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DIFFERENCES IN COMPETITIVE AGGRESSIVENESS BETWEEN GROWTH AND MELTDOWN PERIODS

By

Ishfaq Malik

A thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of
Master of Engineering in Telecommunications Technology Management

Department of Systems and Computer Engineering

Carleton University

Ottawa, Canada, K1S 5B6

April 2005

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submitted by

Ishfaq Malik

in partial fulfillment of the requirements for the degree of
Master of Engineering in Telecommunications Technology Management

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Carleton University

April, 2005

ABSTRACT

The objective of this research is to identify similarities and differences in the relationship between firm-level factors and competitive aggressiveness and the relationship between competitive aggressiveness and company performance during periods of market growth and market meltdown. Using 142 company years drawn from 33 suppliers of telecommunications equipment from 1998 to 2003, a set of seven hypotheses was examined. Results suggest that: the relationship between firm-level factors and action volume during market growth is similar to that during market meltdown; action diversity is negatively related to performance during market meltdown but not related during market growth; there is a negative relationship between action volume and action diversity; and action diversity during market meltdown is greater than action diversity during market growth.

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1. INTRODUCTION

The objective of this research is to identify the similarities and differences in the relationship between firm-level factors and competitive aggressiveness and the relationship between competitive aggressiveness and firm performance during growth and meltdown periods.

Growth and meltdown periods can be identified using the methodology established by the National Bureau's Business Cycle Dating Committee¹. Accordingly, a growth period starts with a trough and ends with a peak of business activity. A meltdown period starts with a peak and ends with a trough of economic activity.

Competitive aggressiveness is defined as the intensity and diversity of the actions undertaken by a company in order to compete. For the purpose of this research, competitive aggressiveness is comprised of two dimensions: action volume and action diversity. Three firm-level factors are considered to be the antecedents of competitive aggressiveness: the diversity of the company's top management team (TMT), company liquidity and, the company's past performance.

This research builds on Ferrier (2001) and Hao (2004). Table 1 identifies the samples and study periods used by Hao and Ferrier, and their key findings. Ferrier (2001) examined the two single largest companies in 16 industries and found that action diversity exhibits a

¹ Business Cycle Dating Committee, National Bureau Of Economic Research ,<http://www.nber.org>

U shaped relationship with company performance measured as gains in market share. Performance first increases as action diversity increases and then decreases. Hao (2004) examined the competitive behavior of 36 telecommunication equipment suppliers during the market meltdown of January 2001 to October 2003. She found that action diversity decreases company performance. She suggested that during a market meltdown, a company focuses its activities on its core business and limit action types to a narrow range. Both Ferrier (2001) and Hao (2004) found that action volume increases a company's performance (measured as gains in market share and return on assets respectively).

Hao (2004) found that during the market meltdown period she studied, firm-level factors did not affect competitive aggressiveness in the same way as reported by Ferrier (2001). Ferrier (2001) found that TMT diversity is positively related with action diversity. Hao (2004), however, reported that TMT diversity is not related to action diversity. Ferrier (2001) reported that good past performance is not related to action volume. Hao (2004) reported that good past performance is positively related to action volume. Ferrier (2001) found that liquidity is positively related with action volume; however, Hao (2004) found that liquidity was negatively related with action volume.

Table 1. Sample, study period, and results reported by Ferrier (2001) and Hao (2004)

	Ferrier (2001)	Hao (2004)
Sample	Two of the largest single firms in 16 different industries.	36 suppliers of telecommunications equipment.
Study period	1987 to 1993	Market meltdown of January 2001 to October 2003.
Relationship between competitive aggressiveness and company performance	<p>Action diversity is negatively related and action diversity squared is positively related with company performance measured as gains in market share (U shape relationship).</p> <p>Action volume is positively related with company performance measured as gains in market share.</p>	<p>Action diversity is negatively related with company performance measured as return on assets, sales per employee and change in sales.</p> <p>Action volume is positively related with company performance measured as return on assets.</p>
Relationship between firm level factors and competitive aggressiveness	<p>TMT diversity is positively related with action diversity.</p> <p>Liquidity is positively related with action volume.</p> <p>Good past performance is not related to action volume.</p>	<p>TMT diversity was not related with action diversity.</p> <p>Liquidity is negatively related with action volume.</p> <p>Good past performance is positively related with action volume.</p>

The outcomes of this research are particularly relevant to researchers working in the area of strategic management and to the TMT of telecommunications equipment suppliers who need to make decisions during periods of market growth as well as meltdown.

This research contributes to the literature on competitive aggressiveness by illustrating how economic conditions affect the relationship between firm-level factors and

competitive aggressiveness as well as the relationship between competitive aggressiveness and company performance.

This research also contributes to management practice. TMTs wish to be competitive both during market growth and meltdown periods. This research provides TMTs of telecommunication equipment suppliers with insights on which relationships of the antecedents and consequences of competitive aggressiveness are stable during periods of growth and meltdown and which relationships are not.

This research is organized into seven chapters. Chapter 1 is the introduction. Chapter 2 provides the literature review. The research model and the hypotheses are developed in Chapter 3. Chapter 4 describes the research method. Chapter 5 provides the results and Chapter 6 provides a discussion of the results. Finally, Chapter 7 provides the conclusions, limitations, and suggestions for future research.

2. LITERATURE REVIEW

This literature review has been organized into six sections. The first section reviews the literature investigating the relationship between firm-level factors and company aggressiveness. The effects of top management team (TMT) diversity, company liquidity, and past performance are explored. Recent research on meltdown is also covered in this section. The second section reviews studies that examine the relationship between competitive aggressiveness and company performance. Also examined here are the effects of action volume and action diversity on company performance, which are then compared with the studies on market downturns. The third section presents the basis within the literature for the analysis of company performance. The fourth section addresses research on market growth and meltdown. The fifth section identifies Hao's (2004) findings on meltdown and then summarizes the principal conclusions found in the literature. A summary of the entire literature review is presented in Tables 2 and 3.

