qualitative and was done during the pilot study phase of the project. During the pilot study phase, interviews done during the review of the questionnaire were analyzed using content analysis procedures (Bogdan and Biklin 1992). The purpose was to determine whether other factors or terms more aptly described the influence of organizational work force reduction upon specialization. A pilot study was used to determine the reliability of the questionnaire. Interviews, and written comments about the questionnaire obtained about potential problems with the questionnaire were addressed during this stage. Appendix H contains the results of the pilot study and the changes made to the questionnaire. The questionnaire was modified by the addition of other choices regarding the number of jobs outsourced. It was also discovered that position level within the organization did have a strong impact on the ability of the individual to complete the questionnaire. Non-exempt employees during the pilot
study phase could not complete the questionnaire due to lack of availability of the needed information. The results of the pilot study can be found in appendix H.

The second part was quantitative and used survey procedures as outlined by Dillman (1978). The first objective was to develop a measure for classifying the effect of downsizing on the organizational structure. Organizational work force reduction (OWFR) was used as this measure. It was addressed with the understanding that any organization which experiences a reduction in work force also experiences change in the level of specialization. This occurrence is evident in the employment costs (human) to the organization.

The final questionnaire derived from the pilot study was mailed to fifty-one fully integrated oil companies. The data from forty returned questionnaires were entered into an Excel work sheet. This work sheet was imported to the mainframe where the SAS statistical program was used to analyze the data. The data were analyzed both for statistical relevance and for testing the relationship between the dependent and independent variables.

**Statistical Method**

This study involves three independent variables (change in the number of employees, change in the level of integration, and change in technology) and one dependent variable (change in level of specialization). Because the three independent and one dependent variables are continuous data, it was statistically proper to use multiple regression statistical procedures to analyze the data (Huck, Cormier, and
Bounds 1974). Besides using multiple regression statistical procedures for data analysis, a factor analysis was also be performed on the three independent and one dependent variables. The factor analysis was done to determine if there was common method variance (Podsakoff and Organ 1986). Both SAS and SPSS/PC for Windows were used to perform both the multiple regression and the factor analyses.

Reliability and Validity

SPSS PC was used to check the reliability of the questionnaire. The split-half procedure was used since only one return per respondent was obtained. The advantage of using a questionnaire is the absence of interviewer bias which can occur, not only in the formal communication process, but also because of the appearance and demeanor of the interviewer. A written, unsigned questionnaire also gave the respondents a greater feeling of anonymity. During times of reorganization, some individuals may be sensitive to questions about work. The written questionnaire allowed those individuals to feel confident that their answers were anonymous (Churchill 1987).

The Aston questionnaire was used for all respondents, eliminating any ambiguity that might exist if different questionnaires were used. This made it easier for future researchers to use the instrument on different levels within the organization or different industries. The chief advantages to a fixed question and answer questionnaire are its ease of administration, tabulation, and analysis.

Disadvantages in using the fixed answer format lie in two areas: reliability and
validity. Reliability or consistency in use diminishes proportionally with time (Carmines and Zeller 1979, Dillman 1978). Changes in both the external and internal environments affect attitudes and responses. Validity is lowered if the questions do not accurately address the parameters of the research. Bias is introduced if there are omissions of an appropriate response category. This is why during the pilot study a pretest was performed (Kerlinger 1986). The results of the pretest can be found in appendix H. Validity is also a paramount issue when selecting appropriate methods for the statistical procedure. Type I or Type II errors could result if improper methods are selected to test the data (Cohen et al. 1988).

**Chapter Summary**

This study used both quantitative and qualitative analysis procedures to analyze the effects of organizational resizing on structure. The qualitative phase was performed during the pilot test phase to enhance the survey. The quantitative phase used a mail questionnaire to sample fifty-one integrated oil companies. From this data, multiple regression analysis procedures were used to determine the effect of organizational resizing upon organizational structure.
CHAPTER 4

RESULTS

The results of the analysis on the data collected are presented in this chapter. This chapter is divided into three parts. The chapter opens with a summary of how the variable relationships were analyzed and the statistical procedures used to test the hypotheses. This is followed by a review of the statistical analysis of the hypotheses. The chapter concludes with a review of the statistical analysis, considering both the quantitative and qualitative survey data. In this final section, both descriptive and inferential analysis of the survey data is reviewed. An analytical review of the data characteristics to ensure the assumptions of the general linear model (GLM) can be found in appendix I.

Relationship Analysis

Order of Analysis

The dependent and independent variable relationships were analyzed using regression analysis. Before any analyses were performed, assumptions of normality tests were performed to ensure the adequacy of the data. The results of this analysis can be found in appendix I. The next phase of the statistical analysis used the PROC GLM procedure found in SAS to analyze the relationship between the dependent variable of specialization and the three independent variables: percentage change in the
number of employees, percentage change in the level of integration, and the percentage change in the level of technology.

Seven separate regression analyses were performed. Individual regressions were run for each the three independent variables. The first was between the dependent variable of specialization and the independent variable of percent change in the level of integration. This was followed by regressing each of the other two independent variables individually. Next, four regressions were performed using the dependent variable of specialization and then combinations of the three independent variables. This followed the logic of the hypotheses as presented in chapter 2 of this study. The results of the regression analysis are presented in the Hypothesis Tests section.

Statistical Relationships

Each of the variables was also analyzed using SAS to identify the parameters of the data. The results of this analysis are presented in table 12. The change in specialization data was characterized by a mean of minus two (-2). On the average, specialization had decreased for the respondents to the questionnaire by at least two positions. The range for specialization was broad since one company had increased specialization by seven positions while another had reduced specialization by seven positions. The ranges for each of the three independent variables were, accordingly, skewed dramatically. The reason was that the two companies had either experienced dramatic growth or had dramatic declines in their businesses. This is supported in the
review of the data characteristics provided in appendix I. These two companies represent the two leverage points identified in the data analysis.

Table 12. -- Variable characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>SUM</th>
<th>Minimum Value</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialization</td>
<td>40</td>
<td>-2.0250</td>
<td>3.0254</td>
<td>-81.00</td>
<td>-7.000</td>
<td>7.000</td>
</tr>
<tr>
<td>% Change in Integration</td>
<td>40</td>
<td>-1.5375</td>
<td>6.8109</td>
<td>-61.49</td>
<td>-42.930</td>
<td>0.531</td>
</tr>
<tr>
<td>% Change in Number of Employees</td>
<td>40</td>
<td>0.1772</td>
<td>1.0771</td>
<td>7.086</td>
<td>-0.611</td>
<td>5.375</td>
</tr>
<tr>
<td>% Change in Investment of Technology</td>
<td>40</td>
<td>-0.0274</td>
<td>0.2537</td>
<td>-1.0979</td>
<td>-0.847</td>
<td>0.590</td>
</tr>
</tbody>
</table>

The correlation analysis provided in table 13 indicates that two of the independent variables are highly correlated. The percent change in the number of employees and the percent change in the level of integration are highly correlated. Although these variables are measured independently of each other and represent two entirely different measurements, the correlation should be expected. Chapter 1 appropriately described the population's characteristics and the homogeneity and monolithic nature of the fully integrated oil industry. When a portion of the industry leaders decide to change strategies, such as laying off employees, the rest generally adopt similar strategies (Tucci and Sweo 1996). When the population behaves in such a uniform manner, the direction of change in the variables should be similar.
For the oil industry, this certainly is true. The direction and magnitude of change is somewhat limited by both the capacity of the followers' ability to adopt the leaders' strategy and the few inconsistencies found with the population.

Table 13. Correlation analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Change in Specialization</th>
<th>% Change in Integration</th>
<th>% Change in Number of Employees</th>
<th>% Change in Investment in Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in Specialization</td>
<td>1.00000</td>
<td>-0.39204</td>
<td>0.49237</td>
<td>0.20772</td>
</tr>
<tr>
<td></td>
<td>0.0</td>
<td>0.0124</td>
<td>0.0012</td>
<td>0.1984</td>
</tr>
<tr>
<td>% Change in Integration</td>
<td>1.00000</td>
<td>0.0</td>
<td>-0.49773</td>
<td>-0.01403</td>
</tr>
<tr>
<td></td>
<td>0.0</td>
<td>0.0011</td>
<td>0.9315</td>
<td></td>
</tr>
<tr>
<td>% Change in Number of Employees</td>
<td></td>
<td></td>
<td>1.00000</td>
<td>0.01305</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.0</td>
<td>0.9363</td>
</tr>
<tr>
<td>% Change in Investment in Technology</td>
<td></td>
<td></td>
<td>1.00000</td>
<td>0.0</td>
</tr>
</tbody>
</table>

The data were analyzed for reliability using split-half procedures. The reliability for the complete test was .8204. This is similar to the .85 result obtained by Miller (1988) when using the same dependent variable. Reliability for the variables used in this study appeared to be within acceptable limits (Cohen et al. 1988). A post-hoc power analysis was performed to determine with what confidence the following hypotheses tests were rejected or assumed to predict the relationships. Using the Pearson-Hartley analysis method, a theta of 1.83540 was found. With the total response of forty, this yields a power of .83 (Neter, Wasserman, and Kutner 1985). A minimum power of .80 was targeted as the minimal level of acceptable power.
The actual power of .83 provides support for the assumptions made during the hypothesis tests.

**Hypothesis Tests**

The hypothesis tests were performed through a series of regression analyses. Each regression analyzed the relationship between one of the three independent variables and the dependent variable. Further regression analyses were performed with each of the independent variables with the dependent variable and then in multiple combinations. Table 14 contains the results of these tests (Huck, Cormier and Bounds 1974). Further explanation of these results follows in the next section of this study.

<table>
<thead>
<tr>
<th>Criterion Variables</th>
<th>R</th>
<th>$R^2$</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Change in Number of Employees</td>
<td>.49237</td>
<td>.24243</td>
<td>12.16027**</td>
</tr>
<tr>
<td>% Change in Level of Integration</td>
<td>.39204</td>
<td>.15369</td>
<td>6.90089*</td>
</tr>
<tr>
<td>% Change in Investment in Technology</td>
<td>.20772</td>
<td>.04315</td>
<td>1.71361</td>
</tr>
<tr>
<td>% Change in Number of Employees and % Change in Level of Integration</td>
<td>.52071</td>
<td>.27114</td>
<td>6.88212**</td>
</tr>
<tr>
<td>% Change in Number of Employees and % Change in Investment in Technology</td>
<td>.53194</td>
<td>.28296</td>
<td>7.30040**</td>
</tr>
<tr>
<td>% Change in Level of Integration and % Change in Investment in Technology</td>
<td>.44113</td>
<td>.19459</td>
<td>4.46979*</td>
</tr>
<tr>
<td>% Change in Number of Employees and % Change in Level of Integration and % Change in Investment in Technology</td>
<td>.55775</td>
<td>.31108</td>
<td>5.41861*</td>
</tr>
</tbody>
</table>

* $p < .05$, df = 1.38  
** $p < .01$, df = 1.38
A significant result was obtained in the regression analysis using the independent variable percent change in the number of employees and the dependent variable, change in specialization. Hypothesis 1 stated that there would be a significant relationship between the percent change (decrease) in the number of employees and a change in specialization. A significant relationship was found ($F = 12.16027, \text{df} = 1,38, p < .05$). The actual p value for the percent change in the number of employees was .0012. The results of this analysis support hypothesis 1. The adjusted $R^2$ for the change in number of employee variable was .24243. This result indicates that 24% of the variance in the dependent variable is accounted for by the change in the independent variable. A value of 15% is the minimum accepted threshold value for variance explained (Freund and Littell 1986). The implications of the variance explained by this variable is discussed in chapter 5.

A significant result was evident for the regression analysis using the independent variable percent change in assets and the dependent variable, change in specialization. Hypothesis 2 stated that there would be significant relationship between organizational dis-integration as measured by a percent change in assets and the dependent variable change in specialization. A significant relationship was found ($F = 6.90089, \text{df} = 1,38, p < .05$) for this test. The actual p value for percent change in assets was .0124 which supports hypothesis 2. The adjusted $R^2$ for the change in dependent variable was .15369. This result indicates that 15.3% of the variance in the dependent variable is accounted for by the change in the independent variable. A value of 15% is the minimum accepted threshold value for variance explained (Freund
Hypothesis 3 predicted that there would be significant relationship between the third independent variable, increase in information or manufacturing technology and the dependent variable, change in specialization. A significant relationship was not found ($F = 1.71361, \text{df} = 1,38, \ p > .05$). The actual $p$ value for the percent change in technology was .1984. The results of this analysis do not support the assumption that specialization decreases when there is a decrease in technology, as stated in hypothesis 3. The adjusted $R^2$ for the change in number of employee variable was .04315. This result indicates that 4% of the variance in the dependent variable is accounted for by the change in the independent variable. A value of 15% is the minimum accepted threshold value for variance explained (Freund and Littell 1986). The implications of the lack of variance explained by this variable is discussed in chapter 5.

A significant relationship was claimed in hypothesis 4 for the independent variables, percent change (decrease) in the number of employees and dis-integration through the reduction of assets and the dependent variable, change in specialization. A significant relationship was found ($F = 6.88212, \text{df} = 2,37, \ p < .05$). The actual $p$ value when both variables were included was .0029. Although the adjusted $R^2$ value increased by the addition of the dis-integration variable to the change in the number of employees, the magnitude of change was from .24243 to .27114. The results of the analysis support hypothesis 4, which proposed that specialization would decrease when
a company reduces the number of employees and engages in dis-integration.

