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# STRATEGIC GROUPS AND COMPETITIVE ENACTMENT: A STUDY OF DYNAMIC RELATIONSHIPS BETWEEN MENTAL MODELS AND PERFORMANCE

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*This study used computer-assisted content analysis of more than four hundred presidents' letters to shareholders to examine empirical linkages between cognitive strategic groups clustered by themes in the reports and strategic groups clustered by performance. We found these groups converged as predicted by the literature, and that mental models and performance are involved in a recursive process of competitive enactment which contributes to strategic group stability. Our research used inductively derived themes from the letters to structure a mental model widely shared in the pharmaceutical industry, and then employed thematic variations to find stable clusters of companies. These thematic clusters were triangulated with the strategic groups from a published study of the same industry, in the same period, and were shown to converge. Additionally, longitudinal linkages between earlier mental models of strategic goals and later reports of performance were found. The findings of our large-scale empirical study support strategic group theory, demonstrate a novel approach to data mining, and pose questions for future research.* Copyright © 2001 John Wiley & Sons, Ltd.

## INTRODUCTION

From 1972 to the present, strategic group theory has produced a robust body of literature that discusses an intermediate level of industry analysis that is based on clusters of companies. This body of literature has progressed from infancy (1972), through childhood (1977–1986), and rapid growth (1987–1990), to a new level of maturity (1991–present) (Bogner and Thomas, 1996, 1993; Bogner, Thomas, and McGee, 1996; Caves and Porter, 1977; Cool and Dierickx, 1993; Cool and Schendel, 1987, 1988; Dranove, Peteraf, and Shanley, 1998; Fiegenbaum, Sudharshan, and Thomas, 1987; Fiegenbaum and Thomas, 1990, 1995; Hatten and Hatten, 1987; Hodgkinson, 1997; Levenhagen, Porac, and Thomas, 1993; Lewis and Thomas, 1990; McGee and Thomas, 1986; Nath and Gruca, 1997; Nath and Sudharshan, 1994; Peteraf and Shanley, 1997; Porac and Thomas, 1990, 1994; Porac, Thomas, and Baden-Fuller, 1989; Porac *et al*., 1995; Porter, 1980, 1985; Reger and Huff, 1993; Reger and Palmer, 1996; Thomas and Carroll, 1994; Thomas and Venkatraman, 1988; Wiggins and Ruefli, 1995).

Beginning with Hunt's (1972) study of white goods (home-appliance industry), early studies

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used various measures to find clusters of firms in the pharmaceutical, brewing, and insurance industries (Cool and Schendel, 1987, 1988; Johnson and Thomas, 1987; Fiegenbaum and Thomas, 1990). Recently, analyses of strategic groups have been based on cognitive maps of industry participants and social constructionist ideas which address the way in which the leadership groups of organizations enact their strategic competitive environment (Weick, 1979; Smircich and Stubbart, 1985; Stubbart and Ramaprasad, 1988; Stubbart, 1989). This second approach informed the study of the Scottish knitwear (Porac *et al*., 1989) and Chicago banking (Reger and Huff, 1993) industries. Embedded throughout the literature, however, were several potentially troublesome questions.

Differences in measures and concerns about whether strategic groups are real or simply artifacts of cluster analysis could have split the research domain into competing camps of scholars (Hatten and Hatten, 1987; Barney and Hoskisson, 1990). Such a division appears to have been avoided because recent articles have shown how these two ways to study strategic groups converge (Nath and Gruca, 1997). Additionally, recent research suggests that strategic groups are more than methodological artifacts (Dranove, *et al*., 1998; Fiegenbaum and Thomas, 1995; Hodgkinson, 1997; Peteraf and Shanley, 1997; Wiggins and Ruefli, 1995). With these potentially difficult questions addressed, Hodgkinson (1997) outlined challenges for the future.Observing that most strategic group research was exploratory in nature, and limited in scale, Hodgkinson suggested three propositions for testing by large-scale, empirical studies (Hodgkinson, 1997: 626). His first proposition is shown below.

> To the extent that competitive groups are detectable and there is significant variation in actors' cognitions across these groups, there will be detectable empirical linkages between measurable features of mental models of the competitive arena, or 'competitive space,' and measurable aspects of strategic behavior and organizational performance. (Hodgkinson, 1997: 633)

Our study examines Hodgkinson's (1997) first proposition by inductively seeking empirical linkages between cognitive themes that characterize strategic group mental models and performance themes that characterize results, across time (Jackson, 2000). Recognizing its heavy reliance on social constructionist ideas and Nath and Gruca's (1997) finding of convergence between approaches to measurement, our study also provides performance-based confirmation of results by triangulating its findings with Cool and Schendel's (1987) analysis of the U.S. pharmaceutical industry. By documenting statistically significant linkages between strategic groups with similar mental models and subsequent performance-based strategic groups, our study supports the proposition that strategic groups are involved in an ongoing process of competitive enactment (Hodgkinson, 1997: 629; Berger and Luckman, 1967; Smircich and Stubbart, 1985; Weick, 1979). In competitive enactment, leaders' mental models of competition positively influence strategic performance, and recursively, strategic performance modifies decision makers' mental models (Hodgkinson, 1997; Jackson, 2000; Porac *et al*., 1989, 1995) (see Figure 1).

## Hypotheses

Our study tests two hypotheses related to Hodgkinson's (1997) observations. Their confirmation would strengthen the findings of earlier strategic group research.

> *Hypothesis 1: Cognitive strategic groups and performance strategic groups have the same members at $T_1$.*

A positive finding for this hypothesis would add large-scale empirical support for Nath and Gruca's (1997) study that found convergence between strategic groups identified by cognitive and per-

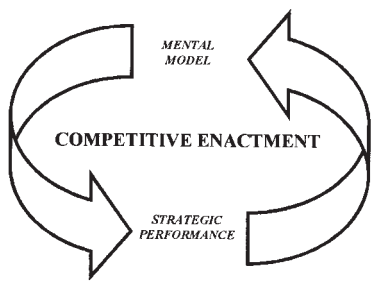


Figure 1. Cycle of competitive enactment

formance measures. Testing involved triangulations (Jick, 1979) with Cool and Schendel's (1987) study of the pharmaceutical industry and laid the foundation of Hypothesis 2.

> *Hypothesis 2: Cognitive strategic group goals at $T_1$ are positively related to performance at $T_2$.*

Before explaining the methods used to test these hypotheses, it is important to address two factors in greater detail. These factors are important because they concern the complex research design used, and the unusual measures employed. Specifically, strategic groups clustered on performance and strategic groups clustered on cognitive mental models are discussed before moving to the methods used to find and analyze them.

### Performance-based strategic groups

Our study intentionally sought to use current strategic group research and terminology. While the process used was new, the fundamental purpose was to test current theory, rather than to create new ideas. To make sure our analysis was firmly connected with existing literature, our findings were compared, or triangulated, with a well-accepted article which used performance measures to identify strategic groups in the American pharmaceutical industry. That is, our study used Cool and Schendel's (1987) sample of companies, for the same period, to find clusters of firms with cognitive mental models whose similarities placed them in common strategic groups. These groups were compared with those found in Cool and Schendel's (1987) study, and we found they converged as predicted by Nath and Gruca (1997).