2.1 Company level factors

Table 2 identifies the effects of firm-level factors on a company's competitive actions. Listed in this table are the various empirical studies reviewed for the present study. The sample population, the source of data, the propositions tested, and the lessons learned for each of these studies are also shown

Table 2. Empirical studies showing the relationship between firm-level factors and aggressiveness

Research	Study Sample	Data source	Relationship between	Lesson learnt
Ferrier (2001)	16 largest firm-pairs across 16 industries from Fortune 500 during 1987-1993	F&S Predicates Dun & Bradstreet Reference Book of Corporate Management	Company level factors (TMT diversity, Liquidity, Past performance) and competitive aggressiveness	TMT with high diversity results in high attack complexity and duration. High level of liquidity enabled high attack volume, and duration. Good past performance was negatively related to attack duration.
Hambrick, Cho, & Chen (1996)	32 companies in airline industry during 1979-1986	Aviation Daily (industry journal)	TMT diversity and competitive action/response	TMT with high diversity was more likely to act/respond in noteworthy ways, but speed was low.
Hao (2004)	71 action years of 36 telecommunication equipment provider companies	Company web sites SEC Google.com	TMT education diversity and asset disposal High liquidity and action volume Good Past performance and action volume	The relationship between firm-level factors and competitive aggressiveness during market meltdowns is different from stable market condition. Education diversity was found to effect negatively to asset disposal. High liquidity as well as good past performance effects action volume.
Miller & Chen (1994)	32 U.S. domestic airlines during 1979-1986	Aviation Daily Airport Activity Statistics of Certified Route Carriers	Past performance and competitive inertia	Good past performance increased competitive inertia. Good past performance increased more inertia in tactical actions than in strategic actions.

Research	Study Sample	Data source	Relationship between	Lesson learnt
Rountree (2004)	Top 2 telecommunication interexchange carriers and 2 local exchange carriers during 1996-2002	Statistics of Communication Common Carriers Annual Reports SEC filings Corporate websites	Top management team and aggressiveness Past performance and aggressiveness Competition and aggressiveness Regulation and aggressiveness	Competitiveness is affected by top management team aggressiveness. Good past performance is negatively related to diversity. Industry growth and concentration to entry together influence a firm's motivation. Industry growth reduces motivation, whereas as concentration increases motivation.
Smith, Grimm, Gannon, & Chen (1991)	32 U.S. domestic airlines during 1979-1986	Aviation Daily	Liquidity and response likelihood	High level of liquidity was negatively related to response likelihood.
Wiersema & Bantel (1992)	87 companies from Fortune 500 manufacturing in 1980	TRINET line-of-business data Dun & Bradstreet Reference Book of Corporate Management	TMT diversity and propensity of changing company strategy	TMT with high diversity was more likely to change company strategies.

Top management team (TMT) diversity

TMT diversity refers to the degree to which members of management differ with respect to work related backgrounds (Bunderson & Sutcliffe, 2002). The term background includes each team member's company tenure, function, and education backgrounds (Hambrick, Cho, & Chen, 1996). Company tenure diversity identifies the number of years a team member has spent in the company. Functional diversity represents the different areas within which team members have spent the greater part of their careers (Bunderson & Sutcliffe, 2002). Educational diversity refers to the range of educational credentials of team members (Hambrick, et al., 1996).

The TMT is key to problem sensing and decision-making (Sutcliffe, 1994). A TMT with a high level of diversity is likely to have broad cognitive knowledge a wider field of vision, enabling it to sense problems and take advantage of more opportunities within a dynamic market place (Ferrier, 2001; Hambrick, et al., 1996; Knight, Pearce, Smith, Olian, Sims, Smith, & Flood, 1999; Rountree, 2004). Therefore, TMT heterogeneity is associated with complex cognitive initiatives (Rountree, 2004).

Chen (1996) examines team heterogeneity, relates it positively to the firm's prosperity and strategic significance. Rountree (2004) in the research on competitive aggressiveness came to the same conclusion and states that a heterogeneous top management team is better equipped to sustain complex sequence of competitive moves than a homogenous top management team.

Hao (2004) suggests that during a market meltdown, TMT education diversity affects asset disposal, one of the dimensions of the competitive aggressiveness. Hao's study shows that diversity of education increases problems in knowledge sharing and communication, making it difficult for the TMT to reach a consensus.

Empirical studies also suggest that TMT diversity reduces agreement-seeking behaviors, social cohesion and informal communication in the context of strategic decision-making (Knight, et al., 1999). Heterogeneous teams will experience more conflicts among their members as they vigorously and comprehensively debate various courses of action given their diverse cognitive and experiential backgrounds.

Liquidity

Empirical research defines liquidity as organizational slack (Bourgeois, 1981). It conveys the notion of a cushion of excess resources available within an organization in the event of new strategies or strategic changes. Moreover, liquidity is the cushion of actual and potential resources that allows an organization to compete better, adapt successfully to the internal pressures for change in policy, and initiate a change in strategy with respect to external environments.

Bourgeois (1981) identifies four purposes of organizational slack. The slack exists as a resource for conflict resolution, as a buffering mechanism, as an inducement for organizational actors and as a facilitator of certain types of strategic or creative behavior

within an organization. Organizational slack allows companies more liberty, allows them to choose from among various courses of action when pressured by market or technological forces.

An organization can afford to experiment with new strategies as more slack is generated (Hambrick & Snow, 1977). As the slack resources increase, a firm's ability to initiate and sustain an aggressive pattern of competitive actions also increases (Ferrier, 2001).

Interestingly, Hao (2004) suggests that during a market meltdown companies behave quite differently as high liquidity is negatively related to action volume. This finding suggests that during a market meltdown companies slow down new actions and focus on core activities. Smith, Grimm, Gannon and Chen (1991) had also come to the same conclusion that high level of liquidity is negatively related to response likelihood

The phenomena becomes more clear through prospect theory, which describes that individuals use targets or reference points in evaluating choices and that an individual's behavior depends on whether they perceive themselves as above or below a reference point or target they choose. Their behavior will be risk taking when the individuals or organizations find themselves below the reference point or the targets established by them and risk avoiding when they are above (Fiegenbaum, Hart, & Schendel, 1996).