Nevertheless, since these variables were found to be highly correlated, the use of both these independent variables should not be done due to statistical validity issues (Neter, Wasserman, and Kutner 1985). Anytime that two independent variables are highly correlated and the level of significance does not increase without a corresponding decrease in the error terms, the second variable added should be dropped from usage in combination with the first since it arbitrarily inflates the adjusted $R^2$ (Kvalseth 1985; Neter, Wasserman, and Kutner 1985). The adjusted $R^2$ for the two independent variables was .27114. This result indicates that 27% of the variance in the dependent variable is accounted for by the change in the independent variables. A value of 15% is the minimum accepted threshold value for variance explained (Freund and Littell 1986). The implications of the variance explained by these variables is discussed in chapter 5.

Hypothesis 5 claimed there would be a significant relationship between the two independent variables: percent change decrease in the number of employees, together with an increase in either information or manufacturing technology, and the dependent variable, change in specialization. A significant relationship was found ($F = 7.30040$, df = 2,27, $p < .05$). The actual p value for both variables was .0021. Nevertheless, since the adjusted $R^2$ value only increased by .04, the addition of the change in technology variable to the model should be handled with caution since this variable does not add appreciably to the explanation of the variance. Anytime that two independent variables do not increase the level of significance without a corresponding
decrease in the error terms, the second variable added should be dropped from usage in combination with the first since it arbitrarily inflates the adjusted $R^2$ (Kvalseth 1985; Neter, Wasserman, and Kutner 1985). The results of this analysis lend support to hypothesis 5. The adjusted $R^2$ for the two independent variables was .28296. This result indicates that 28% of the variance in the dependent variable is accounted for by the change in the independent variable. A value of 15% is the minimum accepted threshold value for variance explained (Freund and Littell 1986). The implications of the variance explained by these variables is discussed in chapter 5.

Hypothesis 6 stated that there would be a significant relationship between the dependent variables of dis-integration, as measured by a change in assets, and an increase in technology with the dependent variable, change in specialization. A significant relationship was found ($F = 4.46979, df = 2,37, p < .05$). The actual $p$ value for both variables was .0183. Since the adjusted $R^2$ value increased by .02, the addition of the change in technology variable as implemented in this study should be used with caution if at all. The results of this analysis suggest support for hypothesis 6, but, as with hypothesis 5, the support of this hypothesis is not warranted due to the issue of statistical validity. Anytime that two independent variables do not increase the level of significance without a corresponding decrease in the error terms, the second variable added should be dropped from usage in combination with the first since it arbitrarily inflates the adjusted $R^2$ (Kvalseth 1985; Neter, Wasserman, and Kutner 1985). The results of this analysis lend support to hypothesis 6. The adjusted $R^2$ for the two independent variables was .19459. This result indicates that 19% of the
variance in the dependent variable is accounted for by the change in the independent variable. A value of 15% is the minimum accepted threshold value for variance explained (Freund and Littell 1986). The implications of the variance explained by these variables is discussed in chapter 5.

Hypothesis 7 stated that there would be a significant relationship found when three independent variables were regressed upon the dependent variable. A significant relationship was found ($F = 5.41861$, $df = 3,36$, $p < .05$) when all three independent variables were regressed on the dependent variable. Actual $p$ value for all three independent variables was .0035. Again, the adjusted $R^2$ value increased by .07. It should not be assumed that the addition of both the change in technology and the disintegration variables increase the utility of the model. The results of this analysis support hypothesis 7, but, as with hypotheses 5 and 6, the support of this hypothesis is not warranted due to the issue of statistical validity. The results of this analysis suggest support for hypothesis 7, but, as with hypothesis 5 and 6, the support of this hypothesis is not warranted due to the issue of statistical validity. Anytime that three independent variables do not increase the level of significance without a corresponding decrease in the error terms, the added variables should be dropped from usage in combination with the first since it arbitrarily inflates the adjusted $R^2$ (Kvalseth 1985; Neter, Wasserman, and Kutner 1985). The results of this analysis lend support to hypothesis 7. The adjusted $R^2$ for the three independent variables was .31108. This result indicates that 31% of the variance in the dependent variable is accounted for by the change in the three independent variables. A value of 15% is the minimum
accepted threshold value for variance explained (Freund and Littell 1986). The implications of the variance explained by these variables is discussed in chapter 5.

This section finds that two of the seven hypothesis are supported, one is rejected, and the remaining four are supported conditionally. This is due to the relationship of the first two independent variables: change in the number of employees and the change in the level of integration, and the inability of the third independent variable: change in the level of investment in technology to adequately explain the change in the dependent variable. The change in the number of employees accounts for a majority of the variance explained (77%) when used with the other independent variables. The change in the level of assets is an adequate measure to explain the variance in the dependent variable, although it does so while minimally meeting the minimum acceptable threshold of 15% (Freund and Littell 1986).

Descriptive and Inferential Findings

Descriptive Findings

Although not included in the hypotheses, other data were gathered that may be useful in explaining the results of the hypotheses and point the way for future research. Only the results of the data analysis are given in this section; results and implications are reviewed in chapter 5.

Within the study, the respondents were asked if they would characterize their jobs as becoming more specialized, more general in nature, or not changing. Regression analysis was performed using their answers. Significant results were
obtained when personal change in specialization data were regressed upon the change of specialization measure for their company ($F = 4.68213, df = 1,38, p = .0368$).

The respondents were also asked if their company had changed its corporate strategy since 1987 to focus upon a more efficient and competitive structure. A significant relationship was found with the dependent measure of specialization ($F = 4.01417, df = 1,38, p = .0523$). A question about the particular division in which the respondents worked was also regressed on the specialization measure. No significant relationship was found ($F = 3.34805, df = 1,38, p = .0751$). The type of organizational work force reduction was also regressed against the measure of specialization. No significant relationship was found ($F = 1.00743, df = 5,34, p = .4284$).

Inferential Findings

The respondents in the study were asked to give the percentage of employees at each level of the organization who had been laid off. The organizational level with the greatest reductions was the first-line supervisory position, with a mean score of 2.775. This represents approximately a 10 to 15 percent reduction of all first-line supervisors. This group was followed by middle management positions, with a mean score of 2.500. Middle-managers also suffered similar manpower reductions of approximately 10 to 15 percent.

The third and fourth highest levels were the executive and non-exempt (blue collar) employees, respectively. The mean for the executive level was 2.375, while
the non-exempt (blue collar) mean was 2.200. Both of these groups experienced
cutbacks of approximately 5 to 10 percent in their ranks.

The last page of the survey contained a multiple choice table, and respondents
were instructed to mark each position that had been outsourced since 1987. The mean
number of positions outsourced was 3.2, with a standard deviation of 2.078. The
maximum number of outsourced jobs that any one company acknowledged was seven.

Chapter Summary

Significant results were found for the relationship between specialization and
either a change (reduction) in the number of employees or a change in assets. No
significant results were obtained when testing for the relationship between
specialization and change in technology. Combinations of the three independent
variables regressed upon the dependent variable (specialization) yielded significant
results with reservations.

Most of the managers in the oil industry who participated in this survey
indicated that their jobs are becoming less specialized and that morale within the
company was continuing to decline.
CHAPTER 5

DISCUSSION OF FINDINGS

This chapter contains an examination of the findings relating organizational work force reduction (OWFR) to changes in the level of specialization. Significant results were obtained with two of the three independent variables used in this study. The implications of these results suggest that there is a change, not only to the study of organizations, but also as to how business may function in the future. This study explicates that changes in the number of employees and the dis-integrating of the organization, as done in the last eight years, are dramatically altering the concept of organizational structure.

As a by-product of this study, more important revelations about changes in organizational structure paradigms are made. Changed concepts of specialization, the difference between essential and non-essential tasks, the value of cost and profit centers, and the impact of government regulation are apparently being used as the new defining factors for structural boundaries. These boundaries are significantly changing competitive paradigms. The findings from the research performed during this study are discussed in this chapter.

This chapter begins with a discussion of the findings from the hypothesis tests. This is followed by a discussion of the general findings of the study. The Findings section also includes inferential findings and qualitative discoveries and explains their
relationship to the overall study. Part three includes a discussion of validity issues and limitations as it relates to this study. This is followed by part four, a discussion of the implications of OWFR as it pertains to research in general and more specifically, how organizations change the ways in which we work. Part five summarizes the chapter.

**Discussion of Hypotheses Tests**

In discussing hypotheses tests, insignificant findings are first considered, followed by a discussion of the significant findings. Findings are reported for each of the independent variables: change in technology, dis-integration, and change in the number of employees.

**Discussion of Change in Technology**

Four hypotheses (hypothesis 3, 5, 6, and 7) included the change in technology as an independent variable measure. **Hypothesis 3**, which states that specialization should decrease after the organization has experienced an increase in either information or manufacturing technology, was rejected when used as the sole measure to predict a change in specialization. Several reasons may exist for the rejection of this hypothesis. First, technology may not be as directly linked to structure as has been suggested. This relationship may be moderated by one or more of the sixteen measures of specialization. Bakke (1959) stated that each measure represents a specific task that must be performed for any business to function.

A review of the specialization measures from the questionnaire indicates that each of the sixteen functional positions that define specialization is dependent upon a
minimal level of technology to perform adequately. In essence, technology may serve a different function than that assumed in the hypothesis. Consideration of the results suggest that technology may not be essential to structure for three reasons.

The first reason is that technology may serve as a tool to increase operational efficiency rather than as a strategy for reducing the work force. Increasing technology may be a tactic to accomplish a strategy of reducing the work force rather than being the principal strategy. Technology, as defined in this study as an investment in process or information technology, should be controlled for as an intervening variable in future studies.

Second, technology may not have changed dramatically enough during the period under study to provide any significant findings. Since sixteen organizational functions were used to determine the measure of specialization, technology might have changed dramatically within just one or two of these functions. The remaining fourteen or fifteen functions may have seen little or no change in the level of technology. An overall measure of technology, as used in this study, could misinterpret this phenomenon.

A third possible reason for the lack of significance may be the measure of technology used. There is still widespread disagreement about how technology may be measured (Swed 1995). The use of information and process R&D expenditures as a measure of technology was not successful in this study, but perhaps these results will provide information to future researchers about the utility of this type of variable when used for study of organizations that are technology intensive.
The fifth, sixth, and seventh hypotheses were not rejected, but if the change in technology variable is to be used in future research, it should be used with caution since a major component of all three hypotheses contained this rejected measure. Change in technology used in conjunction with either the measures of dis-integration and/or change in the number of employees gave significant results when regressed with the dependent variable, change in specialization. When the change in technology variable is used in conjunction with the other independent variables for detecting changes in specialization, the findings are overshadowed by the predictive abilities of either the change in the number of employees or a change in assets. The variance accounted for by the technology variable was only 4%, below the established minimum threshold of 15% (Freund and Littell 1986). The change in technology variable as used in this study did not provide adequate explanation for the variance in the dependent variable to be accepted as a valid construct. For this reason, technology in conjunction with the other two independent variables is not discussed further.

Discussion of Dis-integration

Hypothesis 2 predicted that, as an organization experiences dis-integration, specialization decreases. To measure dis-integration, a measure of a change in assets over the time span of the study was performed. Significant results were obtained when change in assets was regressed on the dependent measure of specialization. The implications of this finding may be far reaching since many organizations, as discussed in chapter 2, are finding saturated markets in the United States. Since
growth is not an option, many companies see the ever-increasing need to become more efficient and streamlined to compete. Harrigan (1988) suggests that this pressure forces these companies to adopt end-game strategies. One end-game strategy is to focus on specific key markets rather than on as many markets as possible. The strong positive relationship found between specialization and dis-integration not only supports hypothesis 2 but also supports Harrigan's supposition that mature industries engage in dis-integration.

Beyond adopting end-game strategies, the internal organizational structure is also affected by the aforementioned changes in the market. As specialization decreases and generalization increases, work of the same type and amount must be performed. The tasks that were once done by a number of specialists are now done by fewer employees. This also supports both the qualitative findings of the pilot study and the supporting literature (Harris 1991, Kolsky and Trice 1992). The net effect of the selling of assets to focus on key elements of the business is that the remaining employees are concerned about the future plans of the organization.

Change in assets as a measure of integration has proven useful for predicting a change specialization. The findings of this study using the change in assets measure provided support for the use of this variable in future organizational structure studies. Because this variable can be obtained through different sources and is a good measure in predicting changes in specialization, consideration of the use of change in assets in any other structural study as a primary variable should not be underestimated. Other studies focused on growth, often outlined related problems within the organization as it
grew (Greiner 1972). As an investigative analysis, this study was limited to changes in structure. Other phenomena, such as control and communication within the organization as it contracts, deserve further attention in future studies of disintegration.

The variance explained by the change in the level of integration variable did meet the minimum threshold of 15%. Nonetheless, further statistical analysis found that when this variable was used in conjunction with the change in the number of employees, it did not adequately add to the explanation of the variance and was dropped from the model. The implication of this result is that it is adequate when used alone. The importance of this finding is that when the change in the number of employees measure is unavailable, the change in the level of integration is an adequate surrogate measure for the change in the number of employees variable within a study. This study, however, suggests that both variables should be measured and used since a company that undergoes change may decide to dis-integrate while not changing the number of employees. Without this variable, it would be difficult to determine a change in structure base solely on a change in the number of employees.

Discussion of Changes in Number of Employees

The measure of change in the number of employees exhibited the strongest predictive relationship when regressed upon the change in specialization. There is a positive significant relationship between the number of employees and the level of specialization within an organization, as predicted in hypothesis 1. One of two
presumptions may be made from this finding. One is that managers are targeting a certain organizational size in an attempt to achieve a certain competitive position, or secondly, that managers may be reacting to the trend of OWFR by similarly downsizing as other competitors have to remain competitive (Tucci and Sweo 1996).