Cool and Schendel (1987) used a combination of performance measures to identify strategic groups in a careful examination of the American pharmaceutical industry. Building on prior lines of inquiry, they employed two concepts, strategic scope and strategic resources, to define strategic group membership (Cool and Schendel, 1987: 1103). These ideas (shown with their component variables in Table 1) were operationalized by 15 measures.

Using these measures, Cool and Schendel (1987) identified six strategic groups in a 20-year sample of performance data from 22 pharmaceutical companies. They also found that membership in these groups shifted three times between 1963 and 1982 (Cool and Schendel, 1987). These periods, and the strategic groups that characterized them, are shown in Table 2.

Their research was used without change to triangulate the static analysis (Hypothesis 1) and with modest adjustments to verify the longitudinal analysis (Hypothesis 2). That is, the membership of different strategic groups, in four periods (Table 2), became a benchmark used to evaluate our study's findings. By using Cool and Schendel's (1987) work for triangulation (Jick, 1979), our study was able to link its findings to the larger body of strategic group theory.

### Cognitive mental models-based strategic groups

The concept of cognitive groups appears in Porac *et al.*'s (1989) article about strategic groups in the Scottish knitwear industry. They described 'cognitive oligopolies' composed of companies whose executives shared mental models and therefore made similar strategic choices. Two dimensions, or themes, characterized managers' mental models and were particularly relevant to the development of cognitive oligopolies. First, industry leaders shared themes about the boundaries of the competitive domain, and second, there was wide (partly implicit) agreement among those leaders concerning the legitimate competitive process inside that domain (Porac *et al*., 1989). These two dimensions are good examples of themes used by Porac *et al*. (1989) to both construct and measure mental models (Jackson, 2000; Burrell and Morgan, 1979). To sum up, Porac *et al*. (1989) and Reger and Huff (1993) identified groups of companies whose top managers held shared mental models of strategy within their industry. These mental models were identified because their frameworks were constructed of themes that allowed qualitative comparison and clustering of companies in each industry. In our study, we call strategic groups clustered on such cognitive dimensions 'cognitive strategic groups,' and we use themes from annual reports to measure changes in the collective mental models (Peteraf and Shanley, 1997) which guide performance.

Table 1. Strategic group variables and attributes

| Scope variable | Resource variable |
|---|---|
| *Range of market segments* | *Research and development* |
| 1. Focus | 8. R&D Budget |
| 2. Ambulatory Care Market | 9. R&D Capital Stock |
| | 10. R&D Orientation |
| *Types of products* | *Marketing commitment* |
| 3. Ethical Drug Market | 11. Product Strategy |
| *Generic drug market* | *Promotion strategy* |
| 4. Branded Generics | 12. Medical Profession |
| 5. Commodity Generics | 13. Consumers |
| 6. Maintenance Drugs | 14. Distribution |
| *Geographic scope* | *Size* |
| 7. Foreign Reach | 15. Scale of Operations |

Source: Cool and Schendel (1987: 1110, Table 1). (Reprinted by permission.)

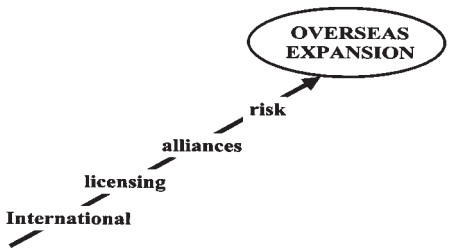


Figure 2. Illustration of the theme 'overseas expansion'

## METHODS

### Themes as measures of mental models

We defined a 'theme' as a topical schema that categorizes words into statistically related groups that reflect strategic ideas. For instance, 'international,' 'alliances,' 'foreign-exchange,' 'risk,' and 'licensing' might define a theme labeled 'overseas expansion' (see Figure 2).

This definition of a theme is consistent with Jackson (2000):

> [Themes] are manifested in the form of a word, a phrase, or a statement that interprets events in the past, envisions events in the future, or depicts current events that are removed in time and/or space from the actual activities of the group. (Jackson, 2000: 194)

The literature suggests variations in theme content or frequency may reflect changes in leadership perspectives and highlight observable shifts in subsequent performance (Barr, Stimpert and Huff, 1992; Porac *et al*., 1989, 1995; Smircich and Stubbart, 1985; Suchman, 1995). Such sensitivity to changing factors makes themes particularly useful measures when studying the strategic intent of a company (Hamel and Prahalad, 1989). In turn, strategic intentions measured by themes provide skeletal structures for 'cognitive oligopolies' (Porac *et al*., 1989). Cognitive oligopolies, or cognitive strategic groups, are outcomes of the shared mental models of industry executives (Porac *et al*., 1989).

In 1993, Reger and Huff provided further support for the cognitive group concept. Their measures of cognitive dimensions were used to classify companies in an approach that paralleled Porter's (1980) use of performance dimensions. Working with Chicago area banks, Reger and Huff elicited a substantial number of observations from expert witnesses (Reger and Huff, 1993: 110), and they provided a statistical footing for the concept of groups characterized by common themes. Differences in themes led to identification of five groups, which they labeled *core*, *secondary*, *transient*, *misfit*, and *idiosyncratic* (Reger and Huff, 1993: 117). As they showed, each of these groups followed different strategic approaches to providing banking services. Reger and Huff (1993) sug-

Table 2. Cool and Schendel's strategic groups (1963–82)

| Strategic group | Periods from 1963 to 1982 | | | |
|---|---|---|---|---|
| | P-1 (1963–69) | P-2 (1970–74) | P-3 (1975–79) | P-4 (1980–82) |
| SG-1 | Abbott<br>Lederle<br>Lilly<br>Merck<br>Squibb | Abbott<br>American-Home<br>Lederle<br>Lilly<br>Squibb<br>Warner-Lambert | Abbott<br>American-Home<br>Bristol-Myers<br>Lederle<br>Warner-Lambert | Abbott<br>American-Home<br>Bristol-Myers<br>Pfizer<br>SmithKline<br>Warner-Lambert |
| SG-2 | American-Home<br>Bristol-Myers<br>SmithKline<br>Sterling | Bristol-Myers<br>Carter-Wallace<br>Johnson and Johnson<br>Morton-Norwich<br>Richardson-Vicks<br>SmithKline<br>Syntex | Lilly<br>Merck<br>Pfizer<br>Schering-Plough<br>Squibb<br>Sterling<br>Upjohn | Lilly<br>Merck<br>Upjohn |
| SG-3 | Johnson and Johnson<br>Morton-Norwich<br>Pfizer<br>Richardson-Vicks<br>Schering-Plough<br>Syntex | Merck<br>Pfizer<br>Schering-Plough<br>Searle<br>Sterling<br>Upjohn | Johnson and Johnson<br>Morton-Norwich<br>Richardson-Vicks<br>Robins<br>Searle<br>SmithKline<br>Syntex | Johnson and Johnson<br>Schering-Plough<br>Squibb<br>Sterling |
| SG-4 | Searle<br>Warner-Lambert | Robins<br>Rorer | Carter-Wallace<br>Marion<br>Rorer | Searle<br>Syntex |
| SG-5 | Carter-Wallace<br>Robins<br>Rorer | Marion | | Carter-Wallace<br>Marion<br>Morton-Norwich<br>Richardson-Vicks<br>Robins<br>Rorer |
| SG-6 | Marion | | | Lederle |

Information extracted from Cool and Schendel (1987: 214, Table 2).

gest these categories may fit other industries as well, and Table 3 provides their definitions of these groups.