Past performance

The literature shows that successful past performance reduces the motivation to sustain competitive attacks because it breeds complacent behavior (Ferrier, 2001). Past success can reduce a firm's motivation to initiate or sustain competitive attacks for a significant period. Rountree (2004) using Ferrier (2001) model of aggressiveness for telecommunication equipment suppliers proved that the attack unpredictability, one of the dimension of response aggressiveness to be negatively related to past performance.

Hao (2004) differs from this point of view in her study of market meltdowns. She states that companies with good past performance undertake more competitive actions and therefore, good past performance is positively related to action volume.

A contrary view to the above argument is that poor past performances obstruct managers to implement more changes and taking a larger number of competitive actions. The managers with poor past performance, in order to save their reputation firmly hold to past course of action instead of trying large number of actions (Staw, 1976; Staw, Sandelands, & Dutton, 1981; Brockner, 1992).

2.2 Response aggressiveness and performance of company

Companies compete for market share using various competitive actions and competitive aggressiveness ultimately impacts a company's financial performance. Some of these

actions identified from a review of the literature are aggressive pricing, advertising, first mover advantages, product innovation, and quick responses to competitive challenges.

Ferrier (2001) defines competitive aggressiveness from an action-based head-to-head rivalry perspective. His model of aggressiveness defines a competitive action event as an externally directed, specific, and observable move initiated by companies to enhance its competitive position. He further specifies that the attack volume, attack duration and attack complexity are related to market share gain

Other researchers have also offered competing theories to explain competitive aggressiveness. Schumpeter's theory of creative destruction (Schumpeter, 1950), describes head-to-head rivalry as "an incessant race to get or to keep ahead of one another". Companies compete aggressively to find new ways to satisfy customers in order to get ahead of competitors (D'Aveni, 1994; Schumpeter, 1950).

Strategic actions during a turnaround or period of downturn require a different competitive strategy. In this regard, Hofer (1980) mentions two types of turnaround strategies. The first strategy, the operating turnaround, focuses on increasing revenue, decreasing cost, decreasing assets, or a combination of all these efforts. The second strategy, strategic turnaround, focuses on strategic changes. These two strategies are further explored by Hambrick and Schechter (1983), who concluded that both these strategies tend towards refocusing of the business to those sectors that are more profitable, or in which the companies have a distinctive strength i.e. the core business.

In the context of this discussion on the change in economic business cycle, the aggressiveness also undergoes a change from risk taking to risk avoiding. When formulating their reference point theory, Fiegenbaum, et al., (1996) explain this change. The individuals and organization choose their reference points based on organizational priorities, goals and objectives. Their behavior will be risk taking when they find themselves below the reference point, and risk avoiding when they are above the reference point.

Table 3 identifies the relationship between company's competitive aggressiveness and performance. Listed in this table are the various empirical studies reviewed for the present study. The sample population, the source of data, the propositions tested, and the lessons learned for each of these studies is also shown.

Table 3. Empirical studies showing the relationship between competitive aggressiveness and company performance

Research	Sample data	Data source	Relationship between	Lesson learnt
Ferrier (2001)	16 largest firm-pairs across 16 industries from <i>Fortune</i> 500 during 1987-1993	F&S Predicasts Dun & Bradstreet Reference Book of Corporate Management	Competitive aggressiveness (attack volume, attack duration, attack complexity, attack unpredictability) and relative performance (market share)	Attack volume and attack duration increased companies' relative performance. Attack complexity and unpredictability exhibited U-shaped relationship with relative performance.
Ferrier, Smith, & Grimm (1999)	41 leader/-challenger company-pairs in 41 industries during 1987-1993	COMPUSTAT F&S Predicasts	Leader/challenger action volume and market share gap erosion Leader/challenger action complexity and market share gap erosion	Leaders that carry out more competitive actions than challengers had lower rate of market share gap erosion. Leaders that have complex action repertoires had lower rate of market share gap erosion.
Hao (2004)	71 action years of 36 telecommunication equipment provider companies	Company web sites SEC Google.com	Action volume and return on assets Diversity and performance	Action volume was found affecting return on assets positively. Diversity was found affecting negatively to performance.
Hambrick & Schechter (1983)	260 companies in mature industries during 1979-1982	Profit Impact of Market Strategies (PIMS) database	Magnitude of strategic moves (asset reduction, cost cutting, revenue generation, product/market refocusing) Cost reduction: lead to performance	Asset reduction and cost cutting moves were associated with successful short-term turnaround in mature industries. Refocusing of business towards profitable sectors.

Research	Sample data	Data source	Relationship between	Lesson learnt
Hofer (1980)	12 Single business units		Asset reduction, cost cutting, revenue generation, product/market refocusing: performance	Focus on existing line to achieve profitability.
Miller & Chen (1994)	32 U.S. domestic airlines during 1979-1986	Aviation Daily Airport Activity Statistics of Certified Route Carriers	Competitive inertia and performance	High inertia in strategic actions increased near-term performance, but inertia in tactical actions had no effects. The benefits from inertia diminished with increases in market diversity.
Rountree (2004)	Top 2 telecommunication interexchange carriers and 2 local exchange carriers during 1996-2002	Statistics of Communication Common Carriers Annual Reports SEC filings Corporate websites	Competitive aggressiveness (attack volume, attack duration, attack complexity, attack unpredictability) and performance	Attack complexity and attack unpredictability are related to performance.
Smith, Grimm, Gannon, & Chen (1991)	32 U.S. domestic airlines during 1979-1986	Aviation Daily	Response likelihood and performance	The likelihood of response is positively associated with performance.
Young, Smith, & Grimm (1996)	345 company-year observations from public single-business companies in U.S. computer software industry during 1983-1991	SEC filing F&S Predicasts	Competitive action volume and performance	As competitive activity volume increases, company performance increases.