Changing the level of work force through downsizing is not without certain implications for these companies. Managers may decide to accomplish downsizing in a number of different ways as outlined in chapter 2 but their decision on which departments, divisions, or classifications of personnel to be reduced is still subject to management's decision making. One of two outcomes could have come from this study. The first outcome was that managers would decide to cut the number of employees evenly across all classifications and divisions. This would have yielded no net change in specialization. This was not expected, however, since the competitive and economic environment was similar to the earlier studies by Harrigan (1986). The second possible outcome, indicated that under similar environmental conditions, firms would engage in end-game strategies and corresponding reductions in staff would not be evenly distributed but targeted at specific functions as suggested in recent literature.

To measure specialization, respondents were asked sixteen questions concerning types of positions found in their company. Each of these questions related directly to Bakke's (1959) earlier work suggesting that an organization must perform these tasks in one manner or another to function as a business. Eight of the sixteen tasks were eliminated more often than the remaining positions. These eight tasks account for most of the change in specialization for the fully integrated oil industry (see table 15).
Identification of these eight targeted positions was important in this research project since these eight positions share commonalities, although they may be industry specific. The implications of eliminating these positions conform to what Hammer and Champy (1993) have identified as factors important to companies wishing to undertake business process reengineering. These commonalities can be classified across several dimensions: (1) administrative support positions, (2) positions involving cost centers (as compared to a profit center), and (3) positions with outsource potential. Positions in one of these three areas have a higher probability of being purged from the organization through one means or another. These three dimensions of commonality provide the definitions for a new organizational boundary paradigm.

Hammer and Champy (1993) advocate that a firm assess the essential work processes within the company and then identify those processes that can be reengineered (reallocated), thereby eliminating redundant work and associated positions. The results of this study indicate that the assessment of work processes most often uses one of these three commonalities. If business process reengineering has been adopted by the oil industry, it may be assumed that the above-named eight
positions would be the positions that are most likely to be absorbed by other closely related positions, eliminated when business process analysis was performed or outsourced to a firm specializing in that task.

The variance explained by the change in the number of employee variable was significant at 24% and was above the accepted minimum threshold of 15% (Freund and Littell 1986). This variable accounted for a majority (77%) of the variance explained when used in conjunction with the other two independent variables: change in the level of integration or change in the level of investment in technology. Used independently, the change in the number of employees to explain the variance in dependent variable, change in specialization, is adequate. Further research into organizations undergoing structural change could be enhanced if the independent variable, change in the number of employees, is used.

Since using the investment in technology variable failed to yield significant results, while the change in the number of employees and level of integration variables indicated significance, it would appear that the model for OWFR factors suggested in chapter 1 does not appropriately address the findings of this study. A major change in the model is suggested by the deletion of the information and manufacturing technology variable. When and if any significance is found in the future using this variable, it could be added back into the model. This change is reflected in figure 9.

Discussion of Potential Alternative Hypotheses

Two alternative variables were offered in chapter 2 that might explain changes
The first explanation offered was environmental turbulence. Environmental turbulence has been suggested as a cause for changes within organizations (Kumar 1990). Nonetheless, the definition of environmental turbulence changes with the addition of factors that modify the level of turbulence within the environment (Ansoff 1990). These moderating factors change the level of turbulence with increases in technology, governmental regulation, and changes in the economy of foreign countries that may either inhibit or encourage global competition. As organizations react to this change, several options are available to management which may not include a corresponding change in structure. Therefore, the hypotheses using the change in the number of employees and change in the level of integration in this study predicting changes in structure are superior to the use of an environmental turbulence variable.

The second explanation offered was declining incomes as reflected by poor financial performance, excessive debt, bankruptcies or threat of bankruptcies. The use of declining incomes also shares some of the same problems as the first alternative explanation in that management has options that may not include a corresponding change in the structure. Management may decide to eliminate certain products, product lines, obtain more debt, or become involved in a merger or acquisition to overcome the problem of a declining income. The decision to change organizational structure may also be negated by financial reserves that may support the company through a period of poor returns. Because of these mitigating factors, the constructs used in this study are superior to using a declining income variable.
Figure 9. -- Modified model of OWFR factors
General Findings

This section includes a review of the findings, using a broad approach. It is divided into two parts, the first of which is a discussion of the ramifications, implications, and potential consequences beyond the acceptance or rejection of the hypotheses. The second part is a review of the findings, utilizing a qualitative approach to discuss OWFR in relationship to the environment in which it occurs.

Inferential Findings

The finding that both the percent change in the number of employees and the percent change in assets were significant when predicting a change in specialization has several ramifications. The first is a change in the complexity within the organizational structure itself. As organizations reevaluate their competitive positions, either as a result of poor financial performance or proactively to enhance competitiveness, the reengineering trend is toward corporate specialization in product, market, or service rather than toward corporations that have high internal levels of specialization. The addition of the experience curve to the concept of highly specialized organizations leads one to believe that competition will become even greater since experience will tend to reduce costs for the firm and enhance the firm's competitive position.

From a macro-perspective, industries will come to be dominated by highly specialized organizations instead of industries being dominated by organizations that have high levels of specialization. In any industry, this specialization may be evident
in the segment of the business in which the company chooses to compete. This summarization is hinted at in Harrigan’s (1986) end-game strategy analysis. It appears that the hint started to become reality when companies began adopting Porter’s (1980) core competencies value-chain approach, which was later extended by Hammer’s (1990) philosophy of process reengineering.

With the move toward more specialized organizations, there may be an increase in the number of network organizations (Miles and Snow 1995). Network or virtual organizations will be able to exist because the competitive pressures placed on organizations operating in a dynamic global environment which demands that an organization be highly adaptable. The potential for an organization to adopt a “node” (contract outsourcing firm) as a human resource management partner in the United States and a different node in Europe would allow for the flexibility needed yet still provide the expertise to operate in any chosen environment. Under this new paradigm, remaining competitive through the ability to adapt to markets that move from one physical location to another creates a climate beneficial to this type of organization.

Organizations adopting the business process reengineering philosophy are forced to consider only those components that comprise the core business and outsource non-essential components that may be done better through an outside service firm. Compounding this effort to reengineer the processes is the ability to use technology in ways that have not been used by business before. Both local area and wide area networks (LAN and WAN) allow the organization to exist and perform its internal work in ways previously considered unfeasible. An example of this is the
ability of firms to automate many processes, such as invoice processing, by using technology and passing processed information directly to those responsible for making decisions about authority limits and those making purchasing decisions (Champy 1995).

The dynamics of the shift in specialization from the organizational chart to the strategic response of the firm to the competitive environment may mirror the change society experienced as we moved from an agrarian-based economy to a manufacturing economy. This change may have the same result in that large numbers of people may be unemployed until there are new job opportunities. However, the displacement may be limited in the short run as the unemployed are hired by contract firms filling the specialized niches. This is evidenced in the increase in the number of outsourcing firms.

All of the ramifications discussed above may result in an increased level of outsourcing. An increase in the level of outsourcing can have several possible effects. One could be an increase in entrepreneurship due to the high number of skilled and educated individuals being terminated through OWFR. Anecdotal reporting of increases in the number of consulting firms lend support to this assumption. This increase in entrepreneurship may also yield other new types of businesses, such as those on the Internet.

Qualitative Findings

Employee concerns emerged as being the primary outcome of the qualitative
analysis in this study. Three concerns dominated most of the discussions: morale, forced delegation, and outsourcing. The negativity of organizational work force reduction emerged as the most prevalent factor in the analysis of the anecdotal and research literature. This is consistent with the participants' comments obtained in the pilot study, as well as the written comments in the open-ended response section of the questionnaire. Listed in table 16 are the terms used by respondents during the course of this study.

In all instances, morale was the defining central issue for those left behind after work force reduction. Some companies have announced that a fluctuating work force will be the norm rather than an exception, because adapting to the competitive environment is now a primary objective.

Table 16. -- Common terminology

<table>
<thead>
<tr>
<th>Downsizing</th>
<th>Reengineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction</td>
<td>Rightsizing</td>
</tr>
<tr>
<td>Layoffs</td>
<td>Distrust</td>
</tr>
<tr>
<td>Cutbacks</td>
<td>Outsourcing</td>
</tr>
<tr>
<td>Forced Delegation</td>
<td>Poor morale</td>
</tr>
<tr>
<td>Anxiety</td>
<td>Reduction</td>
</tr>
<tr>
<td>Contraction</td>
<td>Reorganization</td>
</tr>
<tr>
<td>Lean and mean</td>
<td>Job security</td>
</tr>
<tr>
<td>Severance</td>
<td>Guilt</td>
</tr>
</tbody>
</table>
For this study, management decisions to downsize or reengineer the company may be a measure of how turbulent or unstable management perceives the external environment to be. All the employees interviewed expressed their concern about the sale or closure of their company or about their job being eliminated.

The second most prevalent term was forced delegation. A president of one company who serves as a vice-president for the parent company said that decision making and responsibility for all aspects of the operations were being forced as far down the corporate ladder as they could go. The amount of work delegated to employees of the organization forces a move toward self managed work teams thereby creating a more participative atmosphere. A representative response from a divisional engineering manager states:

Restructuring is seen as a way to force groups to prioritize work. With a large group, all work is seen as important, but when the size of the group is reduced, what was seen as important is eliminated when nobody is available to perform the task.

The third most prevalent factor was how outsourcing was used within the firm. In the engineering department, whole tasks or work activities are not contracted. Instead a smaller group with both permanent and contract employees are expected to achieve the same output as the pre-restructured group. In some instances, only some parts of the business are outsourced. However, this outsourcing and the utilization of outsourcing services are seen as a way to balance staffing. When work force demand is high, such as during a boom in the oil industry when new oil fields are being developed, more contractors are hired to fulfill work requirements while the full-time
One observation was the respondents' reactions to the phenomenon of organizational work force reduction. Most respondents said that the most dramatic outcome of work force reduction was the lower morale after the announcements were made of plans for layoffs, early retirement packages, and reduction through attrition. Many respondents noted that the managers who made the announcements also stated that employee work force adjustment would be an ongoing process as the new company continually adjusts the work force to meet market demands and global competition. These changes may all be reflective of the changing roles of the work force as the level of expectation and specialization changes for each employee.

Re-definition of Specialization

Analysis of the literature also indicates that there is a misunderstanding of specialization by both researchers and practitioners. Apparently there are two definitions of specialization. The first, as used historically in the literature, refers to the tasks that are complete and independent of each other by definition. Bakke's (1959) study defined specialization for business by identifying sixteen separate and independent tasks that must be performed for a business to operate. The other definition for specialization is based on the number of separate tasks as defined by titles within the organization. This second definition allows one specific function to be subdivided. The second definition does not establish a standard for specialization
because each task could be divided in multiple ways. Division of tasks by product type is one example. To obtain a specialization score utilizing this method, the number of products, managers and/or employees, respectively would have to be counted. This score would not include the other fifteen positions, which would be treated in a like manner. The use of Bakke's specialization score allowed for generalization regardless of industry.

Bakke's definition of specialization is nearly forty years old. Redefining specialization may be a necessity because firms are now classifying positions or tasks as being essential or non-essential. Using the three dimensions for finding commonality of positions: (1) administrative support positions, (2) positions involving cost centers (as compared to a profit center), and (3) positions with outsource potential with the essential and non-essential task classification provide a better measure of specialization than the traditional measuring of sixteen pre-defined tasks (see table 17).

Table 17. -- New specialization matrix

<table>
<thead>
<tr>
<th></th>
<th>Administrative support positions</th>
<th>Positions involving cost vs. profit centers</th>
<th>Positions with potential for outsourcing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential positions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-essential positions</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This new specialization measure should be superior to Bakke's (1959) specialization measure, originally designed for manufacturing firms. The new specialization measure should work well for both manufacturing and service industry
firms. Instead of Bakke's (1959) sixteen questions identifying separate tasks, the new questions would need to focus on four areas: core business (essential and non-essential tasks), administrative services, cost and profit centers, and outsourcing availability. More exact definitions of each of these areas are beyond the scope of this project.

The use of different specialization measures confounds the development of paradigms representing potentially dramatic organizational changes. A paradigm shift has occurred due to environmental changes, resulting in fewer than the sixteen positions Bakke proposed in 1959. If there are now fewer than sixteen positions within the organization, this will have serious repercussions for academicians and practitioners alike.

A useful observation occurred during the pilot study. One respondent asked why only sixteen positions were measured since his company had many positions. The researcher explained Bakke's 1959 study about the sixteen core essential tasks in any business. During the explanation, the differences in how people understand and misunderstand specialization in the context of their daily job became evident. Several tasks were identified for the subject and were explained to be sub-components of the broader definition of specialization as used in this study. Analysis of this respondents' comments suggests that business may be changing in that technology may allow for greater automation and elimination of some positions while other unknown positions may emerge in the organizational structure. The implications of such are discussed in the following section.
Validity of Findings

A trinitarian perspective was used to evaluate the validity of this study (Cohen et al. 1988). This section evaluates the study on content validity, criterion-related validity, and construct validity (Cook and Campbell, 1979).

Content Validity

Bakke (1959) clearly defined the sixteen functions that comprise the total score for the measure of specialization. Numerous studies have used this measure to define specific structural attributes that differentiate one structural form from another. The reliability of this measure has been checked by the analysis of organizational charts to identify the level of specialization within the organization (Sathe 1978). The score derived from the organizational chart was checked against the score derived from the survey for the same organization during the same time period. The scores were found to be interchangeable. The specialization measurement instrument was found to be accurate and reliable.

Another issue of validity is experimenter expectancies. Since the participants did not come into contact with the researcher, except for those during the pilot study, expectancies should have been limited to the questionnaire and hypothesis guessing. Hypothesis guessing probably presented the greatest exposure for bias since nearly every company had been or was undergoing OWFR. An effort to minimize this was done by putting the specialization part of the questionnaire at the beginning. Since the specialization section asks only about tasks, it was hoped that assumptions about the
hypothesis would not be made until the participants reached the latter portions of the questionnaire.