### Convergence of cognitive and performance-based strategic groups

Studies of the pharmaceutical industry hint at broad convergence between cognitive and performance measures of strategic groups (Bogner and Thomas, 1996; Cool and Schendel, 1987; Nath and Gruca, 1997; Reger and Huff, 1993). For instance, using companies from different strategic groups as examples, Abbott appeared to be in the 'core' group, whereas Merck was a 'secondary' firm, and Carter-Wallace a 'transient' company. Marion, which had no discernible membership (Cool and Schendel, 1987: 1115, 1117) may have been a candidate for Reger and Huff's (1993) 'misfit' category. The explosive growth of Syntex made it an idiosyncratic company throughout most of the study period. Comparison of Reger and Huff's descriptions of firms in five cognitive strategic groups (Reger and Huff, 1993:

Table 3. Strategic group labels

| Labels | Description of firms |
|---|---|
| Core | Firms that are tightly associated and define the basic 'recipe' of a strategic group |
| Secondary | [Firms] that implement the strategic groups recipe less consistently than core firms |
| Transient | Firms whose strategies are changing from one strategic position to another, but along dimensions common to other firms in the industry |
| Misfits | Firms whose strategies are inconsistent over time |
| Idiosyncratic | Firms whose strategies cannot be expressed along the same dimensions as the rest of the industry |

Based on Reger and Huff (1993: 117).

117) with Cool and Schendel's (1987: 1114–1117) descriptions of firms in six performance strategic groups showed many similarities, although classification in each case was based on a different set of dimensions, in different industries.

Recognizing the contributions of Porac *et al*. (1989) and Reger and Huff (1993), our study assumes themes represent outward manifestations of company intentions (Hamel and Prahalad, 1989) that can identify the skeletal structure of cognitive strategic groups (Burrell and Morgan, 1979: 229; Jackson, 2000: 194). Five themes were inductively discovered through factor analysis of the most frequent words in presidents' letters to shareholders, and these themes placed companies into the generic strategic groups suggested by Reger and Huff (1993). These cognitive groups also converged with Cool and Schendel's strategic groups, as predicted by Nath and Gruca (1997).

## Use of presidents' letters to stockholders

Unfortunately, finding measures of shared mental models is a difficult task. To deal with this problem, reliable knowledge about strategic goals, the future performance outcomes desired by top management teams, and current performance, is needed (Fiegenbaum, Hart, and Schendel, 1996). Further, obtaining valid information about intentions (Hamel and Prahalad, 1989) is difficult because retrospective interviews and memories are often incomplete, misinterpreted, or mistakenly reported because of the outcomes later achieved (Babbie, 1992; Bettman and Weitz, 1983; Bazerman, 1986; Hodgkinson, 1997; Kiesler and Sproull, 1982). To avoid the reliability issues inherent in such data, our study utilized computer-assisted content analysis of archival data in presidents' letters to stockholders (a part of the Annual Report) and qualitative analysis of those letters to assess validity.

### *Computer-assisted content analysis*

Computer-assisted content analysis offered an opportunity to partially measure strategic intentions through analysis of the themes found in public statements by chief executives who were charged with charting the future of their companies. Whether the author is an individual president or a collective of functional area experts, these letters are official documents that discuss themes important to the firm. These themes partially outline company-level mental models by publically addressing major priorities. These letters describe performance and strategy, and are used to inform stakeholders, including regulators, stock analysts, and shareholders, of past achievements, current challenges, and plans for the future. They must be written to survive critical scrutiny because they are regulated by the Federal Trade Commission and the marketplace. Even so, annual reports, just like retrospective interviews, are subject to error (Swales, 1988). To partially manage self-serving biases (Clapham and Schwenk, 1991; Salancik and Meindl, 1984), our study did *not* use these letters to look for personal-responsibility information (such as attributions about performance results) which can be invalid (Bettman and Weitz, 1983). While the presidents' letters are perceptual in nature, so are the outlines of the cognitive mental models found by Porac *et al*. (1989) and Reger and Huff (1993). Perceptions, whether captured by interviews, questionnaires, or annual reports, are the raw data used to map cognitive mental models, and these sources are subject to distortion (Bazerman, 1986; Bettman and Weitz, 1983; Fiol, 1995). Our study

recognized the limits distortion placed on the validity of the mental models revealed through narrative, but found support for their use in the literature (Fiol, 1995; Barr *et al*., 1992; Jackson, 2000; Swales, 1988).

### Data mining archival data with computer-assisted content analysis

The approach chosen to measure mental models was a complex, multistage design based on computer-assisted content analysis of archival data. This permitted large-scale analysis by computer programs. Since the content was narrative in form and the volume of data large, the design was conceptually modified by incorporating data-mining ideas to find high-value information clusters, or 'hot spots' (Ramaprasad, 1996). These hot spots, while based on statistical analysis, pointed to specific sentences in the presidents' letters that provided the context used in qualitative analysis. In summary, statistical methods were used to find hot spots, to verify statistically significant relationships among the different companies' mental models, and to test relationships across time. To interpret the meaning of the quantitative data in the hot spots, a qualitative review of the words and sentences composing the hot spots was done. A detailed flow diagram of the design is in the Appendix, and discussion of conceptual and methodological issues, follows.

#### *Boundaries*

Our study is tightly bounded in space and time (Bacharach, 1989). In conceptual space, it is limited to 22 major firms in the American pharmaceutical industry that were U.S. owned and headquartered in North America. Temporally, our study runs from 1963 to 1982. Table 4 provides a summary of information about the context of the research.

These boundaries were set by two considerations. First, during the 1963–82 period, the American pharmaceutical industry was relatively uncomplicated by the extensive diversification, mergers, international acquisitions, biotechnology, and other changes that have occurred with increasing frequency since 1982 (at least five of the 22 companies in our study have merged since 1982, and other mergers are under discussion) (Bogner *et al*., 1996; Cool and Schendel, 1987). By using the earlier period, some of the complexity associated with more recent studies is eliminated (Bogner *et al*., 1996). This simplifies evaluation of the relationship between themes and strategic groups. Second, as described above, two excellent studies of the pharmaceutical industry during this period have been published (Cool and Schendel, 1987, 1988), and these works served as triangulation points which helped confirm our strategic groups (Jick, 1979). Besides identifying strategic group members, Cool and Schendel (1987) also detected three distinct reorientations (Tushman and Romanelli, 1985) during the 20-year period. By identifying group membership and including this temporal element, Cool and Schendel (1987) left the door open for longitudinal studies to extend their work.

#### *Design overview*

The search for empirical relationships between cognitive and strategic groups required a systematic, multistep process. The research design used computer-assisted content analysis, common factor analysis, Q-sorting, cluster analysis, and cross-tabulation, to convert a large mass of data into useful information (Babbie, 1992; Hair *et al*., 1992; Ramaprasad and Poon, 1985; Ramaprasad, 1996). The large volume of data, combined with computerized analysis, provided quantitative reliability while also offering an opportunity to monitor validity by referring to full-text source documents. A quick review of the Appendix, which provides a map and notes about the multistep process used, provides a visual framework that can be used to help follow the narrative details set out in the following paragraphs.