Types of actions

This section will describe empirical studies on competitive aggressiveness, turnaround and down turn strategies, and then compare the results with the recent research of Hao (2004).

Firm level actions can be divided into strategic and tactical types (Miller & Chen, 1994). Strategic actions include facility expansions, mergers and acquisitions, strategic alliances and important new products or services. Tactical actions include price changes, advertising campaigns, and incremental product or service adjustment. More so than tactical actions, strategic actions involve larger expenditures of resources, longer time horizons and a greater departure from the status quo (Dutton & Duncan, 1987).

Ferrier (2001) divided action types into six main areas, capacity actions, new product actions, signaling actions, pricing actions, and service actions. He uses these actions to measure the four dimensions of competitive aggressiveness consisting of attack volume, attack duration, attack complexity, and attack unpredictability.

Strategies may differ during downturn or turnaround periods. Empirical studies show that during turnarounds, the action types can be classified as asset reduction, cost cutting, revenue generation, and product/market refocusing (Hambrick & Schechter, 1983; Hofer, 1980). The competitive actions taken by a company during downturn or turnaround are different from the growth period.

Action volume

Empirical studies on market growth suggest that industrial growth influences action volume (Dess & Beard, 1984). This is because more action volume is related to the creation of better opportunities and higher competitive ability during the market growth. Thus, firms that carry out more actions than rivals will be exploiting more opportunities (Ferrier, 2001).

Companies that carry out more effective actions gain higher competitive ability to profit and succeed (Young, Smith & Grimm, 1996). Firms with a rich history of competitive activity are also capable of undertaking more moves in a given time; thus, they have more chances of remaining competitively aggressive and perform better (Ferrier, Smith & Grimm, 1999).

Action diversity

Empirical studies on the market growth suggest that the greater the number of competitive actions, the greater is an organization's competitive aggressiveness. Moreover, by increasing their competitive aggressiveness, firms have a better chance of sustaining a significant market share (Ferrier, et al., 1999).

Action diversity exhibits a U-shaped relationship with respect to a company's performance. At a low level of action complexity, the TMT is able to make decisions

quickly and implement different types of competitive actions that improve performance (Ferrier, 2001). As the level of action diversity increases, the required complexity of decisions reduces the decision-making time and implementation speed, which lowers a company's performance. As the level of action diversity continues to increase, a company that is able to undertake many different types of actions may be able to suppress the competitors' capability of competing and responding quickly, thereby enhancing the company's performance.

For the market turnarounds, Hofer (1980) suggests that the firm should focus primarily on its existing line of product. It may focus on the line of product that it discontinued provided that these products can be introduced quickly and profitably. Hambrick and Schechter (1983) in accordance with selective product/market pruning strategy, suggest that firms should refocus upon those businesses which were profitable or in which they had a distinctive strength - core business. The strategies followed by successful companies in a shrinking defense industry are worth mentioning in this regard (Rayner, 1992). For example, industry giants reshaped themselves around the core businesses that worked for them in past downturns.

Hao (2004) found that during a market meltdown, diversity in the types of actions that a company undertakes lowers its sales per employee, change in sales, and return on assets. Therefore, the action diversity is found to perform differently in periods of growth and meltdown.

2.3 Basis for the analysis of company performance

The different criteria used in the empirical studies to measure the company performance are being depicted in the Table4. However, this research has followed the criteria used by Hao (2004) also listed in the table.

Table 4. Measures of performance

Research	Sample Data	Measures of company performance
Dess & Beard (1984)	52 manufacturing industries during 1968-1977	Growth in sales Growth in price-cost margin Growth in total employment Growth in value added Growth in number of establishments
Ferrier (2001)	16 industries during 1987-1993	Growth in gross sales in industry
Ferrier, Smith, & Grimm (1999)	41 industries during 1987-1993	Growth in gross sales in industry
Hao (2004)	36 Telecommunication equipment suppliers 2001-2003	Change in sales Return on assets Sales per employee
Keats & Hitt (1988)	Manufacturing industries during 1969-1973	Growth in industry net sales Growth in operating income in the dominant industry
Miller & Chen (1994); Miller & Chen (1996)	U.S. airline industry during 1979-1986	Growth in total industry volume (growth in total revenue passenger miles)
Rountree (2004)	Top 2 telecommunication interexchange carriers and 2 local exchange carriers during 1996-2002	Change in sales (market share gain and value migration)

2.4 Measures of market growth and downturn

Market growth and meltdown are measured using the chronology established by the National Bureau's Business Cycle Dating Committee. National Bureau of Economic Research identifies market growth as expansion and downturn as contraction.

- The peak in business activity marks the end of expansion in the market and start of recession. Recession is the period from a peak to a trough of the business activity. A recession begins just after the economy reaches a peak of activity and ends as the economy reaches its trough. Contraction follows with lower sales, income and employment losses.
- The trough of the business activity marks the end of recession and beginning of the market expansion. Expansion is a period from a trough to a peak. Between trough and peak, the economy is in an expansion. Expansion is the normal state of the economy. Growth results in more opportunities, better jobs, sales and profits.

2.5 Hao's research on one meltdown period

The objective of Hao's research was to examine the relationship between competitive aggressiveness and company performance during the period of meltdown. The research was based on Ferrier's competitive aggressiveness framework (Ferrier, 2001). Some relevant results of Hao (2004) research are as follows:

1. During periods of market meltdown, the greater the action diversity the lower a company's performance regardless of how it is measured. Action diversity was found to be the only dimension of responsive aggressiveness that affects all three measures of company performance - sales per employee, change in assets and return of assets.
2. Action diversity and action volume affect company performance more than asset disposal and headcount reduction.
3. Liquidity and to a lesser extent past performance affect competitive aggressiveness more than TMT diversity does.
4. TMT education diversity was found to affect asset disposal
5. A strong relationship between asset disposal and company performance was not established.
6. Traditional firm-level factors (TMT diversity, liquidity, and past performance) were found not to affect action diversity
7. When sales per employee and return on assets are used as the company performance measure, headcount reduction, action volume and action diversity affect company performance, and liquidity affects both headcount reduction and action volume. When return on assets is used as the performance measure, past performance also affects action volume and headcount reduction
8. When change in sales is used as the company performance measure, only action diversity affects company performance.
9. The relationship between firm-level factors and competitive aggressiveness may be different for market downturns than it is for growth periods.