Interaction of different treatments posed no threat since the variables were not manipulated. This is also true for the other threats of interaction of testing and treatment, confounding constructs, and level of constructs. Statistical threats to the validity of findings are relevant when considering the use of investment in technology as used in this study. The rejection of hypothesis 3 and the inclusion the technology variable in hypotheses 5, 6, and 7, limit the ability of the model to explain more variance. The use of other accepted measures of technology in the future may overcome this limitation. Since the improvements in the variance explained was not significantly improved by adding this variable, changing the way this variable is operationalized and measured together with increasing the size of the population may help overcome this deficiency.

Criterion Validity

The measure of specialization used in this study has been used in a number of studies concerning differences in organizations. It has been found to be reliable in measuring how tasks are divided within the organization. Scores for the measure of specialization have been published in earlier studies; they are cited in chapter 2. Earlier studies used growth in organizational size to predict changes in specialization. Since change in organizational size is an accepted method of measuring structure, the use of the change in the number of employees as an independent variable appears to
be a useful and valid measure for organizations that are contracting. The actual reverse of this phenomenon was tested to determine if contraction in organizational size had the same or a different effect. The results of the hypothesis tests indicate that either a change in the number of employees or in the level of integration are excellent predictors of specialization.

All studies using mail questionnaires as a primary source of data may be suspect for various reasons because it is difficult to ascertain the environment in which the questionnaire was being answered and even the capabilities of the person providing the information. The issue of determining who was answering the questionnaire was minimized by numerous follow-up phone calls directly to the respondents or their secretaries. Nevertheless, it is highly improbable that all the responses on the questionnaire came from the person randomly chosen to participate. This is a potential weakness of the study, but the level of threat is believed to be minimal since the information requested was relatively easily obtained, according to the respondents in the pilot study.

Since this study involved a relatively lengthy period of time, from 1987 to 1993, history and maturation may influence the respondents' ability to accurately respond to the questionnaire. One response item on the survey concerned years with the company. Only one respondent had been with the company less time than the time period specified for the survey. This respondent, during a follow-up phone call, expressed discomfort in participating in the survey. The survey was mailed to another individual having sufficient years with the company as well as access to data needed
to respond to the questions. All of the data requested in the questionnaire should have been available to the respondents through internal channels within the company. Since the data requested could be obtainable from company records, the dependence on memory to remember specific data should have minimized errors in response. History and maturation did not appear to be problems in this study.

The findings for this study are applicable only to companies or organizations which fit the parameters defined in chapter 1. Limitations may also be placed on the usefulness of the research by the characteristic nature in which the structural variables have been defined by previous studies. Changes in job titles and the meanings of those job titles may have different implications for the dependent variable. The ability of the participants to discern changes in the magnitude of the dependent variable is critical to the development of reliable measures for future research concerning restructuring the organization and its effects on future strategies.

The primary limitation of this study were the available populations. The use of fully integrated companies was required since these companies would have the greatest potential for engaging in end-game strategies and in satisfying the requirements of the research question. The oil industry has oligarchic market structure characteristics and is monolithic in nature. This peculiarity was useful in minimizing the number of extraneous variables that often hinder generalization to other large mature industries. Nevertheless, extrapolation of the data for use in comparing a different industry should be done with caution until potential moderating variables that would account for the differences between the industries are defined.
Quantitative research, especially as related to the use of questionnaires, is highly dependent upon an individual's opinion or attitude within the company while answering the questionnaire (Dillman 1978). It has been found that a single factor can influence the ratings by the individuals (Podsakoff and Organ, 1986). Future research could enhance and further this study through the use of company phone books and the development of structural diagrams, organizational charts, and organigrams (Sethe 1978). These charts, in combination with the obtained qualitative data, would allow for the delineation of company personnel and would be useful in classifying them into their relative structural positions within the companies. This would make the validity argument stronger as well as generalization to similar industries. The use of charts in conjunction with the questionnaire should minimize exposure to mono-operation problems. A firm does offer commercially available organizational charts for research purposes (Conference Board, 1996).

Secondary limitations associated with questionnaire methodology were addressed through the use of the qualitative research methods of observation, documentation, and interviews (Patton 1990). For this reason, dual methodologies are often recommended and are used to develop the appropriate structural theory as well as in the analysis of the hypotheses (Fielding and Fielding 1986, Jick 1979).

Still another limitation that could possibly hinder the research is the availability of a cross-sectional representative sample. Access to all the strata of the corporations in this study was difficult due to geographical/locational and divisional/stratigraphical differences. To overcome this problem, human resource managers were the target of
the questionnaire. It was felt that the human resource manager at each oil company was in a better position than most managers to know about changes in specific job assignments. Human resource managers were, therefore, the logical choice to use as participants in this study since they have access to both personnel records and the necessary archival data to have completed the questionnaire. Since the questions were not personal in nature, evaluation apprehension should have been minimized.

Construct Validity

Although Bakke's initial 1959 study used different wording for the tasks than Miller's 1986 study, the changes in the definitions of tasks represent a change in society's description of those tasks. Numerous studies have been performed since that time, utilizing the same measure of specialization as modified by Miller (1986) and used in this study. Mono-operation bias was minimized in this study to some extent since the respondents not only provided the raw data by which the score of specialization could be developed, but they also were asked two questions of a different type to determine whether specialization had changed. These two questions were used to verify the respondents' specialization score. Because there were several questions to operationalize the specialization measure, mono-operation bias should not have presented any significant threat to the validity of this study.

The independent variables were taken from the COMPUSTAT database that has been accepted by the research community as a source of accurate and reliable information. The independent variables used for this study were verified against
another data source, Compact Disclosure database, to verify the information. Other validity problems, such as hypothesis guessing, confounding constructs, or evaluation apprehension, did not appear to cause any problems since the questionnaire was limited to the measure of specialization and to qualitative questions. None of the variables were manipulated during the study.

Statistical threats to validity did not appear to be a problem for this study. Previous studies established how the score for specialization was to be derived by the summing of the responses about specific functions on the questionnaire. The independent measures were taken from the COMPUSTAT database. ANOVA analyses were performed to test for correlation between the variables. During the study one statistical concern emerged concerning the lack of significance in relation to the technology variable. Although the use of this variable did not produce a significant result, it was close enough to cause some concern. Only future studies with larger sample sizes can determine if a Type I error occurred in this study by the rejection of hypothesis 3. Nevertheless, with the post-hoc power test analysis resulting in a power of .83, it can be assumed that the model does fairly predict the proposed relationships. To increase the level of power for this study, alternative independent variables could be used that would provide a greater differentiation in the means. The greater mean differences between the independent variables would then increase the power of the predictive ability of the model.

Threats to the validity of this study were minimized by careful control of the administration and follow-up on the questionnaire. The use of accepted constructs,
dependent and independent variables, and the use of several measures also minimized the potential of common method variance. The use of several data items to obtain the dependent variable from the questionnaire and the use of a different source of information to obtain the independent variables helped in reducing common method variance. Since survey techniques are most susceptible to common method variance, the use of questions asking for general business data rather than personal data minimizes the threat that the individual ratings would be biased by a single factor in the population (Podsakoff and Organ 1986).

**Research Implications**

The investigative nature of this study strongly supports the supposition that specialization decreases when either the number of employees is reduced or a company engages in dis-integration through the sale or closure of operating assets. Although several suggestions were made for future research in the discussion of the hypotheses, broader suggestions to extend this study are offered here. The implications of reduced specialization within organizations are discussed from both the academic and practitioner perspective.

**Academic Implications**

Another area needing continued research is the level of outsourcing and its relationship to the level of government regulation. A review of the respondents to questions concerning sections of the company that have been outsourced since 1987 reveals two additional areas for extending this study. The first area needing further
investigation concerns the relationship between the level of government regulation and those functions that have been outsourced. The second area is the type and rate of change in regulation. Table 18 lists the functions that have been outsourced by more than two companies since 1987. Table 19 lists the functions that were outsourced by one company. Table 20 lists the functions that have not been outsourced since 1987 or were outsourced prior to this date.

Observation of those components that are in table 18 may indicate that some portions of the company most likely to be outsourced are those with the highest level of government regulation. For example, the maintenance function in the oil industry is regulated by both the Environmental Protection Agency (EPA) and the Department of Transportation (DOT).

Table 18. -- Jobs outsourced by two or more companies

| Human Resources | Accounting | Invoice Processing | Health Services | Legal Services | Maintenance | Communication Services |

Many of these outsourced functions are also strictly regulated by the federal government. The findings in this study suggest that areas in which there a high degree of expertise is required in dealing with interpretation of pertinent laws, outsourcing is a viable option. Again the commonality dimensions suggest that, if the function is a cost center, provides some type of administrative support, or has a high
level of government regulation, that function can be outsourced so that specialists in that field can provide the support.

Table 19. -- Jobs outsourced by one company

<table>
<thead>
<tr>
<th>Engineering</th>
<th>Environmental Services</th>
<th>Safety</th>
<th>Chemical Processing</th>
<th>Security</th>
<th>Marine Services</th>
<th>Exploration</th>
<th>Air Transportation</th>
<th>Drilling</th>
<th>Pipeline</th>
<th>Training</th>
</tr>
</thead>
</table>

Table 20. -- Jobs not outsourced since 1987

<table>
<thead>
<tr>
<th>Production</th>
<th>Seismic Services</th>
<th>Refining</th>
</tr>
</thead>
</table>

Outsourcing of the invoice-processing component by many companies may be related to the volume of BPR literature, citing invoice processing as an example. Extending this study to determine whether other industries have eliminated or reengineered their invoice processing may indicate that BPR is no more than a popular concept or fad that has been rarely extended beyond those business functions that have been proven to work.

Outsourcing of the positions in table 18 also leads one to theorize that outsourcing may involve classifying the business into cost or profit centers. Responses to the questionnaire indicate that cost-center functions are more often outsourced than
those performed by profit centers. Results indicate that refining, production, and seismic processes are seldom if ever outsourced (see table 20). Seismic services have historically been outsourced. Because both the production and refining process are revenue generators for most fully integrated oil companies, they are seldom outsourced. An extension of this study to examine the outsourcing phenomenon is needed to understand end-game strategies and potential options for mature and/or declining industries.

Increased ability to communicate through improved technologies continues to change the way organizations accomplish their objectives. Dissemination of information to different members of the organization will probably result in changes in responsibility. This is in part supported by the ability of management to use forced delegation as one means of restructuring organizations.

As communication and process technologies improve, other dramatic changes can be expected (Sweo 1995). Although the hypotheses that included technology as a variable were rejected, the rejection may be due to the fact that the oil industry has always been highly dependent on technology. Therefore, technology may serve more as a tool than a means or strategy for accomplishing organizational work force reduction.

Technology should be included in future studies since it provided some marginal benefit when combined with the other two independent variables (disintegration and change in the number of employees) in this study. Other industries may react differently to the technology measure than did the oil industry due to
differing task requirements. In summary, the use of technology as a measure may have to be tempered by an understanding of the level of technology required by the firm to operate or compete. The lack of significant results using the research and development technology measures may be due to the high-technology-dependent nature of the oil industry. Other low-technology industries may have significant results as they adopt higher levels of technology. Re-definition of technology as a structural change variable should be done to account for the differing technology requirements from industry to industry.

Because specialization decreases with reductions in the work force, the remaining work must be outsourced, eliminated, or divided among the remaining employees. If the remaining work is not eliminated, the employees must be trained to complete the new task assignments. Job enlargement, resulting from forced delegation, generally requires training to allow for the efficient disposition of the added assignments. The net effect, one would expect, would be an increase in training and development dollars spent to provide this training. Studies to determine whether outsourcing replaced the lost positions, or whether reassignment of existing employees was used should be included in future studies. If reassignment of existing employees is suspected, the costs for employee training and development should also be included. Training measures should include tracking the type of training and the associated costs. Tracking retraining cost expenditures to accommodate job enlargement might be indicative of how well the organization is progressing in the restructuring process. A more broadly trained work force should be easier to work with during a business
process reengineering effort.

Practitioner Implications

Practicing managers must be keenly aware that adopting OWFR as a means to change organizational structure to become more organic, more competitive, or both, has long-range implications. Problems of lower morale and anxiety may offset expected advantages from a downsizing effort and the associated reduction in costs. The problem of lower morale may be difficult to overcome, especially if the change is significant enough to modify the positive aspects of the organizations' culture.

Difficulty in understanding the role of specialization presents another problem for the practitioner. The literature indicated that managers utilizing business process reengineering have failed more often than not. Success in reengineering work-flow processes may be based on an ability to find individuals with broad backgrounds (generalists) who can comprehend the entire business process rather than viewing the work flow from their self-referencing criteria function (specialization).

Understanding the positive and negative consequences of specialization also allows practitioners to help organizations successfully adopt new organizational forms. The emergence of the network organization is one example where specialization is evolving from the functional level of the organization to becoming the dominant organizational form. The network organization is highly dependent upon utilizing only specialized node companies. Each node may perform the roles that were once internal operations of the parent company.
The movement of these specialized tasks to contract positions reduces the level of specialization within the company. The external (contract) company or node organization performing a specific function may use their specialty for several companies concurrently. The net effect for practitioners is that specialization can become the primary decision variable when they decide to modify the organization. Specialization would be added as another variable in the decision process, together with functional, divisional, product, or geographic organizational structure decision options.