#### *Data*

The first step was to find the common themes used in the presidents' letters. To accomplish this, more than 400 annual reports from the pharmaceutical industry's top 22 American companies were collected and scanned into electronic files. To maintain reliability, conversion accuracy was electronically checked using word processing (spell check) and manually confirmed by scanning a random sample of sentences. Errors, which occurred in approximately 10 percent of the cases, were corrected by referring to source documents.

Table 4. Study sample

| | | |
|---|---|---|
| Worldwide pharmaceutical industry sales (1983)[a] | | $24.6+ Billion |
| Worldwide # of companies with >1% market share (1983)[a] | | 33 |
| U.S. companies in world top 25 (1983)[a] | | 15 |
| U.S. companies in study with <1% of worldwide sales[a] | | 7 |
| U.S. companies in the study | | 22 |
| Potential number of annual reports | | 440 |
| Number of letters scanned[b] | | 426 (96.8%) |
| Time period | | 1963–1982 |
| *Company listing* | | |
| Abbot | Merck | SmithKline |
| American-Cyanamid (Lederle) | Morton-Norwich | Squibb |
| American Home | Pfizer | Sterling |
| Bristol-Myers | Richardson-Vicks | Syntex |
| Carter-Wallace | Rorer | Upjohn |
| Johnson and Johnson | Robins | Warner-Lambert |
| Lilly | Schering-Plough | |
| Marion | Searle | |

[a]Bogner, Thomas, and McGee (1996: 88–89; Wiggins and Ruefli (1995: 1640)
[b]Poor copy-quality annual reports eliminated.

Once conversion to electronic form was complete and accurate, annual reports were indexed and every sentence in each report was labeled with the name of its company, the year in which it was written, and its sequence number. Indexing was the critical connection between the quantitative data that identified significant relationships and pointed to information hot spots in the data base, and the qualitative context of that information. Besides labeling each sentence, WordCruncher 4.6 (Brigham Young University, 1989) provided a frequency count for each word in the data base. With more than 37,000 sentences and 450,000 words to consider, an efficient approach to data management was essential.

### *Data processing*

The second step in the design identified themes by common factor analysis. In smaller projects, content analysis might have been done manually. For instance, 'Classic' content analysts would have identified themes *a priori*, then classified sentences into those themes, and lastly tested the classification with Q-sorting (Babbie, 1992; Holsti, 1968; Kassarjian, 1977). In this case, such a process was impractical because of the scale of the archival data and the reluctance of the researchers to establish themes *a priori*. To respond to Hodgkinson's (1997) desire for large-scale, empirical research, and to eliminate one potential for bias, computer assistance was used to modify the slow, labor-intensive techniques required by classic content analysis.

Using the most frequent nonstructural words ('a,' 'and,' 'the,' etc., are considered structural words), *common factor analysis*, a nondependence method (Hair *et al*., 1992), was used to *inductively* find major underlying themes in the data. Inductive derivation of themes was considered an improvement over classical, deductive content analytic methods because the opportunity for researcher bias was greatly reduced. In effect, the data were allowed to speak, and they revealed the themes present in the annual reports of pharmaceutical companies from 1963 to 1982 (Burrell and Morgan, 1979; Jackson, 2000). Common factor analysis was iterated on progressively smaller sets of the most frequent words. Such reduced sets were made possible by using the Kaiser–Meyer–Olkin Measure of Sampling Adequacy (Hair *et al*., 1992) to cull words that failed to meet the minimum standard set out by the Kaiser–Rice Scale (Stewart, 1981). Additionally, scree plots were used to decide the number of themes present. After a VARIMAX rotation, the outcome was a set of five factors, or themes,

each of which was composed of four to six words with high factor loadings. These five themes and their loadings were intuitively labeled, as shown in Table 5.

The quantitative outcomes were considered highly reliable (replicable) because of the care taken with data accuracy, and the use of SPSS 7.0 (SPSS, 1995) to calculate relationships, but two other issues—validity and discriminatory power—remained.

### *Validity of themes*

The validity of the themes was first verified by constantly returning to the indexed text of the annual reports. For example, a random sample of 20 sentences containing words from each theme was Q-sorted into shoe boxes labeled with each theme name (plus an 'all others' box). This procedure was done by four independent raters. Their coefficient of agreement (0.87) provided reasonable assurance of validity (Robinson, 1957). Second, the ability of each theme to discriminate between companies and periods (or years) was assessed.

### *Discriminatory power of themes*

MANOVA was used to control experiment-wise error (alpha = 0.05) and revealed that all companies, in most years, discussed changes in their top management team (governance), their stock values and financial performance (financial), and matters affecting their employees (management). MANOVA showed that these three themes were statistically identical across the entire annual report data base and were, therefore, of little analytic value. Only two of the five themes (R&D and marketing) could discriminate among companies during the periods studied. Again, qualitative verification was sought by using the indexed full text. Based on the quantitative results of the MANOVA and the qualitative review of theme content, analysis continued using only the 'R&D' and 'marketing' themes because these two were the only ones that showed enough variance to be useful.

## Separating future-oriented strategic intentions from current and past performance

In the presidents' letters, descriptions of future-oriented strategic themes were interspersed with long sections of narrative about current and past achievements. These two categories of information, when considered together, confounded statistical analysis and presented a challenge that was overcome by resorting to the flexible ideas of data mining (Ramaprasad, 1996). Specifically, the two types of data—future-oriented strategic intentions and past/present performance—are expressed in English in two grammatical forms. For example, intended actions are described in future tense formats (we plan to build ...), while reports about performance are written in the present or past tenses (we sold more than ...). Using this qualitative grammatical tool, independent raters separated the sentences in each theme into two categories: 'future tense' and 'all others.' The outcome of this data-mining approach was two sets of refined cognitive information which no longer confounded analysis.

### *Cluster analysis*

Frequency values for the future tense sentences from the 'R&D' and 'marketing' sentence lists were entered into separate cluster analyses, another nondependence statistical procedure (Hair *et al.*, 1992). Cluster analysis placed each of the 426 annual reports into a cognitive strategic group

Table 5. Five themes discovered by common factor analysis

| R&D[a] | Marketing[a] | Governance | Finance | Management |
|---|---|---|---|---|
| New (0.63)[b] | Division (0.63) | President (0.76) | Stock (0.81) | People (0.68) |
| Facilities (0.61) | Product (0.48) | Executive (0.76) | Shares (0.71) | Development (0.61) |
| Plant (0.60) | Sales (0.47) | Board (0.69) | Foreign (0.63) | Future (0.50) |
| Research (0.52) | Market (0.35) | Chairman (0.68) | | Performance (0.39) |
| | | Director (0.61) | | |

[a]Per MANOVA (alpha= 0.05), a statistically useful theme
[b]Factor loadings after a VARIMAX rotation

and those groups were compared with Cool and Schendel's performance strategic groups in four periods (Period 1: 1963–69; Period 2: 1970–74; Period 3: 1975–79; Period 4: 1980–82). Additionally, present and past tense sentences were clustered by strategic group and set aside for later use.