2.6 Lessons learnt from the literature

A lesson can be thought of as a unit of instruction, a parable, or an identified gap, an area for further study. This review of the literature highlighted some significant research works on competitive aggressiveness, including the recent and most relevant study undertaken by Hao (2004), as well as turnaround and downturn studies. Also elaborated were the measures of market growth and the downturn. There are three primary lessons that emerge from the literature.

Competitive aggressiveness:

Some similarities and contradictions appear when the work of Hao (2004) is compared to research undertaken by Ferrier (2001). The two research works sometimes show no relationship between the variables they investigated. Ferrier (2001) investigated firm level factors, aggressiveness and company performance, while Hao (2004) looked at firm level factors, competitive aggressiveness and company performance for a specified period of meltdown in telecommunication industry.

- Hao (2004) found a negative relationship between the action diversity and performance, whereas Ferrier (2001) found that action diversity was positively related with company performance
- Hao (2004) found that high level of liquidity is negatively related to action volume whereas Ferrier (2001) suggests that liquidity is positively related to

action volume

- Hao (2004) found that good past performance is positively related to action volume while Ferrier (2001) found that that good past performance is negatively related to action volume

Turnaround and downturn strategies

- During market meltdowns, businesses retrench to focus on their core business
- The research on market downturn and turnaround strategies suggests that companies should focus primarily on their core business. For example, Hofer (1980) suggests that companies in turnaround strategies focus on their existing line of products
- Hambrick and Schechter (1983) suggest short-term strategies during business turnaround to be asset/cost surgery, selective product/market pruning, and piecemeal moves
- Rayner (1992) portrays some of the strategies followed by successful companies in shrinking defense industry where the industry giants reshaped themselves around the core businesses that have worked for them in past downturns

Measures of market growth and the downturn

Market growth and meltdown is measured using a chronology established by the National Bureau's Business Cycle Dating Committee.

- Market growth period is the period from a trough to a peak of the business cycle.
In the time between a trough and a peak the economy is expanding
- Market meltdown is period from a peak to a trough of the business cycle. Between peak and trough, the economy is in a contraction

3. RESEARCH MODEL AND HYPOTHESIS DEVELOPMENT

This chapter is organized into three sections. The first section describes the research model. The hypotheses are developed in the second section. The third section lists the hypotheses that are tested in this thesis.

3.1 Research model

Figure 1 illustrates the research model. This model posits that prolonged periods of economic growth or downturn (i.e., market meltdown) affect (1) the relationship between firm-level factors and competitive aggressiveness and (2) the relationship between competitive aggressiveness and company performance.

Figure 1. Research model

In addition, the research model in Figure 1 examines:

- Whether or not action volume and action diversity are related to each other in the same way during market growth and market downturn
- Whether action volume and action diversity for market growth are greater than the action volume and action diversity for market meltdown

The model shown in Figure 1 builds on the research on competitive aggressiveness reported by Ferrier (2001) and Hao (2004). Consistent with Ferrier (2001) and Hao (2004), the firm-level factors constrain and enable a company's competitive aggressiveness and high competitive aggressiveness increases company performance. The model shown in Figure 1, examines whether the two relationships studied by Ferrier (2001) and Hao (2004) are the same during periods of market growth and periods of market meltdown.

Figure 2 illustrates the specific firm-level factors, dimensions of competitive aggressiveness, and performance measures that will be examined. Three firm-level factors enable and constrain competitive aggressiveness: TMT diversity, liquidity, and past performance. They are shown on the left of the model in Figure 2.

Figure 2. Firm-level factors, dimensions of competitive aggressiveness, and performance measures used in the research model

Competitive aggressiveness refers to the intensity and diversity of the actions undertaken by a company (Hao, 2004). The middle section of Figure 2 includes the two dimensions of competitive aggressiveness used by Ferrier (2001) and Hao (2004): action volume and action diversity. To date, these two dimensions have been conceptualized as being independent from one another.

Consistent with Hao (2004), company performance is measured in three different ways: sales per employee, change in sales, and return on assets. This is illustrated on the right of the model in Figure 2.

Consistent with findings from Ferrier (2001) and Hao (2004), the three firm-level factors shown in Figure 2, affect action volume and not action diversity. A TMT is a firm level-

factor defined as the group of individuals above the vice president level who are not regional presidents (Ferrier, 2001; Michel & Hambrick, 1992; Murray, 1989). This research examines two types of TMT heterogeneity: tenure diversity and function diversity. It is predicted that TMT heterogeneity is positively related to action volume during periods of market growth and meltdown.

Liquidity is a measure of the firm's unabsorbed slack. Consistent with other studies (Ferrier, 2001; Hao, 2004; Smith, Grimm, & Gannon, 1992), liquidity is measured using the quick ratio, the ratio of current assets less inventory to current liabilities. It is predicted that liquidity will be positively related to volume during periods of market growth and negatively related during market meltdowns.

Past performance refers to the company's annual return on assets lagged one year (Ferrier, 2001; Hao, 2004). It is expected that past performance will be positively related to volume in periods of market growth and meltdown.

The model shown in Figure 2 predicts that action volume is positively related to company performance and that action diversity is negatively related to company performance. It also tests whether or not action volume and action diversity are in fact independent dimensions.