Training and development expenses may be reduced long term because there are fewer employees. However, in the short term, training needs of the remaining employees may increase for two reasons. First, training and development costs may increase because increased conflict between the organization and the outsourcing firm. Another reason that training costs may increase is the lack of experience and inability to perform the new tasks assigned to the remaining employees as organizations develop a lean and mean profile. The complexity of the training needs may depend more on which functions are farmed out and/or which ones are not.

Chapter Summary

The results of this study indicate that the measure of specialization as operationalized by a change in the number of employees is a useful tool for both practitioners and academicians in understanding the consequences of OWFR. Although this study was limited in scope, several additional variables were identified
as being potentially useful for predicting changes within the organization. Reduction in the number of employees proved to be the best predictor of change in specialization. Dis-integration, as postulated by Harrigan (1988), proved to be another important indicator and performed adequately when predicting changes in specialization. Technology as measured by investment research and development for process and information technologies was not strongly related with decreases in specialization.

This investigative study raised several peripheral issues that may become more important than the direct findings as presented. The first is that changes in organizational structure paradigms are occurring and changing the way businesses will compete in the future. Secondly, the structural configurational measure specialization may be more broadly defined through several dimensions: essential and non-essential tasks, cost and profit centers, administrative services, and outsourcing availability are being used as the new defining factors for structural boundaries.

The lack of success by many companies in gaining expected benefits from organizational work force reduction in an effort to find the optimal organizational size is metaphorically like the anorexic. During periods of growth, bingeing on profit, market share, and increasing the number of employees becomes an all-consuming concern, but with a downturn in the economy, the attempt to weather hard times perhaps causes managers to overreact dramatically. The resulting anorexic organizations are not only left fighting battles with their competitors in the global market, but apparently internal battles as well.
APPENDIX A

COMPANIES IN SAMPLE FRAME
AND INDUSTRY CHARACTERISTICS
COMPANIES IN SAMPLE FRAME
SIC CODES 1311 AND 2911

AMERADA HESS CORP
AMOCO CORP
ATLANTIC RICHFIELD CO
BROKEN HILL PROPRIETRY
CHAMPLIN
CITIES SERVICE CORP
COASTAL STATES CORP
CROWN CENTRAL
DU PONT (CONOCO)
FINA INC
HOLLY CORP
IMPERIAL OIL LTD
KOCH INDUSTRIES
LYONDELL PETROCHEMICAL
MOBIL CORP
NORSK HYDRO
PETRO-CANADA INC
QUAKER STATE CORP
SHELL OIL CO
SOHIO
SUNCOR INC.
TESORO PETROLEUM CORP
TOSCO CORP
UNICO INC/ NEW MEXICO
USX-MARATHON GROUP
WAINOCO OIL CORP

AMERICAN INTL. PETROLEUM CORP
ASHLAND OIL INC
BRITISH PETROLEUM PLC
CASTLE ENERGY CORP
CHEVRON CORP
CLARK
COMMONWEALTH
DIAMOND SHAMROCK INC
EXXON CORP
GIANT INDUSTRIES INC
HOWELL CORP
KERR-MCGEE CORP
LOUISIANA LAND & EXPLORATION
MAPCO INC.
MURPHY OIL CORP
PENNZOIL CO
PHILLIPS PETROLEUM CO
REPSOL S.A.
ELF AQUIFN
SUN CO INC
TENNECO
TEXACO INC
TOTAL S A
UNION OIL CO OF CALIFORNIA
VALERO
Industry Characteristics

The following six pages of illustrations give an overview of both the maturing and global competitiveness in the oil industry. Figure 10 illustrates the difference between United States production and consumption, which impacts the U. S. domestic companies by forcing them to seek new reserves elsewhere since the potential for new larger finds is minimal (Yergin 1991). Figure 11 illustrates how fast U.S. production of crude oil and condensate (condensate is a by-product of producing oil) is declining.

For integrated companies, more pressure to reduce has been evident, especially when considering that 14 out of 35 refineries have been shut down during the 1980 to 1993 time period in Louisiana alone. This is indicative of Harrigan’s (1980, 1983, 1988) end-game strategies occurring in the U.S. domestic oil industry.

Further reinforcement of the end-game strategy theory are Figures 12, 13, and 14. These three charts first reveal that the number of barrels produced per year is in steady decline. However, oil is only one of several component feedstocks used in the refining process. Natural gas is also produced, not only from gas wells, but from wells that produce both oil and gas. Figure 12 shows that gas production is declining as well.

Figure 13 illustrates that this trend does not appear to be changing dramatically. As can be seen in figure 13 both the number of permits issued and the number of wells completed have also been in steady decline between 1980 and 1992. The first dramatic decline occurred between 1985 and 1986. Complicating the strategic decision making for the oil industry is the continual erosion in the dollar value of their
principal raw material, crude oil, and the relatively stable price of gasoline.

Figure 14 illustrates two primary points to consider in analysis. The first is the price reduction in crude oil during the 1980 to 1993 time period. A 25 percent reduction in crude oil prices negatively impacts integrated companies since their crude oil reserve is counted as an asset. The second point to consider is the lack of price increases over this same time period. Even with inflation, the tighter margins have been putting greater pressure on the industry to cut costs (Melcher, Burrows, and Smart 1994).

Figure 15 gives alternative evidence that the oil industry is trying to restructure. As can be seen in the graph, the oil industry has reduced overall employment over the same time period from 220,000 workers to 150,000 workers, a loss of 70,000 jobs. The loss of 70,000 workers represents an almost 30 percent decline in the work force. The economic impact to the national economy is also severe since it is estimated that there are between three to five spin-off jobs for each oil worker.

The oil industry has a track record of a continuing effort to control resources, minimize exposure to the external environment, and operate internationally (Yergin 1991, Sampson 1975). Also, Harrigan in 1983 had discovered that the oil industry was the only mature industry not to have experienced the effects of maturity and as of 1983 had not adopted any "end-game" strategies. Thus the nature and characteristics of the oil industry as well as the availability of the data validate the use of this industry as a sample.
The diversity issue of like companies attracting like employees is not unique. Industry culture may also be strongly correlated to the relationship issue of developing strategies and the Population Ecology Model (Aldrich 1990, Singh 1990). It is from this presupposition that oil companies should behave in common ways in terms of how they approach decision making, in general, and downsizing, specifically. This supposition proved to be true.

The oil industry not only operates in the industrialized world but also in lesser developed countries (Grogan 1990). This exposure to all tiers of the international market makes the oil industry a good reference with which to compare other industries as they enter less developed countries at a time of changing markets and strategies (Coe 1991).
Figure 11. -- Production decline in Louisiana
Figure 12. -- Production decline in Louisiana
Wells Completed vs. Permits Issued (State of Louisiana)

Figure 13. -- Change in drilling activity
Figure 14. Crude oil and gasoline prices

Nationwide Averages
Figure 15. -- Number of Oil Industry Employees
Appendix B

CORRESPONDENCE
Dear Name,

The average expenditure for a company undergoing downsizing, rightsizing, or business process reengineering was approximately $15 million. This is an enormous expense considering that most decisions to reduce the work force through one means or another is based upon organizational strategies developed in the 1960's and 1970's. All of the earlier research about changing structure was based on growth, not downsizing. Your participation in this study is essential in updating our knowledge about how organizations undergo change.

You and your company were chosen from a select group of companies to participate in this survey because of the unique characteristics of the oil industry. Because of your position as a key player in staffing decisions, I am asking you to take a few minutes of your time to complete the enclosed questionnaire. The questionnaire should take no more than 15 to 20 minutes to complete. A self-addressed, stamped envelope is provided for your convenience to return it to me.

YOUR RESPONSE WILL BE KEPT COMPLETELY CONFIDENTIAL. The only identifying number is placed on the upper right hand side of the form for use in mailing purposes. This identification number is used only for follow-up mailings for those not responding to earlier requests or problems with the mail. All responses will be reported in summary form, not by firm.

All respondents will receive a summary of the findings about the effects of downsizing upon the structure of organizations. I thank you for your assistance with this survey. Should you have any questions, please do not hesitate to call me at (504) XXX-XXXX or (504) XXX-XXXX.

Sincerely,

Jack E. Tucci
Research Director

attachments
Follow-Up Postcard

About one week ago a survey seeking your opinion and knowledge about work force reduction was mailed to you. If you have already completed it and returned it by mail in the self-addressed, postage paid envelope, please accept my heart felt thanks. If you have not filled it out, would you please take the 15 to 20 minutes to do so.

You and your company were chosen from a select group of companies to participate in this survey because of the unique characteristics of the oil industry. It is critical that you participate. If you did not receive the survey, please call me immediately, collect, at (504) XXX-XXXX or (504) XXX-XXXX and I will send you a replacement survey.
Dear Name,

Almost three weeks ago I wrote you asking you to complete a questionnaire about changes in your company’s structure. I still have not received your completed survey which is very important to me.

This research project is being done to update our knowledge and help us better understand how employment reduction affects an organization’s structure which in turn is either supposed to enhance performance or prevent the completion of our goals. As work force reduction continues to occur, we need to understand the implications of this decision if we are to benefit.

Your questionnaire is a significant part of this study. As a reminder, you and your company were selected to participate because of the uniqueness of the oil industry. It is essential that you complete the enclosed questionnaire and mail it back in the self-addressed, postage paid envelope.

REMEMBER, ALL RESPONSES WILL BE KEPT CONFIDENTIAL AND BE REPORTED AS SUMMARIES, NOT BY SPECIFIC COMPANY. All respondents will receive a summary of the findings about the effects of downsizing upon the structure of organizations.

Your cooperation is essential for the success of this study. I thank you for your assistance with this survey. Should you have any questions, please do not hesitate to call me at (504) XXX-XXXX or (504) XXX-XXXX.

Sincerely,

Jack E. Tucci
Research Director
APPENDIX C

PRE- AND POST ORGANIZATIONAL STRUCTURE QUESTIONNAIRE
Demographic and General Information

Please answer all the questions to the best of your ability.

What is your job title?: ________________________________

How long have you worked for the company? ______ (years).

Has there been a change in corporate strategy since 1987 that focuses primarily upon developing a more efficient and competitive structure?  [] NO   [ ] YES

Has there been a change in a company, division, or business unit strategy since 1987 that focuses on targeting a specific organizational size?  [ ] NO   [ ] YES

Please check one of the following that most closely matches the company division or business unit in which you are working.

[ ] Exploration and Production
[ ] Refining
[ ] Transportation
[ ] Chemicals
[ ] Research and Development
[ ] International Division
[ ] Marketing
[ ] Manufacturing

Which of the following terms have you used or heard someone else in your company use before, during, or after the decision to reduce the number of employees in your company. If possible, please rank them in the order the terms were used.

_____ DOWNSIZING

_____ RESTRUCTURING

_____ RIGHTSIZING

_____ BUSINESS PROCESS REENGINEERING

_____ OUTSOURCING

Since 1987 would you characterize your job as:

[ ] becoming more specialized.
[ ] becoming more general in nature
[ ] not changing, neither more specialized or general in nature.
Which of the following activities are dealt with exclusively by at least one full time person currently employed in the firm who:

- is responsible for public relations and advertising. [ ]
- is responsible for the sales, distribution and servicing of the output products. [ ]
- is responsible for the transportation of raw materials, semi-finished goods, and final products for the company. [ ]
- is responsible for the selection, placement, and retention of employees for the company. [ ]
- is responsible for training. [ ]
- is responsible for monitoring the environmental impact of our operations. [ ]
- is responsible for purchasing. [ ]
- is responsible for maintenance and construction. [ ]
- is responsible for accounting and invoice processing [ ]
- is responsible for the control of work flow and assignments. [ ]
- is responsible for the inspection and quality of materials, equipment, and output. [ ]
- is responsible for assessing and devising ways of producing output. [ ]
- is responsible for devising new equipment, new processes, and different outputs. [ ]
- is responsible for developing and carrying out administrative procedures. [ ]
- is responsible for resolving legal matters for the company. [ ]
- is responsible for marketing research for the company. [ ]
IN 1987, which of the following activities were dealt with exclusively by at least one full time person who was employed in the firm who:

was responsible for public relations and advertising. [ ]

was responsible for the sales, distribution and servicing of the output products. [ ]

was responsible for the transportation of raw materials, semi-finished goods, and final products for the company. [ ]

was responsible for the selection, placement, and retention of employees for the company. [ ]

was responsible for training. [ ]

was responsible for monitoring the environmental impact of our operations. [ ]

was responsible for purchasing. [ ]

was responsible for maintenance and construction. [ ]

was responsible for accounting and invoice processing [ ]

was responsible for the control of work flow and assignments. [ ]

was responsible for the inspection and quality of materials, equipment, and output. [ ]

was responsible for assessing and devising ways of producing output. [ ]

was responsible for devising new equipment, new processes, and different outputs. [ ]

was responsible for developing and carrying out administrative procedures. [ ]

was responsible for resolving legal matters for the company. [ ]

was responsible for marketing research for the company. [ ]
Has there been a major change in the information technology used by your company since 1987 in day to day operations that have resulted in a reduction in the number of company personnel?

[] NO  [] YES

Instruction: If the following information about the next two questions is not available to you, please ask an associate in your Research and Development Department or other appropriate person for this information.

What percentage of Research and Development dollars in 1987 was spent solely on product research (not process, information, or software research)?

0-5%  5-10%  10-20%  20-30%  30-40%  40-50%  50-60%  60-70%  70-80%  80-90%  90-100%

What percentage of Research and Development dollars in 1993 was spent solely on product research (not process, information, or software research)?

0-5%  5-10%  10-20%  20-30%  30-40%  40-50%  50-60%  60-70%  70-80%  80-90%  90-100%

Since 1987, what percentage of executive level managerial positions have been eliminated?

5% or less  5%-10%  10%-15%  15%-20%  20%-35%  >35%

Since 1987, what percentage of middle managerial positions have been eliminated?