### *Nominal data and the use of crosstabs*

Crosstabs were used to test for a statistically significant relationship between the cognitive groups in each period and their corresponding strategic groups (from Cool and Schendel's study). Their use was methodologically necessary because of the nominal nature of the data, and the authors' reluctance to assume a dependent relationship, *a priori*. While these factors precluded the use of regression analysis and several traditional time-series techniques, this conservative approach was more firmly grounded in the categorical nature of the data, and avoided potential errors such as autocorrelation. Unfortunately, the nominal data also ruled out potentially useful techniques such as Granger's Tests of Causality (Ashley, Granger, and Schmalensee, 1980; Granger, 1969).

Since crosstabs use nominal frequency data to produce measures of association ('C' and 'e') and report significance, they were considered the most appropriate tools to use to test Hypothesis 1. Using the six cognitive groups from our study and the six strategic groups from Cool and Schendel's research, each of the four periods from 1963 to 1982 was tested for cross-sectional relationships. Statistically significant relationships between our study's cognitive groups and Cool and Schendel's (1987) strategic groups were found, and will be discussed later in this paper when addressing the outcome of Hypothesis 1.

### *Longitudinal analysis*

With the membership of both cognitive and strategic groups established, the stage was set to search for longitudinal relationships. Three factors guided this search. First, the evidence was again nominal (Babbie, 1992; Cohen, 1969) and this required use of crosstabs that, though statistically crude, were appropriate to the limitations of the data type. Second, the search was longitudinal and this pointed to comparison of information from 1963 through 1982. Finally, moving from Cool and Schendel's four multi-year periods to 20 separate annual analyses produced smaller numbers of observations for each crosstab. To deal with the reduction in the number of observations per annual crosstab, cognitive and strategic data were reclustered into *three* groups. This reduced-group structure was suggested by the (1) *core*, (2) *secondary*, and (*3) transient* cognitive strategic groups reported by Reger and Huff (1993). Parallel performance strategic group classifications consistent with Mintzberg and Waters' (1985) model were designated (1) *deliberate*, (2) *mixed*, and (3) *emergent*. By consolidating six groups into three, meaningful results could be obtained using the smaller number of observations available in each year of the period.

### *Logic, time, and causality*

To conduct a longitudinal search, data from future-oriented cognitive groups at $T_1$ were crossed with yearly figures from performance-based strategic groups at $T_2$ through $T_5$. For instance, future-tense core, secondary, and transient cognitive group membership data from 1963 were cross-tabulated with strategic group information for 1964 to 1968 (five separate crosstabs). A progression of crosstabs was used because there was rarely an indication of when a planned event was expected to come to fruition. The research design estimated that strategic performance, resulting from strategic intentions reported in cognitive groups, could most probably be expected between 2 and 5 years after the first reports of intended action. Once the statistical analysis using crosstabs was completed, statistically significant hits were qualitatively reviewed by referring to the specific locations in the full-text data base that had contributed to the statistical finding. The expectation was that, though the subject might vary, members of strategic groups would be sounding similar themes and reporting similar performance outcomes.

## ANALYSIS AND RESULTS

### Computer-assisted content analytic results (review Appendix for additional details)

### *Themes*

Five themes were identified by factor analyzing the most frequent nonstructural words in a sample

of annual reports to pharmaceutical company shareholders. For instance, the words 'new, facilities, plant, and research,' were grouped by common factor analysis and were labeled 'R&D.' Next, every sentence that contained a word from a theme was catalogued based on its tense—future tense representing strategic intent and present/past tense representing current or past performance. The sentences were then placed in five files—one each for *governance, R&D, finance, marketing,* and *management* factors.

Sentences from the two factors (R&D and Marketing) which showed the most discriminatory power, based on MANOVA, were separated by tense and entered into separate data bases—one for the future tense and one for the present/past. This set the stage for identification of cognitive strategic groups based on discussions of future-oriented strategic initiatives along the R&D and marketing themes, and for a similar identification of performance strategic groups based on reports of achievement in the present and near past. Additionally, the reduction of themes from five to two simplified analysis and achieved a desirable improvement in parsimony (Babbie, 1992; Bacharach, 1989; Kerlinger, 1986).

### *K-means cluster analysis*

K-means cluster analysis, a nonhierarchical algorithm (Hair *et al*., 1992: 277) was used to categorize companies into cognitive strategic groups (based on future tense sentence tallies) and performance strategic groups (based on present/past tense counts). K-means cluster analysis requires specification of the number of clusters to be used (Hair *et al*., 1992), so six clusters were used for the cross-sectional portion of our study (Hypothesis 1) and three were used for the longitudinal portion of the research (Hypothesis 2). Initial cluster centers were selected by SPSS (1995) and iterated until the Euclidean distance between centroids changed less than 2 percent (SPSS, 1995). Use of this iterative approach reduced the chances of biases entering the designation of initial cluster seeds, and assured stable clusters once the procedure met the 2 percent convergence criterion (Hair *et al*., 1992: 277–278; SPSS, 1995). ANOVA tables confirmed there was no significant probability ($p = 0.000$, alpha = 0.05) that the observed clusters occurred by chance (SPSS, 1995).

### *Static relationships between cognitive and strategic groups*

The results of cross-tabulating the cognitive groups with Cool and Schendel's (1987) strategic groups are shown in Table 6.

In three of the four periods significant relationships were found, as confirmed by *Cramer's V*. This criterion is a chi-square measure that overcomes the requirement to fill every cell in a crosstab matrix (Norusis, 1996: 370; Reynolds, 1977: 32). Not only were the relationships statistically significant, they showed sizeable relationships between cognitive and strategic groups, as shown by values of the *Contingency Coefficient C,* and the *Effect Size Index,* '*e*.' This is important because 'e' can be interpreted as the counterpart to $r^2$ in multiple regression (Cohen, 1969: 210). Using 'e,' the relationships between cognitive and strategic groups accounted for a range between 0.60 and 0.12 (mean = 0.35) of the variation.

## Consideration of Hypothesis 1

### *Statistical analysis*

Table 6 supports Hypothesis 1 by revealing large, statistically significant relationships between cognitive and strategic groups. While the reliability of these findings is considered high because the data were continually reviewed for accuracy and computers were used for statistical calculations, the validity of these associations can only be approximated through qualitative analysis.

### *Qualitative analysis*

Reading the texts from each period provides a sense of the patterns of strategic change in the industry. Strategic groups during these periods reflect the move away from strategic stability in Period 1 (1963–69) to Period 2's (1970–74) search for growth through one of three grand strategies: diversification, market development, or product development. In Period 2 the groups that followed a product development strategy invested heavily in a newly available research paradigm, 'Rational Drug Design' (Bogner and Thomas, 1996). In doing so, they developed a first-mover advantage that later propelled their group to industry leadership (Bogner and Thomas, 1996).