3.2 Hypothesis development

TMT heterogeneity reduces agreement-seeking behaviors, social cohesion and informal communication (Ferrier, 2001; Knight, et al., 1999) regardless of whether the market is growing or melting. Heterogeneous teams will experience more conflicts among their members as they vigorously and comprehensively debate various courses of action given their diverse cognitive and experiential backgrounds. During market growth and meltdown periods, TMT heterogeneity results in the company undertaking a greater number of competitive actions per unit of time for the purpose of resolving conflicts and experimenting. The agreement seeking behaviors, social cohesions and informal communications of homogeneous top management teams reduce the number of actions they need to undertake for experimentation and conflict resolution purposes. A homogeneous TMT undertakes actions that fall within the team's narrow field of vision and preferences. Therefore,

Hypothesis 1a

Top management team tenure diversity will be positively related to action volume during market growth and meltdown.

Hypothesis 1b

Top management team function diversity will be positively related to action volume during market growth and meltdown.

During market growth, liquidity increases a firm's ability to initiate and sustain competitive actions. The greater the company's liquidity the greater the number of actions the company can undertake (Ferrier, 2001; Young, et al., 1996).

During market meltdowns, companies with high liquidity undertake fewer competitive actions (Hao, 2004). Prospect theory holds that individuals use targets or reference points in evaluating choices and that an individual's behavior depends on whether they perceive themselves as above or below a reference point or target they choose. Their behavior will be risk taking when the individuals or organization find themselves below the reference point and risk avoiding when they are above (Fiegenbaum, et al., 1996). During market meltdowns, financial institutions and equity markets set clear guidelines for a company's liquid position. Going below this reference point increases the company's risk of insolvency or other risky outcomes for the company. Companies with high liquidity are above the minimum reference point and will not spend their resources to undertake a large number of actions and risk going below the reference point for liquidity. Companies with high liquidity will tend to conserve their position instead of decreasing it. Companies below the reference point for liquidity have no other choice but to undertake a number of actions searching for short term payoffs that will enhance their liquid position. Therefore,

Hypothesis 2

High levels of liquidity will be positively related to action volume during market growth and will be negatively related to action volume during market meltdown.

Hao (2004) found that, for the market meltdown she examined, good past performance was positively related to action volume. In contrast, Ferrier (2001) argued that good past performance reduces a company's motivation to compete aggressively and predicted that good past performance was negatively related to action volume. When Ferrier (2001) tested for the negative relationship between past performance and action volume he did not find one. It is surmised that companies with good past performance are better prepared and more motivated to undertake action relative to companies with poor past performance during both market growth and market meltdown. Therefore,

Hypothesis 3

Good past performance is positively related to action volume during market growth and meltdowns.

A company that undertakes a large number of competitive actions during market growth and meltdowns finds and exploits a greater number of opportunities (Ferrier, 2001; Hao, 2004). Therefore,

Hypothesis 4

Action volume is positively related to performance during both market growth and market meltdown.

During market growth, companies focus on a wider range of actions and experiment with a greater number of market opportunities outside of their core business. This increases the

diversity of actions that they undertake. However, the payoffs from some of these activities are expected in the mid-term and the long-term. Thus, it is unlikely that a linear or quadratic relationship exists between action diversity and performance during a period of market growth.

During a period of market meltdown, companies focus on those areas that are core to their businesses. Due to survival uncertainty, a company will cease to undertake activities that do not support the core of its businesses or pay off in the short term (Rayner, 1992). A company focuses on a narrow range of more effective actions. Hao (2004) found that during the market meltdown she examined a company's action diversity was negatively related to the company's sales per employee, change in sales, and return on assets. The greater the action diversity, the lower the likelihood of high performance over the short term. Therefore,

Hypothesis 5a

Action diversity is negatively related with performance during market meltdown but not related during market growth.

Hypothesis 5b

Performance will increase with action diversity at a decreasing rate during market meltdown and will not be related to action diversity during market growth.

To date researchers of competitive aggressiveness have conceptualized action volume and action diversity as being two independent dimensions. There are good reasons to question this assumption of independence. To reduce risk, a company that carries out a large number of actions, will have them distributed among a fewer number of action types. In contrast, a company that carries out a small number of action types may have them distributed over various action types. This will be true for both market growth and meltdown. It is difficult for a company, whether under growth or meltdown conditions, to carry out a high number of actions that are very different from each other in one action year. If a company undertakes a large number of actions, it is unlikely that they will be distributed equally across action types. Similarly, if a company undertakes action types that are very different from each other, it will not carry out a large number of actions. It is predicted that the higher the action volume, the lower the action diversity and that the higher the action diversity, the lower the action volume. Therefore,

Hypothesis 6

Action volume and action diversity are negatively related in periods of market growth and meltdown.

During a period of market meltdown, companies will undertake a fewer number of actions and a fewer number of action types relative to a period of market growth.

Therefore,

Hypothesis 7a

Action volume during market growth is greater than action volume during market meltdown.

Hypothesis 7b

Action diversity during market growth is greater than action diversity during market meltdown.

3.3 List of hypotheses developed

The hypotheses that were developed anchored around the model illustrated in Figures 1 and 2 are:

Hypothesis 1a

Top management team tenure diversity will be positively related to action volume during market growth and meltdown.

Hypothesis 1b

Top management team function diversity will be positively related to action volume during market growth and meltdown.

Hypothesis 2

High levels of liquidity will be positively related to action volume during market growth and will be negatively related to action volume during market meltdown.

Hypothesis 3

Good past performance is positively related to action volume during market growth and meltdown.

Hypothesis 4

Action volume is positively related to performance during both market growth and market meltdown.

Hypothesis 5a

Action diversity is negatively related with performance during market meltdown but not related during market growth.

Hypothesis 5b

Performance will increase with action diversity at a decreasing rate during market meltdown and will not be related to action diversity during market growth.

Hypothesis 6

Action volume and action diversity are negatively related in periods of market growth and meltdown.

Hypothesis 7a

Action volume during market growth is greater than action volume during market meltdown.

Hypothesis 7b

Action diversity during market growth is greater than action diversity during market meltdown.