5% or less  5%-10%  10%-15%  15%-20%  20%-35%  >35%

Since 1987, what percentage of 1st line supervisor positions have been eliminated?

5% or less  5%-10%  10%-15%  15%-20%  20%-35%  >35%

Since 1987, what percentage of non-exempt labor positions have been eliminated?

5% or less  5%-10%  10%-15%  15%-20%  20%-35%  >35%

Since 1987, how many control center consolidations have there been where two or more control centers were combined?

1-3  4-5  6-7  8-9  10-11
Since 1987, what number of control center consolidations have there been where two or more control centers were combined?

1-3___ 4-5___ 6-7___ 8-9___ 10-11___

Since 1987, how many divisions or districts has your company reduced in your company or region?

1-3___ 4-5___ 6-7___ 8-9___ 10-11___

Since 1987, how many subsidiaries has your company reduced through the sale or closing of a subsidiary?

1-3___ 4-5___ 6-7___ 8-9___ 10-11___

Since 1987, how many SBU’s (Strategic Business Units, ie. used for planning and control) has your company reduced through the sale or closing?

1-3___ 4-5___ 6-7___ 8-9___ 10-11___

Since 1987, how many fewer products has your company offered commercial consumers?

1-3___ 4-5___ 6-7___ 8-9___ 10-11___

Since 1987, how many fewer products has your company offered retail consumers?

1-3___ 4-5___ 6-7___ 8-9___ 10-11___

Since 1987, How many “new” products has your company offered either retail or commercial consumers?

1-3___ 4-5___ 6-7___ 8-9___ 10-11___
Please check the following contract services your company uses today that it DID NOT use in 1987

- Human Resources  - Accounting
- Invoice Processing  - Engineering
- Safety  - Security
- Health Services  - Exploration
- Environmental services  - Production
- Legal services  - Seismic Services
- Drilling  - Refining
- Chemical Processing  - Pipeline
- Maintenance  - Cathodic Protection
- Marine Services  - Air transportation
- Communication Services  - Other

Please remember that all this information will be kept strictly confidential. The results will only be reported in tabular form with no indication from which oil industries companies were solicited.

Please write any of your personal observations or omitted topics about the reduction in work force that you feel was not addressed by this survey. Please continue on the back if the space provided is insufficient.
Independent Variable "Number of Employees"
For years 1987, 1993 and Percentage Change
Employess (000)

<table>
<thead>
<tr>
<th>Company</th>
<th>1987</th>
<th>1993</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7.890</td>
<td>10.173</td>
<td>2.2894</td>
</tr>
<tr>
<td>2</td>
<td>.000</td>
<td>.051</td>
<td>-5.375</td>
</tr>
<tr>
<td>3</td>
<td>46.744</td>
<td>46.317</td>
<td>.0098</td>
</tr>
<tr>
<td>4</td>
<td>41.800</td>
<td>31.800</td>
<td>-2.392</td>
</tr>
<tr>
<td>5</td>
<td>25.800</td>
<td>25.100</td>
<td>.0271</td>
</tr>
<tr>
<td>6</td>
<td>126.400</td>
<td>72.600</td>
<td>.4286</td>
</tr>
<tr>
<td>7</td>
<td>.200</td>
<td>.808</td>
<td>-3.040</td>
</tr>
<tr>
<td>8</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>9</td>
<td>51.697</td>
<td>47.976</td>
<td>.0797</td>
</tr>
<tr>
<td>10</td>
<td>5.650</td>
<td>5.500</td>
<td>.0265</td>
</tr>
<tr>
<td>11</td>
<td>17.800</td>
<td>16.000</td>
<td>.101</td>
</tr>
<tr>
<td>12</td>
<td>5.659</td>
<td>3.031</td>
<td>-46.47</td>
</tr>
<tr>
<td>13</td>
<td>3.400</td>
<td>6.300</td>
<td>.8529</td>
</tr>
<tr>
<td>14</td>
<td>140.145</td>
<td>114.000</td>
<td>.187</td>
</tr>
<tr>
<td>15</td>
<td>100.000</td>
<td>91.000</td>
<td>.0900</td>
</tr>
<tr>
<td>16</td>
<td>3.369</td>
<td>3.224</td>
<td>.0430</td>
</tr>
<tr>
<td>17</td>
<td>1.456</td>
<td>1.431</td>
<td>.0434</td>
</tr>
<tr>
<td>18</td>
<td>.947</td>
<td>.950</td>
<td>.0453</td>
</tr>
<tr>
<td>19</td>
<td>.276</td>
<td>.297</td>
<td>.076</td>
</tr>
<tr>
<td>20</td>
<td>11.627</td>
<td>9.470</td>
<td>-18.55</td>
</tr>
<tr>
<td>21</td>
<td>7.670</td>
<td>5.812</td>
<td>.2422</td>
</tr>
<tr>
<td>22</td>
<td>5.441</td>
<td>4.800</td>
<td>.118</td>
</tr>
<tr>
<td>23</td>
<td>.635</td>
<td>.846</td>
<td>.0131</td>
</tr>
<tr>
<td>23a</td>
<td>2.412</td>
<td>2.283</td>
<td>.0535</td>
</tr>
<tr>
<td>24</td>
<td>4.907</td>
<td>5.677</td>
<td>.1569</td>
</tr>
<tr>
<td>25</td>
<td>120.600</td>
<td>81.900</td>
<td>.4887</td>
</tr>
<tr>
<td>26</td>
<td>4.636</td>
<td>1.803</td>
<td>.6111</td>
</tr>
<tr>
<td>27</td>
<td>39.139</td>
<td>32.455</td>
<td>.171</td>
</tr>
<tr>
<td>28</td>
<td>6.153</td>
<td>9.901</td>
<td>.6031</td>
</tr>
<tr>
<td>29</td>
<td>9.484</td>
<td>7.319</td>
<td>.2282</td>
</tr>
<tr>
<td>30</td>
<td>22.500</td>
<td>19.490</td>
<td>.1378</td>
</tr>
<tr>
<td>31</td>
<td>98.400</td>
<td>94.300</td>
<td>.0417</td>
</tr>
<tr>
<td>32</td>
<td>22.611</td>
<td>14.500</td>
<td>.3587</td>
</tr>
<tr>
<td>33</td>
<td>3.960</td>
<td>1.810</td>
<td>.5429</td>
</tr>
<tr>
<td>34</td>
<td>104.000</td>
<td>75.000</td>
<td>.279</td>
</tr>
<tr>
<td>35</td>
<td>2.290</td>
<td>.900</td>
<td>.5909</td>
</tr>
<tr>
<td>36</td>
<td>50.164</td>
<td>32.514</td>
<td>.3518</td>
</tr>
<tr>
<td>37</td>
<td>.860</td>
<td>2.279</td>
<td>.1973</td>
</tr>
<tr>
<td>38</td>
<td>4.890</td>
<td>6.700</td>
<td>.3958</td>
</tr>
<tr>
<td>39</td>
<td>18.130</td>
<td>13.613</td>
<td>.2492</td>
</tr>
<tr>
<td>40</td>
<td>28.292</td>
<td>21.914</td>
<td>.2254</td>
</tr>
<tr>
<td>41</td>
<td>1.988</td>
<td>1.740</td>
<td>.1247</td>
</tr>
<tr>
<td>42</td>
<td>.403</td>
<td>.417</td>
<td>.0347</td>
</tr>
<tr>
<td>43</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>44</td>
<td>6.332</td>
<td>4.177</td>
<td>.3403</td>
</tr>
<tr>
<td>45</td>
<td>33.184</td>
<td>22.212</td>
<td>.3306</td>
</tr>
<tr>
<td>46</td>
<td>1.203</td>
<td>1.293</td>
<td>.0800</td>
</tr>
<tr>
<td>47</td>
<td>.204</td>
<td>.183</td>
<td>.1029</td>
</tr>
<tr>
<td>48</td>
<td>10.235</td>
<td>9.400</td>
<td>.0816</td>
</tr>
<tr>
<td>49</td>
<td>.626</td>
<td>.701</td>
<td>.1198</td>
</tr>
<tr>
<td>50</td>
<td>.375</td>
<td>.409</td>
<td>.0906</td>
</tr>
</tbody>
</table>
APPENDIX E

ASSETS TOTAL
Independent Variable "Assets Total"
For Years 1987, 1993 and Percentage Change

<table>
<thead>
<tr>
<th>Company #</th>
<th>1987</th>
<th>1993</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5,304,804</td>
<td>8,641,542</td>
<td>.6290</td>
</tr>
<tr>
<td>2</td>
<td>8,076</td>
<td>34,987</td>
<td>.333</td>
</tr>
<tr>
<td>3</td>
<td>2,259,600</td>
<td>2,351,300</td>
<td>.0081</td>
</tr>
<tr>
<td>4</td>
<td>405,802</td>
<td>555,181</td>
<td>.8640</td>
</tr>
<tr>
<td>5</td>
<td>2,267,600</td>
<td>2,394,000</td>
<td>.0540</td>
</tr>
<tr>
<td>6</td>
<td>50,204,000</td>
<td>458,259,000</td>
<td>.0871</td>
</tr>
<tr>
<td>7</td>
<td>8,940</td>
<td>392,738</td>
<td>.429304</td>
</tr>
<tr>
<td>8</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>9</td>
<td>344,600,000</td>
<td>347,467,000</td>
<td>.0076</td>
</tr>
<tr>
<td>10</td>
<td>110,000</td>
<td>811,454</td>
<td>.6373</td>
</tr>
<tr>
<td>11</td>
<td>79,890,30</td>
<td>102,271,000</td>
<td>.280</td>
</tr>
<tr>
<td>12</td>
<td>418,726</td>
<td>656,178</td>
<td>.5671</td>
</tr>
<tr>
<td>13</td>
<td>824,700</td>
<td>1,349,700</td>
<td>.6459</td>
</tr>
<tr>
<td>14</td>
<td>2,020,900</td>
<td>378,530,000</td>
<td>.314</td>
</tr>
<tr>
<td>15</td>
<td>74,042,800</td>
<td>84,635,000</td>
<td>.1364</td>
</tr>
<tr>
<td>16</td>
<td>18,520,899</td>
<td>25,112,353</td>
<td>.3679</td>
</tr>
<tr>
<td>17</td>
<td>263,457</td>
<td>279,299</td>
<td>.6061</td>
</tr>
<tr>
<td>18</td>
<td>138,428</td>
<td>249,807</td>
<td>.8023</td>
</tr>
<tr>
<td>19</td>
<td>146,690</td>
<td>164,542</td>
<td>.122</td>
</tr>
<tr>
<td>20</td>
<td>729,006</td>
<td>963,100</td>
<td>.3241</td>
</tr>
<tr>
<td>21</td>
<td>30,711,000</td>
<td>35,470,000</td>
<td>.1550</td>
</tr>
<tr>
<td>22</td>
<td>665,031,000</td>
<td>892,374,22</td>
<td>.3315</td>
</tr>
<tr>
<td>23</td>
<td>160,910</td>
<td>1,838,700</td>
<td>.1440</td>
</tr>
<tr>
<td>23a</td>
<td>1,222,000</td>
<td>1,231,000</td>
<td>.0074</td>
</tr>
<tr>
<td>24</td>
<td>1,365,388</td>
<td>1,940,800</td>
<td>.4212</td>
</tr>
<tr>
<td>25</td>
<td>1,114,000</td>
<td>1,958,500</td>
<td>.0138</td>
</tr>
<tr>
<td>26</td>
<td>206,690</td>
<td>2,168,959</td>
<td>.0494</td>
</tr>
<tr>
<td>27</td>
<td>9,721,964</td>
<td>10,956,796</td>
<td>.086</td>
</tr>
<tr>
<td>28</td>
<td>2,804,725</td>
<td>4,686,199</td>
<td>.7425</td>
</tr>
<tr>
<td>29</td>
<td>4,428,431</td>
<td>4,973,239</td>
<td>.1276</td>
</tr>
<tr>
<td>30</td>
<td>12,111,000</td>
<td>13,868,000</td>
<td>.1626</td>
</tr>
<tr>
<td>31</td>
<td>8,270,000</td>
<td>8,460,000</td>
<td>.2452</td>
</tr>
<tr>
<td>32</td>
<td>12,600,000</td>
<td>9,900,000</td>
<td>.3310</td>
</tr>
<tr>
<td>33</td>
<td>1,599,729</td>
<td>1,526,151</td>
<td>.0457</td>
</tr>
<tr>
<td>34</td>
<td>18,003,000</td>
<td>15,373,00</td>
<td>.189</td>
</tr>
<tr>
<td>35</td>
<td>577,628</td>
<td>424,522</td>
<td>.2418</td>
</tr>
<tr>
<td>36</td>
<td>2,388,000</td>
<td>2,662,000</td>
<td>.2257</td>
</tr>
<tr>
<td>37</td>
<td>559,432</td>
<td>1,492,859</td>
<td>1.670</td>
</tr>
<tr>
<td>38</td>
<td>1,014,053</td>
<td>1,261,400</td>
<td>.2436</td>
</tr>
<tr>
<td>39</td>
<td>10,620,000</td>
<td>9,254,000</td>
<td>.0383</td>
</tr>
<tr>
<td>40</td>
<td>13,291,000</td>
<td>10,005,000</td>
<td>.1864</td>
</tr>
<tr>
<td>41</td>
<td>964,698</td>
<td>1,764,477</td>
<td>.8239</td>
</tr>
<tr>
<td>42</td>
<td>12,677,77</td>
<td>2,968,111</td>
<td>.3492</td>
</tr>
<tr>
<td>43</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>44</td>
<td>612,562</td>
<td>783,677</td>
<td>.2794</td>
</tr>
<tr>
<td>45</td>
<td>2,937,000</td>
<td>2,985,000</td>
<td>.0032</td>
</tr>
<tr>
<td>46</td>
<td>1,376,000</td>
<td>1,570,000</td>
<td>.1010</td>
</tr>
<tr>
<td>47</td>
<td>1,132,000</td>
<td>1,149,000</td>
<td>.0150</td>
</tr>
<tr>
<td>48</td>
<td>2,203,372</td>
<td>2,796,760</td>
<td>.2660</td>
</tr>
<tr>
<td>49</td>
<td>1,789,000</td>
<td>1,899,000</td>
<td>.0615</td>
</tr>
<tr>
<td>50</td>
<td>127,232</td>
<td>134,441</td>
<td>.0566</td>
</tr>
<tr>
<td>51</td>
<td>143,600</td>
<td>158,370</td>
<td>.1029</td>
</tr>
</tbody>
</table>
APPENDIX F