Table 6. Cross-sectional relationships between cognitive and strategic groups

| Period 1 (1963–69) | | | | Period 2 (1970–74) | | | | Period 3 (1975–79) | | | | Period 4 (1980–82) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| V[1] | C[2] | e[3] | Sig.[4] | V | C | e | Sig. | V | C | e | Sig. | V | C | e | Sig. |
| 0.28* | 0.54 | 0.40 | 0.001 | 0.26* | 0.47 | 0.29 | 0.027 | 0.20 | 0.33 | 0.12 | 0.195 | 0.34* | 0.61 | 0.60 | 0.050 |

*Significant.
[1]Cramer's V (Norusis, 1996: 370; Reynolds, 1977: 32).
[2]C = Contingency Coefficient (SPSS Inc., 1995).
[3]e = Effect size index (interpreted the same as $r^2$) (Cohen, 1969: 216).
[4]Alpha =0.05.

Other strategic groups, especially those that pursued unrelated diversification during this period, were a bit slow to adopt the expensive new drug development paradigm, and then fell behind the new leaders. Period 3 (1975–79) was a time when major investments in 'Rational Drug Design' became more widely accepted. Several members of the smaller strategic groups divested themselves of many of their unrelated companies and reinvested the resulting capital in improved R&D. During Period 4 (1980–82) early movers into 'Rational Drug Design' began to reap significant gains while the rest of the industry struggled to catch up with the leaders (Bogner and Thomas, 1996). Taken together, the statistical results and the qualitative evaluations are consistent, and provide a solid basis of support for Hypothesis 1. That is, cognitive and performance-based strategic groups appear to have the same members at $T_1$, and these groups changed strategies in ways that are consistent with Bogner and Thomas's (1996) discussion of changes during that period.

## Consideration of Hypothesis 2

### *Statistical analysis*

The results of cross-tabulating our study's cognitive groups against time-lagged strategic groups, on an annual basis, are shown in Table 7. Results show statistically significant relationships between cognitive groups at $T_1$, and related reports of strategic actions from $T_2$ to $T_6$. Qualitative analysis also suggests intended strategy may have been overcome by emergent strategy in the cases that do not show significant relationships. To an extent, this finding is consistent with Mintzberg and Waters' (1985) contention that deliberate strategy is often diverted by unforeseen effects from the environment.

In 36.3 percent (29/80) of the observations tested in Table 7, there were statistically significant longitudinal relationships between cognitive and strategic groups. Table 7 shows values of 'C' (*Contingency coefficient*) for the statistically significant strategic relationships, and these may be further interpreted by using the *Effect Size Index Conversion Table* shown at the bottom of the chart. Values of 'e' range in size from 0.60 to 0.19 (mean = 0.397). These relatively large values of 'e' show the relationships between cognitive and strategic groups are not only statistically significant, but also large enough to be practically important. Overall, Hypothesis 2, (cognitive group goals at $T_1$ are positively related to strategic group performance at $T_2$) was supported by the longitudinal analysis, and confirmed by reference to the indexed sources of information in the full-text data base of annual reports.

### *Qualitative analysis*

At each stage of the analysis, quantitative results were compared with qualitative observations. This analysis frequently revealed that intended strategic thrusts in *R&D* and *marketing* were followed by related performance reports. For example, discussion of facilities expansion plans in one strategic group were followed in 2 or 3 years by reports of occupancy of new buildings by several members. In marketing, strategic group dialogue about planned new merchandise lines was usually followed by announcements of new product launches. Still later, some of the product launches were deemed successful (or not) and this led to

Table 7. Contingency coefficients (C) for the relationship between cognitive and strategic groups

| Year | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 |
|---|---|---|---|---|---|---|---|---|
| 1-yr lag | | | 0.48*** | | 0.53*** | | 0.60*** | 0.43** |
| 2-yr lag | 0.62*** | | | | 0.40* | | 0.62* | 0.56*** |
| 3-yr lag | | | | 0.52* | 0.51*** | 0.54** | 0.52** | 0.44*** |
| 4-yr lag | | | | 0.56*** | | 0.52* | | |
| 5-yr lag | | | | 0.59*** | | | | 0.49*** |
| Year | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978[a] |
| 1-yr lag | 0.51** | 0.52*** | | | | 0.52* | 0.62*** | |
| 2-yr lag | | | | | | 0.51* | | |
| 3-yr lag | | 0.56*** | | | 0.49* | | 0.48*** | |
| 4-yr lag | 0.51* | | | | | | 0.59*** | |
| 5-yr lag | | | 0.53** | | 0.39* | | | |
| Effect size conversion table (Cohen, 1969: 216) | | | | | | | | |
| C | 0.22 | 0.30 | 0.41 | 0.48 | 0.54 | 0.58 | 0.61 | 0.64 |
| Effect size[b] | 0.05 | 0.10 | 0.20 | 0.30 | 0.40 | 0.50 | 0.60 | 0.70 |

Significance levels: *0.15; **0.10; ***0.05
[a]1978 is the last year in which five lag years can be evaluated since 1982 is the final year studied.
[b]Effect size can be interpreted in a manner similar to $r^2$ (Cohen, 1969).

further discussion in later annual reports. Interestingly, these discussions began, matured, and faded at about the same time within strategic groups, but there were differences, often more timing than content related, noted among the groups. Another strong topic involved plans to expand internationally, and again there were strategic groups that led, strategic groups that followed, and smaller groups that had basic survival concerns. Early announcements were often followed by discussions of international sales growth in later years. Finally, R&D-based innovations such as control of animal diseases and enhancement of research capabilities (Abbott, Lilly, Merck, and others) were discussed. Later, facilities and staff were acquired to enact these strategic thrusts, and within 5 years new product performance was touted. Although the specifics of intended strategies varied, they were usually followed by performance reports (both positive and negative) about the outcomes of the earlier plans. Importantly, companies in each strategic group enacted solutions which were different in their details, but, within a group, almost all were responding to commonly perceived strategic challenges such as growth of R&D capabilities or expansion into foreign markets.

To sum up, the findings of the qualitative review of the text were consistent with the statistically significant relationships revealed by the lagged crosstabs. Qualitative inspections confirmed the relationship between the intended strategy expressed in annual report letters with reports of actions taken and performance achieved at later dates. Together with the earlier findings, this large-scale research project supports Hodgkinson's (1997) view that mental models and performance are linked.

## DISCUSSION

As explained in the Analysis and Results section, above, the research design used for this paper produced several findings that are particularly relevant to the challenge posed by Hodgkinson (1997). Three aspects of his first proposition, including (1) detecting strategic groups, (2) significant variations in strategic group mental models, and (3) linkages between mental models and

performance, will be discussed before arriving at conclusions for this paper.

### Detecting strategic groups (Hodgkinson, 1997: 633)

The initial premise of Hodgkinson's (1997) first research proposition stated that strategic groups must be detectable (Hodgkinson, 1997: 633). This condition was met because several researchers have found competitive, or strategic, groups by using a variety of measures and methods (Cool and Schendel, 1987; Dranove *et al*., 1998; Fiegenbaum and Thomas, 1990; Johnson and Thomas, 1987; Porac *et al*., 1989; Reger and Huff, 1993; Wiggins and Ruefli, 1995). Importantly, Nath and Gruca (1997) demonstrated that strategic groups found using different measures converge. This finding supports the presence of a meaningful construct rather than a phantom artifact of cluster analysis. To meet the conditions of this premise, our study relied on Nath and Gruca's (1997) finding by using narrative themes in presidents' letters to shareholders to construct a mental model which grouped companies in the pharmaceutical industry, 1963–82. These competitive groups converged with those identified by Cool and Schendel (1987) and demonstrated that themes could also be used to detect strategic groups. The success of computer-assisted content analysis of the presidents' letters supported the first premise of Hodgkinson's (1997) proposition. That is, strategic groups can be detected using cognitive or performance measures of industry structure.