4. RESEARCH METHOD

4.1 Unit of analysis

The unit of analysis is one action year of a telecommunications equipment supplier. An action year refers to the set of actions a company carries out to compete with rivals during one year (Ferrier, 2001).

4.2 Study period

The study period is from January 1998 to October 2003.

4.3 Sample selection

The sample is comprised of company action years drawn from telecommunications equipment suppliers. These suppliers are listed in the New York Stock Exchange (NYSE), sell equipment to public service providers and telecom carriers, and have financial data and new releases available for the January 1998 to October 2003 period.

The procedure used to select the sample was identical to the process used by Hao (2004).

Accordingly, the sample was selected using the following four steps:

1. Identified communication equipment suppliers in the directory maintained by the Yahoo Index (<http://finance.yahoo.com>). The companies in the directory include: equipment for public service providers and non-public service providers, communication test and measurement, components for communication equipment makers, software applications for communications, and customer premises equipment for communications.
2. Identified suppliers listed in the NYSE.
3. Identified suppliers selling directly to telecom carriers and public service providers.
4. Eliminated the companies for which financial data was not available.

4.4 Data collection

Data were collected from: (i) company filings with the United States Securities and Exchange Commission (SEC) that appear in company websites (ii) company websites, and (iii) announcements found using the search engine google.com and the search engine in the Factiva.com database.

Company data

Company data was obtained from the company's filings with the United States Securities and Exchange Commission (SEC).

The data collected from the SEC filings included:

1. Company's current assets, inventory, current liability, total assets.
2. Annual revenue, gross profit, and net income.
3. Number of employees.
4. Top Management Team tenure in the company.
5. Top Management Team functional background.

4.5 Identifying the growth and the meltdown periods

The study period, January 1998 to October 2003, was divided into two: growth and meltdown periods. Figure 3 shows the NASDAQ Telecommunication index. The index illustrates the crest used to split the overall sample into the growth and meltdown samples. The growth period is from 1998 to May 2000, and the meltdown period is from May 2000 to October 2003.

Figure 3. NASDAQ Telecommunications Index at Yahoo finance

4.6 Action events

Information on companies' action events was collected from the news releases in the websites maintained by companies and from the Factiva database (www.factiva.com).

Companies action events were classified using the following types:

1. Change in assets.
2. Change in headcounts, increase or decrease.
3. Changes in TMT and company's board of directors.
4. Alliances, mergers and funding new ventures.
5. Investment for core business.
6. Financing activities include raising capital, amending credit facilities, providing guarantees, share splitting/converse, increase in dividends.
7. Fighting law suites and SEC investigations.
8. Product and technology trials.
9. New product introduction and new features on existing products.

4.7 Variable measurements

Variables were organized into three types: (i) Firm-level, (ii) Competitive aggressiveness and (iii) Performance.

4.7a Firm-level

TMT Diversity

TMT is defined as the group of individuals above the vice president level who are not regional presidents (Ferrier, 2001; Michel & Hambrick, 1992; Murray, 1989).

TMT diversity is measured as: Company tenure diversity and Function diversity

Company tenure diversity was calculated as the standard deviation divided by the mean for the number of years the executives on the TMT had spent in the company (Ferrier, 2001; Wiersema & Bantel, 1992). The theoretical maximum value of company tenure diversity as per the formula is infinity and the minimum value is 0. High scores of the TMT tenure diversity indicate that TMT is diverse with respect to members' working years in the company.

Function diversity was measured as a variation of the Herfindahl-Hirschman index proposed by Blau (1977):

$$H = 1 - \sum_{i=1}^n (p_i)^2$$

Where H is the dominant function diversity measure and p is the percentage of TMT

members in each of the nine working experience background categories, n is 9 for the working categories. These categories include:

- Sales or marketing
- Operation/Field service
- Finance or accounting
- Engineering/R&D
- Personnel/HR
- General counsel/secretary
- Public relations
- General management and other

The maximum value of company function diversity is 1 and the minimum value is 0.

High scores of the function diversity indicate that TMT is comprised of members with different functional backgrounds.

Liquidity

The quick ratio was used to measure liquidity (Smith, et al., 1991). The formula for calculating the quick ratio used was:

$$\text{Quick Ratio} = \frac{\text{Current assets} - \text{Inventory}}{\text{Current liabilities within a fiscal year}}$$

Liquidity is lagged by one year (Hambrick, et al., 1996). Thus, the quick ratio to be used for time T is the value of the quick ratio at T-1.

Past performance

Consistent with Ferrier (2001) past performance was calculated as return on asset. Past performance is lagged by one year (Hambrick, et al., 1996). Thus, the past performance to be used for time T is the value of past performance at T-1:

$$\text{Return on asset (ROA)} = \frac{\text{Net income for past fiscal year}}{\text{Total Assets at the end of past fiscal year}}$$

4.7b Company competitive aggressiveness

Action volume

Action volume is the total number of competitive actions carried. This variable was calculated by taking sum of each of the following actions in one fiscal year.

1. Change in assets.
2. Change in headcounts, increase or decrease.
3. Changes in TMT and company's board of directors.
4. Alliances, mergers and funding new ventures.
5. Investment for core business.
6. Financing activities include raising capital, amending credit facilities, providing guarantees, share splitting/converse, increase in dividends.
7. Fighting law suites and SEC investigations.
8. Product and technology trials.
9. New product introduction and new features on existing products.

Action diversity

Action diversity measures the diversity to which a company carries out a range of different action types. The basis of this measure is Herfindahl index, which is commonly used to measure the level of diversification (Ferrier, 2001; Ferrier, et al., 1999). The formula for action diversity is:

$$H=1-\sum_{i=1}^n (N_i/T_i)^2$$

Where N_i/T_i is the proportion of competitive actions in the i th action type; n is 9 for nine action types.

The maximum value of H is 1 and the minimum value is 0. A high action diversity score means that the company carried out competitive actions that typically consist of a broad range of action types. A low score indicates that a company carried out competitive actions with just a few action types.