RESEARCH AND DEVELOPMENT DOLLARS
<table>
<thead>
<tr>
<th>Co #</th>
<th>1987</th>
<th>1993</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>251,000</td>
<td>292,000</td>
</tr>
<tr>
<td>4</td>
<td>17,278</td>
<td>14,014</td>
</tr>
<tr>
<td>5</td>
<td>75,000</td>
<td>109,000</td>
</tr>
<tr>
<td>6</td>
<td>360,000</td>
<td>360,168</td>
</tr>
<tr>
<td>9</td>
<td>209,000</td>
<td>206,000</td>
</tr>
<tr>
<td>14</td>
<td>1223,000</td>
<td>1132,000</td>
</tr>
<tr>
<td>15</td>
<td>524,000</td>
<td>593,000</td>
</tr>
<tr>
<td>16</td>
<td>6,827</td>
<td>17,233</td>
</tr>
<tr>
<td>20</td>
<td>52,000</td>
<td>67,142</td>
</tr>
<tr>
<td>21</td>
<td>9,000</td>
<td>19,000</td>
</tr>
<tr>
<td>25</td>
<td>231,000</td>
<td>301,000</td>
</tr>
<tr>
<td>27</td>
<td>136,128</td>
<td>94,155</td>
</tr>
<tr>
<td>29</td>
<td>13,147</td>
<td>18,562</td>
</tr>
<tr>
<td>30</td>
<td>94,000</td>
<td>93,000</td>
</tr>
<tr>
<td>31</td>
<td>743,000</td>
<td>831,000</td>
</tr>
<tr>
<td>32</td>
<td>22,000</td>
<td>9,000</td>
</tr>
<tr>
<td>33</td>
<td>2,307</td>
<td>2,890</td>
</tr>
<tr>
<td>36</td>
<td>170,000</td>
<td>185,000</td>
</tr>
<tr>
<td>39</td>
<td>53,000</td>
<td>29,000</td>
</tr>
<tr>
<td>40</td>
<td>38,000</td>
<td>41,000</td>
</tr>
<tr>
<td>45</td>
<td>232,000</td>
<td>192,000</td>
</tr>
<tr>
<td>48</td>
<td>98,000</td>
<td>94,000</td>
</tr>
</tbody>
</table>
APPENDIX G

OUTLIER TEST DATA
## Data Used Testing for Outliers

<table>
<thead>
<tr>
<th>Obs.</th>
<th>Cook's D</th>
<th>Hat Diag</th>
<th>Std. Residual</th>
<th>Dffits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.001</td>
<td>0.646</td>
<td>0.2568</td>
<td>1.275</td>
</tr>
<tr>
<td>2</td>
<td>2.175</td>
<td>1.6797</td>
<td>0.1770</td>
<td>0.789</td>
</tr>
<tr>
<td>3</td>
<td>0.002</td>
<td>0.536</td>
<td>0.2345</td>
<td>1.243</td>
</tr>
<tr>
<td>4</td>
<td>0.043</td>
<td>1.5475</td>
<td>0.0694</td>
<td>0.925</td>
</tr>
<tr>
<td>5</td>
<td>0.030</td>
<td>1.0518</td>
<td>0.0984</td>
<td>1.061</td>
</tr>
<tr>
<td>6</td>
<td>0.000</td>
<td>0.1623</td>
<td>0.0377</td>
<td>1.159</td>
</tr>
<tr>
<td>7</td>
<td>3.784</td>
<td>0.5957</td>
<td>0.9767</td>
<td>46.1069</td>
</tr>
<tr>
<td>8</td>
<td>0.002</td>
<td>0.4007</td>
<td>0.0430</td>
<td>1.144</td>
</tr>
<tr>
<td>9</td>
<td>0.010</td>
<td>0.8730</td>
<td>0.0463</td>
<td>1.079</td>
</tr>
<tr>
<td>10</td>
<td>0.001</td>
<td>0.2892</td>
<td>0.0352</td>
<td>1.149</td>
</tr>
<tr>
<td>11</td>
<td>0.018</td>
<td>1.2984</td>
<td>0.0641</td>
<td>0.272</td>
</tr>
<tr>
<td>12</td>
<td>0.014</td>
<td>1.2910</td>
<td>0.0322</td>
<td>0.960</td>
</tr>
<tr>
<td>13</td>
<td>0.001</td>
<td>0.2644</td>
<td>0.2311</td>
<td>1.146</td>
</tr>
<tr>
<td>14</td>
<td>0.056</td>
<td>0.7997</td>
<td>0.2586</td>
<td>1.404</td>
</tr>
<tr>
<td>15</td>
<td>0.015</td>
<td>1.4652</td>
<td>0.0289</td>
<td>0.908</td>
</tr>
<tr>
<td>16</td>
<td>0.000</td>
<td>0.2476</td>
<td>0.0270</td>
<td>1.142</td>
</tr>
<tr>
<td>17</td>
<td>0.002</td>
<td>0.3270</td>
<td>0.0541</td>
<td>1.197</td>
</tr>
<tr>
<td>18</td>
<td>0.067</td>
<td>0.2527</td>
<td>0.2959</td>
<td>1.578</td>
</tr>
<tr>
<td>19</td>
<td>0.006</td>
<td>0.9353</td>
<td>0.0275</td>
<td>1.042</td>
</tr>
<tr>
<td>20</td>
<td>0.003</td>
<td>0.6162</td>
<td>0.0270</td>
<td>1.096</td>
</tr>
<tr>
<td>21</td>
<td>0.024</td>
<td>1.9647</td>
<td>0.0261</td>
<td>0.750</td>
</tr>
<tr>
<td>22</td>
<td>0.026</td>
<td>1.6127</td>
<td>0.0290</td>
<td>0.975</td>
</tr>
<tr>
<td>23</td>
<td>0.000</td>
<td>0.0766</td>
<td>0.0357</td>
<td>1.160</td>
</tr>
<tr>
<td>24</td>
<td>0.003</td>
<td>0.5978</td>
<td>0.0238</td>
<td>1.111</td>
</tr>
<tr>
<td>25</td>
<td>0.002</td>
<td>0.4173</td>
<td>0.0490</td>
<td>1.153</td>
</tr>
<tr>
<td>26</td>
<td>0.003</td>
<td>0.6066</td>
<td>0.0281</td>
<td>1.104</td>
</tr>
<tr>
<td>27</td>
<td>0.000</td>
<td>0.1738</td>
<td>0.0281</td>
<td>1.147</td>
</tr>
<tr>
<td>28</td>
<td>0.073</td>
<td>1.1399</td>
<td>0.0281</td>
<td>1.104</td>
</tr>
<tr>
<td>29</td>
<td>0.005</td>
<td>0.5831</td>
<td>0.0557</td>
<td>1.145</td>
</tr>
<tr>
<td>30</td>
<td>0.000</td>
<td>0.2339</td>
<td>0.0300</td>
<td>1.146</td>
</tr>
<tr>
<td>31</td>
<td>0.002</td>
<td>0.4207</td>
<td>0.0326</td>
<td>1.133</td>
</tr>
<tr>
<td>32</td>
<td>0.000</td>
<td>0.1050</td>
<td>0.1411</td>
<td>1.301</td>
</tr>
<tr>
<td>33</td>
<td>0.009</td>
<td>4.1193</td>
<td>0.0292</td>
<td>0.237</td>
</tr>
<tr>
<td>34</td>
<td>0.036</td>
<td>1.0252</td>
<td>0.1216</td>
<td>1.131</td>
</tr>
<tr>
<td>35</td>
<td>0.005</td>
<td>0.7283</td>
<td>0.0336</td>
<td>1.096</td>
</tr>
<tr>
<td>36</td>
<td>0.000</td>
<td>0.1355</td>
<td>0.0274</td>
<td>1.148</td>
</tr>
<tr>
<td>37</td>
<td>0.001</td>
<td>0.4345</td>
<td>0.0250</td>
<td>1.124</td>
</tr>
<tr>
<td>38</td>
<td>0.001</td>
<td>0.2454</td>
<td>0.0314</td>
<td>1.176</td>
</tr>
<tr>
<td>39</td>
<td>0.022</td>
<td>1.4979</td>
<td>0.0460</td>
<td>0.918</td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX H

SUMMARY OF PILOT STUDY
Summary of Pilot Study

A pilot study was performed to finalize the questionnaire. Of utmost importance was the development of a questionnaire that accurately reflects the research questions as well as the environment under study. Content validity was critical because of the relevance of the questionnaire to the topic being researched (Cohen et al. 1988). The utility and power of this study depend on the fit of the questions to the actual components that differentiate job specialization in the work place.

Construct validity should be reinforced by the pretest in an effort to strengthen the convergence between the growth studies in the past and the static or declining business environment that industry is experiencing. Pretesting of the questionnaire will also help expose any deficiencies in the format or question structure (Dillman 1978). Churchill (1987) postulates that data should not be collected without a pretest of the questionnaire. The pretest of the questionnaire was undertaken using a company included in the general population under study.

The questionnaire was tested on a broad variety of participants, as suggested by Dillman (1978), to help determine those questions that might be difficult to answer. The participants for the pilot study came from three groups. The first group was composed of four oil company middle managers. The second group was composed of four oil company upper level managers. The third group was composed of four oil company human resource managers. All three groups received mailed questionnaires. However, the third group, human resource managers, also received face to face interviews as proscribed by Rosnow and Rosenthal (1993) for three reasons.
First, it established trust and rapport with the subjects, allowing a more in-depth probe of possibly classified or organizational sensitive areas. Second, it allowed the subjects to communicate orally their misgivings or misunderstandings about the questionnaire. Third, respondents were able to offer more appropriate wording for certain sentences that better reflect industry jargon or terminology.

Ambiguity in the questions diminishes the two aspects of criterion-related validity. Predictive measures are important for the understanding of effectiveness and efficiency when measuring changes in specialization. Prediction is, in essence, the ability to deduce probable outcomes from an action. Changes in the structure of the organization, especially during times of contraction, should produce measurable results. The measurements taken by the questionnaire should provide a framework to explain the dynamics of organizational change and its impact upon the structural configurational variables in the oil industry.

Understanding is dependent upon the respondent's ability to interpret the questions as they were intended (Jaeger 1984). Other factors affecting the questionnaire design are numerous. However, six prerequisites need to be met before the data can be transformed into useful information. First, the respondents and participants must be willing to participate. Second, the respondents must have the knowledge or information needed to answer the questions. Third, the respondents should be honest in their responses. Fourth, the respondents must accurately record their answers on the questionnaire. Fifth, the researcher must accurately interpret the information as intended without bias or adjustment. Sixth, the researcher must
transcribe and aggregate the responses accurately so as not to lose the intent of the respondents' answers.

The second dimension of generalization is bounded by two prerequisites. The first is the representation of the sample. The sample as defined by the researcher needs to accurately reflect the population under study. The second prerequisite is the sample size. The problem with substantive generalization was addressed during the pilot study phase of this study during the pretest of the questionnaire. A copy of the final questionnaire is included in appendix C.

Change in Specialization

The interviews yielded both expected and unexpected information. First, the interviews with the human resource revealed that there is great interest in the topic of organizational work force reduction. This was later supported in the subsequent summary of data for each of the questionnaires. Although the data did not yield anything of great statistical significance because of the small sample size and because the data came from only one company, there has been a measurable decrease in task specialization in the company used for the pilot study.

Second, the level of knowledge needed was greatly influenced by the level the person held within the firm. The pilot study required that a total of twelve participants be used to answer the questions. Two additional surveys were given to administrative personnel, a secretary and an engineering assistant. The information garnered from these two surveys was sparse because many questions were left blank.
When asked why so many of the questions were left blank during follow-up interviews, the respondents answered that they did not know the answers and did not know where they could have gotten the information. The information garnered from the respondents, regardless of level, indicated that the same information was not available to all potential respondents equally. The higher the level in the organization, the greater the difference in specialization change scores.

Prior to the interview, the company had undergone major organizational restructuring. This restructuring was accomplished both by early retirements and personnel layoffs of a 20-25 percentage average. Every participant responded that their jobs have become more general in nature. During the interview, each person talked about how his/her job responsibilities had increased.

**Issue of Specialization**

The third interesting item found during the interviews was the request to add additional specialization descriptions to that part of the survey. Two of the respondents who were involved in the operational area of the company suggested that a description of a person who was solely involved in reducing power consumption and increasing operational efficiency was needed. They responded by saying that this was a newly created position in their company that would reflect the next management trend “operational efficiency.”
Job Responsibilities

The increase in job responsibilities included both vertical and horizontal aspects. Vertically, jobs had changed since more responsibility to make decisions of greater importance (both monetary value and personnel problems as described by the respondents) had been forced on them by their supervisors. The term “forced delegation” was used once to describe how job enlargement was accomplished. Primarily, the supervisor would require so much work from the subordinate that the subordinate would have one of two choices. Either the employee could work a significant number of extra hours to accomplish the work or they could delegate some of the decision making farther down the chain of command.