### Significant variations in strategic group mental models (Hodgkinson, 1997: 633)

Simply detecting the presence of groups in an industry was, by itself, of little practical value. Hodgkinson recognized that the need for a second premise, 'significant variation in actors' cognitions across these groups...' (Hodgkinson, 1997: 633), was necessary to identify the characteristics of different strategic groups. The need for a second premise was demonstrated to the authors when attempts to analyze strategic groups led to a series of unstable clusters. Stable clusters were an essential element in the identification of different strategic groups and without the presence of various signatures, or variations, in the data, progress toward the conclusion of the first proposition was impossible (Cool and Schendel, 1987, 1988; Peteraf and Shanley, 1997; Porac *et al*., 1989; Reger and Huff, 1993).

Based on the erratic nature of the clusters, we suspected the presence of one or more confounding factors in the data, and MANOVA found that three of five themes had insignificant discriminatory power. Specifically, all the companies in all the years of our study discussed three themes: (1) governance, (2) financial, (3) management. Since there was no variation in the level of discussion of these three themes, they were powerless to assist in identifying unique clusters. By eliminating these powerless themes from analysis, stable groups based on two themes (R&D; Marketing) emerged and research continued. Our study demonstrated the necessity for variation of values on themes used to identify groups, but it also showed that confounding factors can seriously affect research that uses output from computer-assisted content analysis. This example relates to Hodgkinson's second premise about the need for significant variation between strategic groups, and demonstrates how our study met the condition set out by that premise (Hodgkinson, 1997; Peteraf and Shanley, 1997). It also provides a cautionary note for researchers who use cognitive measures in future strategic group studies.

### Linkages between mental models and performance (Hodgkinson, 1997: 633)

In a large-scale experiment, finding empirical linkages between themes that characterize shared mental models of strategy and reports of performance along those same themes confirms the conclusion set out by Hodgkinson's (1997) first proposition. Since the conditions set out by Hodgkinson's (1997) first two premises had been met, and because the basic nature of the strategic process is to affect future outcomes (Andrews, 1987), the researchers looked for evidence of longitudinal linkages in the data. As shown in the Analysis and Results section, many statistically significant linkages were located. While statistically significant findings were expected, the size of the effects was a surprise. The size suggested the mental models shared by corporate leaders had an important impact on performance. At the same time, even with strong linkages, much of the variance was left unexplained. This

suggests that the connection between mental models and subsequent performance is one of several links in a chain of events leading to strategic group performance. It also suggests much work remains to be done to identify and quantify these other links in the chain.

The linkage also provided qualitative support for the concept of recursive competitive enactment (Hodgkinson, 1997; Smircich and Stubbart, 1985; Stubbart and Ramaprasad, 1988; Weick, 1979). For example, using the marketing theme as a basis of discussion, there were linkages between statements about projected overseas expansion, and later reports about how the expansion was faring. In the same letters in which expansion progress was reported, there were also discussions about further growth, or product shifts, in the newly established markets. This series of reports showed a progression from plans, to actions, to performance, to a new round of plans, to new results. While only traced through two cycles, qualitative analysis suggested that plans led to performance, and that performance then became a baseline for development of new plans. This recursive interaction was an example that clarified the process of competitive enactment predicted by scholars (Figure 1) (Hodgkinson, 1997; Smircich and Stubbart, 1985; Stubbart and Ramaprasad, 1988; Weick, 1979). When taken together, the empirical tests of Hodgkinson's (1997) two premises and final conclusion supported his first proposition, and additionally provided concrete examples of competitive enactment.

## CONCLUSIONS

Two conclusions and several observations are supported by this paper. The first conclusion is that the findings of this research are consistent with recent strategic group literature, and this suggests further integration and generalization of theory is feasible. While Popper (1959) felt true scientific progress was advanced only when firmly held models were disconfirmed, our study suggests consistent models must first be built before they can be usefully examined. By testing several existing conceptual bricks, which together serve as a theoretical foundation for strategic group research, this research found they collectively formed a sturdy foundation for strategic group theory. Specifically, the findings support Nath and Gruca's (1997) conclusion that strategic groups identified by cognitive and performance measures converge, and they advance the field of strategic group research by empirically supporting Hodgkinson's first proposition. Our study accomplished this by intentionally using existing concepts, rather than new constructs, in complementary ways. These observations are consistent with our view that now is a time for consolidation and integration of the complementary dimensions of strategic group theory.

The second contribution concerns using novel methods in strategic group research. With an apparent trend toward the acceptance and use of cognitively defined strategic groups, better methods of measuring the dimensions that define those groups are needed. In the digital era, more and more company and industry information is now electronically recorded and accessible to researchers. Our study showed how computers and flexible data-mining concepts can enhance traditional content analysis, and rapidly focus attention on rich veins of information in narrative overburden. In this instance, computer assistance permitted statistical pointers to be developed, and these pointers directed researchers to the relevant (statistically significant) sections of text. This novel, but useful, variation on the integration of qualitative and quantitative research designs deserves further exploration by researchers who would like to overcome the statistical limitations of anecdotal evidence, and the loss of connection with research subjects associated with purely quantitative studies. Taken together, the findings and methods of our large-scale empirical study supported and extended current strategic group research, demonstrated a novel approach to data analysis, and posed challenging questions for future research.