The increase in horizontal job responsibilities was brought about by a major reorganization of the company. Reporting responsibilities were left open for a period of time (three months), while management tried to determine the best way to organize work operations. The lower level employees reported that this allowed for a great deal of interaction between the operating units, which enhanced working relationships. Following this period, the issue of “governance” has emerged a major roadblock in redefining management’s role in the day-to-day operations.

Changes in Questionnaire

The only suggested changes to the questionnaire were the aforementioned addition to the specialization measure and the addition of blank lines with Other where the questions asked about changes in outsourcing. An example is given below.
Summary of Pilot Study

The pilot study was conducted between the weeks of May 14 and June 12th, 1995. One of the participant companies was contacted, and permission was obtained to conduct the pilot study. Fourteen surveys were given out, and follow-up interviews were conducted with four human resource managers, as outlined in chapter 3. Because of the close proximity and close working relationships between the human resource managers and the operation managers, additional interviews were performed.

The pilot study yielded rich information about the inner workings of organizational work force reduction. The interest in this subject by both operation and management personnel was notable. Of great importance, and probably related to all research incorporating the survey method, is the issue of positional level within the company. Ensuring consistent sampling across levels is critical in obtaining consistent information. Only minor changes as outlined above are necessary to make the questionnaire more understandable and flexible for the respondents.

Final Questionnaire

The final questionnaire was used to gather data from the companies selected for the study. The questions chosen provided the respondents with clear choices that have direct relevance to the study. Construct validity is the primary purpose for
finding a good fit between the questions asked and the data collected.

Mono-operation bias, generally caused by attempting to define a construct with too few measures, is eliminated by the use of multiple questions focused on each of the individual variables (Labaw 1980). A good questionnaire will provide the respondents with questions that are readily understood. The final questionnaire was mailed June 20, 1995, to the human resource managers in each of the oil companies. On June 30, follow-up postcards were mailed. By July 3, twenty-seven questionnaires were returned for a response rate of 53 percent. A second mailing attached with the appropriate cover letter per Dillman (1978), was mailed on July 5, 1995. For the second mailing, a follow-up postcard was mailed July 13, 1995. Follow-up phone calls to all nonrespondents were made the week of July 17, 1995. A total of eight surveys were returned from the second mailing by August 16. The second mailing response rate was 33 percent. The overall response rate by the end of the second mailing period was 69 percent. This yielded a total of thirty-five returned questionnaires, three short of the required amount to meet the demands of the power analysis.

A modified third mailing on August 18, was done to encourage those who were hesitant in participating in this project. Ten, $5 bills were attached to ten surveys being sent to those respondents who had indicated their interest in this project during earlier follow-up phone calls. Five of the surveys were returned by August 30, 1995. This yielded a response rate of 50 percent for the third mailing, and 78 percent response rate overall.
APPENDIX I

DATA CHARACTERISTICS
DATA CHARACTERISTICS

The data set were tested for significant interaction, collinearity, and the presence of outliers to ensure that the data set was both adequate and accurate for valid statistical analysis.

Interaction

To test for interaction, separate ANOVA tests were performed for each combination of variables. The interaction test with all the variables included in all possible combinations (see table 21) revealed that the interaction terms are not significant at the .05 level.

Table 21. -- Parameter estimates

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Independent Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>BF = Specialization</td>
<td>BK = Dis-integration</td>
</tr>
<tr>
<td></td>
<td>BO = Change in Number of Employees</td>
</tr>
<tr>
<td></td>
<td>BU = Change in Technology</td>
</tr>
</tbody>
</table>

| Variable | DF | Estimate | Standard Error | T for H0: Parameter=0 | Prob > |T| |
|----------|----|----------|----------------|-----------------------|--------|
| INTERCEP | 1  | -2.050519| 0.45908957     | -4.466                | 0.0001 |
| BK       | 1  | -0.008341| 0.38896782     | -0.021                | 0.9830 |
| BO       | 1  | 1.029014 | 0.48758123     | 2.110                 | 0.0427 |
| BU       | 1  | 5.293913 | 5.35840872     | 0.988                 | 0.3306 |
| BKBO     | 1  | -0.025406| 0.13212574     | -0.192                | 0.8487 |
| BKBU     | 1  | -3.431451| 17.90021846    | -0.192                | 0.8492 |
| BCBU     | 1  | 15.638665| 19.10341095    | 0.819                 | 0.4191 |
| BKBOBU   | 1  | 10.288225| 56.42346313    | 0.182                 | 0.8565 |

Other ANOVA analyses were performed with different combinations of the independent variables (see table 22) to determine if there were significant interactions.
The analysis results showed that the interaction terms were not significant at the .05 level.

Table 22. -- Parameter estimates

| Variable | DF | Parameter Estimate | Standard Error | T for H0: Parameter=0 | Prob > |T| |
|----------|----|-------------------|----------------|----------------------|--------|
| INTERCEP| 1  | -2.052950         | 0.45212418     | -4.541               | 0.0001 |
| BK       | 1  | -0.012452         | 0.38258356     | -0.033               | 0.9742 |
| BO       | 1  | 1.030796          | 0.48028965     | 2.146                | 0.0393 |
| BU       | 1  | 4.671878          | 4.07119124     | 1.148                | 0.2594 |
| BKBO     | 1  | -0.024032         | 0.12996421     | -0.185               | 0.8544 |
| BKBU     | 1  | -6.360159         | 7.78497533     | -0.817               | 0.4198 |
| BGBU     | 1  | 14.142121         | 16.99588687    | 0.832                | 0.4113 |

| INTERCEP| 1  | -2.289485         | 0.44754116     | -5.116               | 0.0001 |
| BK       | 1  | -0.092816         | 0.38977962     | -0.238               | 0.8132 |
| BO       | 1  | 1.108617          | 0.49004817     | 2.262                | 0.0300 |
| BU       | 1  | 2.385220          | 1.67515482     | 1.424                | 0.1633 |
| BKBO     | 1  | 0.002393          | 0.13240608     | 0.018                | 0.9857 |

| INTERCEP| 1  | -2.101422         | 0.42627915     | -4.930               | 0.0001 |
| BK       | 1  | -0.083646         | 0.06866179     | -1.218               | 0.2313 |
| BO       | 1  | 1.051716          | 0.43506750     | 2.417                | 0.0210 |
| BU       | 1  | 1.616490          | 1.65296065     | 0.978                | 0.3348 |
| BKBU     | 1  | -10.456585        | 5.71724222     | -1.829               | 0.0759 |

| INTERCEP| 1  | -2.121797         | 0.42319210     | -5.014               | 0.0001 |
| BK       | 1  | -0.081728         | 0.06865252     | -1.191               | 0.2417 |
| BO       | 1  | 1.091219          | 0.43375146     | 2.516                | 0.0166 |
| BU       | 1  | 6.923698          | 2.93030115     | 2.363                | 0.0238 |
| BGBU     | 1  | 23.191562         | 12.54965075    | 1.848                | 0.0731 |

Collinearity

To test for collinearity, the Variance Inflation (VIF) was checked to ensure that the sum of the three independent variable inflation factors did not exceed 10 (VIF>10) (Lee 1993, Webster 1995). The sum of the variance inflation factors (see table 23)
for the three methods of downsizing is 3.659. Since the sum of the inflation factors
does not exceed 10, it is unlikely that the variables exhibit collinearity.

Table 23. -- Variance inflation factors (VIF)

<table>
<thead>
<tr>
<th>Variable</th>
<th>DF</th>
<th>Tolerance</th>
<th>Variance Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERCEP</td>
<td>1</td>
<td>0.00000000</td>
<td>0.00000000</td>
</tr>
<tr>
<td>BK</td>
<td>1</td>
<td>0.75220442</td>
<td>1.32942584</td>
</tr>
<tr>
<td>BO</td>
<td>1</td>
<td>0.75222441</td>
<td>1.32939052</td>
</tr>
<tr>
<td>BU</td>
<td>1</td>
<td>0.99975430</td>
<td>1.00024576</td>
</tr>
</tbody>
</table>

Sum = 3.65906212

Outliers

The test for outliers serves two purposes. The first is to identify the
observations in the data set which may be so far from the normal distribution that they
would influence the ability to make a fair statistical assumption from the results. The
second purpose is to check identified data points to ensure that these points are factual
and accurate rather than erroneously recorded data from the original measuring
instrument.

Four types of tests were performed: Cook's D, RStudent, Hatian Diagonal
Matrix, and the Difference of Fits test. The Cook's D test utilizes a comparison of
each data point with a F value (3, 36, a=.05) = 2.86626 for the sample. For the
Cook's D, only observation 7 exceeded this value, possibly indicating an outlier. This
finding coincided with the results of the Hatian Diagonal Matrix and the Difference of
Fits tests. A check of the values for observation 7 confirmed that the data for
observation 7 is factual and had not been entered erroneously.

The Hatian Diagonal Matrix (≥ 2p/n = 6/40 = .15) and Difference of Fits tests (2 X sq rt p/n = .548) indicated that five other observations were found that might be outliers or erroneously entered data. A check of these data points revealed that they were also factual. A list of the data values for the outlier tests of independent variables is located in appendix G.

The R Student test was performed to test the dependent variable for potential outliers. The R Student test compares each calculated data point (student residual) with a t value for the sample t(.95, n-p-1) = t (.95, 36) = 1.68829. Observations 22 and 34 were indicated as potential outliers in this test, but a check of the data revealed that they are factual. Data values for the outlier test of the dependent variable are located in appendix G. The data set was not edited or manipulated by the changing or deletion of the leverage points.

Tests indicate that the data set has no significant interaction, collinearity, or outliers, making it appropriate for statistical analysis. To substantiate the appropriateness of using linear regression in analyzing the data set, the following four assumptions must be met (Kvanli, Guynes, and Pavur 1989; Lee 1993; Neter, Wasserman, and Kunter 1985).

1. The mean of the error components is zero.

2. Each error component follows an approximate normal distribution.

3. The variance of the error components is the same for all values of the independent variable.
4. The errors are independent of each other.

The first assumption was tested by graphing the residual terms on the Y axis and the dependent variable on the x-axis for each observation (see figure 16). Observation of the graph reveals that the data do indeed form a linear pattern. Examination of the graph shows there are two leverage points that could cause potential problems when using the general linear model. The earlier evaluation done to check for outliers in the data set concerning these two points corresponds to observations number 2 and 7. Because no curvilinear pattern was observed, the data appear to meet the criterion for assumption 1, that the mean of each error component is zero.

The second assumption, that the error terms follow a random normal distribution, was tested using two procedures. First, studentized residuals were graphed against the dependent variable (see figure 17). The resulting plot shows that the variables are evenly distributed. The second test for normality uses the SAS Univariate procedure (see table 24) to test for normality. The Shapiro-Wilk's value for normality is .9516. The Shapiro-Wilk's sample distribution tests explains that the sample for this study has approximately a 95 percent normal distribution.
Table 24. -- Univariate procedure

<table>
<thead>
<tr>
<th>Variable=RBF</th>
<th>Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moments</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>40</td>
</tr>
<tr>
<td>Mean</td>
<td>0</td>
</tr>
<tr>
<td>Std Dev</td>
<td>2.511137</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.968158</td>
</tr>
<tr>
<td>USS</td>
<td>245.9266</td>
</tr>
<tr>
<td>CV</td>
<td>.</td>
</tr>
<tr>
<td>T:Mean=0</td>
<td>0</td>
</tr>
<tr>
<td>Num ^= 0</td>
<td>40</td>
</tr>
<tr>
<td>M(Sign)</td>
<td>0</td>
</tr>
<tr>
<td>Sgn Rank</td>
<td>-34</td>
</tr>
<tr>
<td>Shapiro-Wilks:Normal</td>
<td>0.951682</td>
</tr>
</tbody>
</table>
Figure 16. -- Residual plot
BF - Studentized Residual Plot

Figure 17. -- Studentized residual plot
The third assumption, which states that the variance of the error components is the same for all values of the independent variable, was checked by plotting the residual against each of the independent variables. Graphs of the residuals plotted against the three independent variables can be seen on figures 18, 19, and 20. Because there is no curvelinear, cone or wedge-shaped patterns, and all the observations except for one leverage point appear to be equally distributed, it can be assumed that the variance is constant and therefore meets the requirements for the GLM. Scaling of figures 18, 19, and 20 are different due to the presence of leverage points, as discussed earlier in the Outlier Section.

The fourth assumption, which states that the errors are independent of each other, is met if the variables do not exhibit autocorrelation. To test for autocorrelation, the residuals are plotted against their observation number (see figure 21). When testing for autocorrelation using the graphing method, the researcher looks for observable patterns. No observable patterns emerge within the plot. Typically, if autocorrelation exists, the data values will form repeatable patterns. Because no patterns can be observed, autocorrelation is assumed not to exist.
Figure 18. -- Residual plots against dis-integration
Figure 19. -- Residual plotted against change in number of employees.
Figure 20. -- Residuals plotted against change in technology
Figure 21. Residuals plotted against observation number testing for autocorrelation.
REFERENCES


Dalton, Gene W., Paul R. Lawrence, and Jay W. Lorsch. 1969. Introduction to the structural design of organizations Homewood, IL: Irwin and Dorsey.


Mandel, Michael J. 1990. This time the downturn is dressed in pinstripes. *Business Week* 1 October, 130-31.


Reich, Robert. 1992. U.S. economic conditions and the NAFTA treaty. Produced by WGBH, Boston, Massachusetts, directed by Andrew Morris. 1 hr. PBS.