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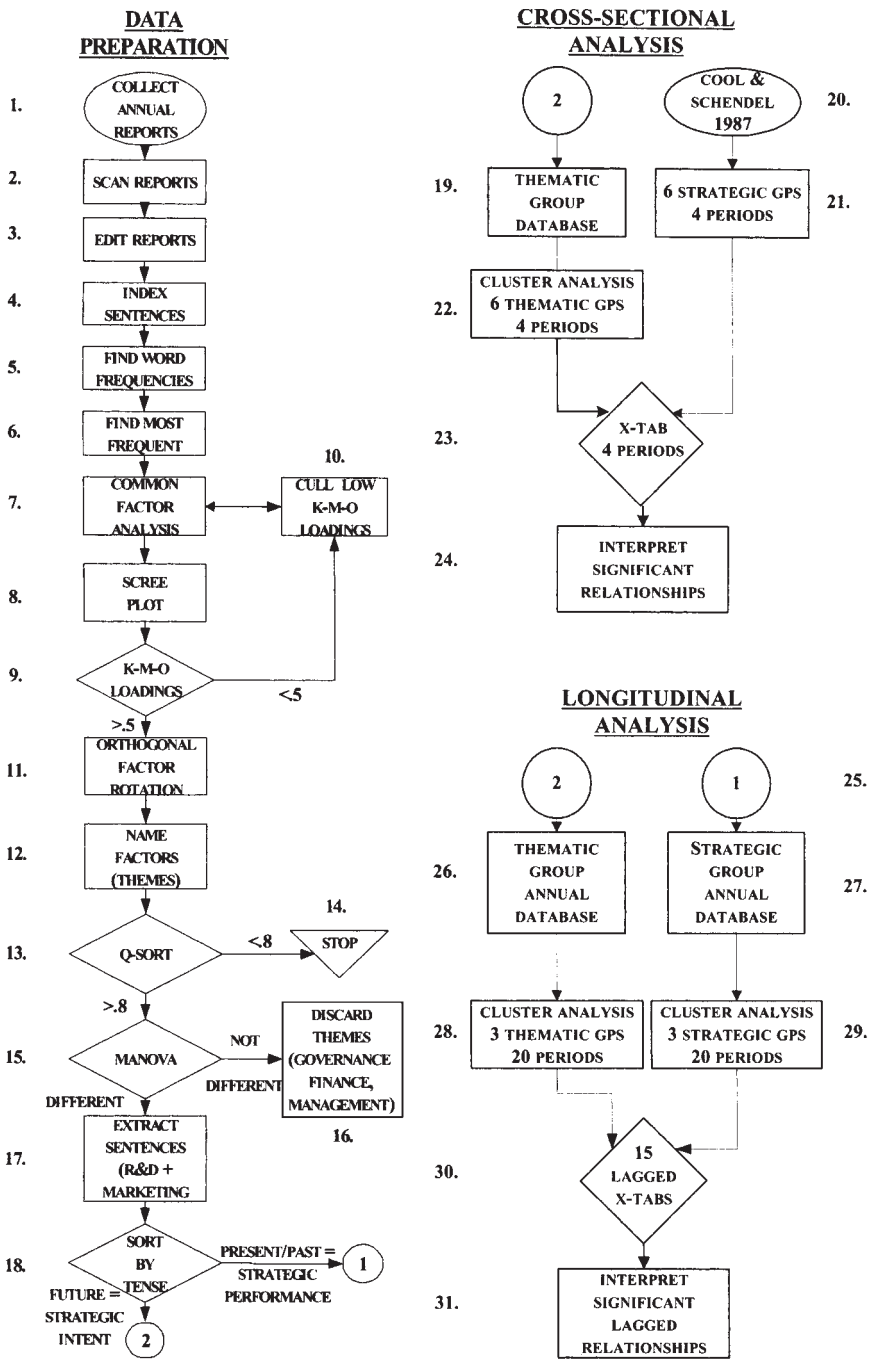
## APPENDIX: METHODOLOGY MAP AND NOTES

**Notes:**

1. 426 annual reports collected at a midwestern university.
2. Reports scanned using 1995 Hewlett-Packard IIIc scanner.
3. Reports edited by spell check and spot checking.
4. All sentences, in all reports, indexed and labeled with WordCruncher 4.5/6 (Brigham Young University, 1989).
5. WordCruncher provides frequencies for words in all reports.




6. 46 most frequent nonstructural words identified.
7. Common factor analysis performed on the word set.
8. Scree plot indicates 5 strong factors present in the data (Hair *et al.*, 1992: 231).
9. Kaiser–Myer-Olkin Measure of Sampling Adequacy values >0.5 kept per Kaiser–Rice scale (Stewart, 1981: 58).
10. Variables (words) with KMO-MSA <0.5 culled and process iterated to step 7, until all values >0.5 on KMO-MSA.

11. VARIMAX, orthogonal rotation performed and retained after comparison with an ORTHOMAX oblique rotation (Stewart, 1981: 59).
12. Factors/themes named by researcher as: Governance, R&D, Finance, Marketing, and Management.
13. Sentences from each variable (word) in each theme Q-sorted by doctoral students (Babbie, 1992).
14. Measure of agreement = 0.87, adequate (Robinson, 1957)
15. MANOVA used to test the discriminatory power of the 5 themes, while controlling experiment-wise error at <0.05. Results showed Governance, Finance, and Management could not separate firms or years, while R&D and Marketing themes could make such distinctions.
16. The Governance, Finance, and Management themes were discarded from the study after a qualitative analysis confirmed the MANOVA. The qualitative analysis showed these three themes were discussed by most companies in most years, which confirmed they had insufficient variability to make distinctions among cognitive group members.
17. Indexed sentences containing words from the R&D and Marketing themes were extracted from all annual reports by WordCruncher 4.5/6 (Brigham Young University, 1989).
18. College students were paid to separate future tense sentences from present and past tense sentences. Work was spot-checked by the authors.
19. The cognitive group data base contains frequency counts of future tense (strategic intent) statements.
20. Cool and Schendel (1987) analyzed the pharmaceutical industry between 1963 and 1982.
21. Cool and Schendel (1987) identified up to six strategic groups in each of four time periods.
22. Cluster analysis of the cognitive group data base identified up to six cognitive groups in each of four time periods. The same number of groups and the same time periods used by Cool and Schendel (1987) were explored.
23. Crosstabs were run for each of the four periods.
24. As shown in Table 6, statistically significant, and unusually large relationships were shown in Period 1 (1963–69), Period 2 (1970–74), and Period 4 (1980–82). These findings support Hypothesis 1: *There is a parallel relationship between cognitive groups and strategic groups in a cross-section of firms during a fixed time period.*
25. Performance data from the R&D & Marketing themes were used in the longitudinal analysis.
26. The cognitive group data base contains frequency counts of future tense (strategic intent) statements.
27. The strategic group data base contains frequency counts of present/past tense (performance) statements for the R&D, and Marketing themes.
28. Cluster analysis identified three cognitive groups in each year of the study (1963–82).
29. Cluster analysis identified three strategic groups in each year of the study (1963–82).
30. 15 sets (set = 5 lagged crosstabs) of crosstabs (total of 75) were run.
31. Values of the contingency coefficient were noted for alpha = 0.05, 0.10, and 0.15. These values were entered into a table and used in conjunction with the full-test data base to conduct a qualitative analysis of the statistically significant relationships. Qualitative analysis revealed many logical connections between intent and performance, and provided rich anecdotal detail to give context to the statistical findings.

**Added Notes:**

*32. Auto-correlation.*

Auto-correlation, a potential problem with higher orders (interval and ratio) of continuous data, was not an issue in this study, because nominal data was used (Newbold, 1988), and because each annual report could be considered as a separate, noncontinuous event.

*33. Granger's Test of Causality.*

(Granger, 1969; Ashley, Granger and Schmalensee, 1980). Again the nominal nature of the data precluded the use of regression-based techniques to determine either causality or beta weights for the themes. Further, Granger's Test

is usually applied to situations in which the direction of causality is ambiguous and data points are plentiful. Since the available data did not meet the requirements to use Granger's Test, and because the direction of causality was logically clear (T1 → T2), this test, though considered in detail, was not used.

*34. Complementary use of quantitative and qualitative data.*

Nominal data, such as was available in this study, is usually interpreted by reference to logic, known time relationships, and knowledge about the nature of the variables under consideration. Often the results are very lean and not too satisfying. In this study, limitations on the use of more sophisticated regression techniques were partially offset by referring nominal number statistical relationships back to indexed qualitative data. This referral process worked very well since the annual reports very often reported outcomes which had earlier been discussed as intended actions. In this instance, the use of qualitative data offset the lack of interpretive power which is associated with the use of nominal data, and provided surprisingly rich insights into the relationship between strategic intent and strategic performance.