4.7c Company performance variables

Company performance will be measured in three ways: sales per employee, one-year percentage change in sales, and return on assets.

Sales per employee

Consistent with Hao (2004) sales per employee for an action year was calculated as:

$$\text{Sales per employee} = \frac{\text{Sales}}{\text{Number of employees}}$$

Change in sales

Following Boeker (1997), change in sales for an action year was calculated as:

$$\text{Change in sales} = \frac{\text{Sales in current year} - \text{Sales in previous year}}{\text{Sales in previous year}}$$

Return on assets

Following Young, et al., (1996), return on assets was calculated as

$$\text{Return on assets} = \frac{\text{Net operating profit after taxes}}{\text{Total assets}}$$

4.8 Analysis of the data

The data was analyzed using an eight-step process.

In the first step, scatter plots were used to search for outliers. An outlier is a data point

that emanates from a different model than do the rest of the data (Chambers, Cleveland, Kleiner & Tukey, 1983).

The second step consisted in calculating the descriptive statistics for all the variables in the research model and determining whether or not the variables were normally distributed. Descriptive statistics were calculated for the growth, meltdown and overall periods.

To determine whether or not a variable was normally distributed, its skewness and kurtosis statistics were examined. If the skewness is greater than twice the standard error and the kurtosis statistic was outside the -2 and $+2$ range, it was concluded that the variable was not normally distributed.

The third step was to measure the strength of the linear association between two variables for all the variables in the research model. If the variables were normally distributed, Pearson correlation coefficients will be used. If the variables are not normally distributed, Spearman correlation coefficients will be used. Both of these coefficients range in value from -1 to $+1$. Pearson correlation coefficients are calculated using the actual data values. The Spearman correlation coefficients replace the actual data with ranks.

Two tail tests with $p < 0.10$ are used to determine linear associations between variables.

The fourth stage consisted of calculating correlation coefficients for the three

performance variables and the correlation coefficients for the two variables of competitive aggressiveness and the three performance measures. Correlation coefficients, Pearson or Spearman, were calculated for the growth, meltdown and overall samples.

The fifth step was comprised of regressing each dimension of competitive aggressiveness against those firm-level factors that have no significant correlations between them. The ordinary least squares method was used.

The sixth step was comprised of regressing measures of performance against the measures of competitive aggressiveness.

The seventh step was to perform the regression for the quadratic fit for the relationship between aggressiveness and performance.

For the overall, growth and meltdown periods, the function regressed was:

$$\text{Performance} = b_0 + b_1 (\text{Action diversity}) + b_2 (\text{Action diversity})^2$$

$$\text{Performance} = b_0 + b_1 (\text{Action volume}) + b_2 (\text{Action volume})^2$$

where:

Performance = return on assets, change in sales or sales per employee

b_0 is a constant, b_1 and b_2 are the coefficients for the action volume and the action diversity variables.

The eighth step was the use Mann-Whitney U Test to examine whether or not the means

of the firm level factors dimensions of aggressiveness and performance variable in the growth and meltdown samples were different.

4.9 Testing hypotheses

Hypotheses 1a and 1b

To test hypotheses 1a and 1b, the writer used correlation analysis and regression analysis. This writer would first check if TMT team tenure diversity, TMT function diversity and action volume are normally distributed in the growth and meltdown samples. If normally distributed, Pearson correlation analysis would be used. If not normally distributed, Spearman correlation analysis would be used.

If one-tailed tests with $p = 0.05$ of the alternative hypothesis shows that the correlation coefficient for TMT tenure diversity and action volume is positive and significant for the growth and meltdown samples, hypothesis 1a is supported.

If one-tailed tests with $p = 0.05$ of the alternative hypothesis shows that the correlation coefficient for TMT function diversity and action volume is positive and significant for the growth and meltdown samples, hypothesis 1b is supported.

For the growth and meltdown samples, action volume was also regressed against firm level factors that were not correlated. If the regression coefficient for TMT tenure diversity was positive and significant in the growth and meltdown samples, hypothesis 1a

is supported. Similarly, if the regression coefficient for TMT function diversity was positive and significant in the growth and meltdown samples ($p < 0.05$), hypothesis 1b is supported.

Hypothesis 2

To test hypothesis 2, this writer would first check if liquidity and action volume are normally distributed in the growth and meltdown samples. If normally distributed, Pearson correlation analysis would be used. If not normally distributed, Spearman correlation analysis would be used.

If one-tailed tests with $p = 0.05$ of the alternative hypothesis shows that the correlation coefficient for liquidity and action volume is positive and significant for the growth and meltdown samples, hypothesis 2 is supported.

For the growth and meltdown samples, action volume was also regressed against firm level factors that were not correlated. If the regression coefficient for liquidity was positive and significant ($p < 0.05$) in the growth sample and negative and significant ($p < 0.05$) in the meltdown sample, hypothesis 2 is supported.

Hypothesis 3

To test hypothesis 3, this writer would first check if past performance and action volume are normally distributed in the growth and meltdown samples. If normally distributed, Pearson correlation analysis would be used. If not normally distributed, Spearman

correlation analysis would be used.

If one-tailed tests with $p = 0.05$ of the alternative hypothesis shows that the correlation coefficient for past performance and action volume is positive and significant for the growth sample and negative and significant for the meltdown sample, hypothesis 3 is supported.

For the growth and meltdown samples, action volume was also regressed against firm level factors that were not correlated. If the regression coefficient for past performance was positive and significant in the growth and meltdown samples, hypothesis 3 is supported.

Hypothesis 4

To test hypothesis 4, this writer would first check if action volume, return on assets, change in sales and sales per employee are normally distributed in the growth and meltdown samples. If normally distributed, Pearson correlation analysis would be used. If not normally distributed, Spearman correlation analysis would be used.

If one-tailed tests with $p = 0.05$ of the alternative hypothesis shows that the correlation coefficient for action volume and one or more of the three performance variables is positive and significant for the growth and meltdown samples, hypothesis 4 is supported.

Hypothesis 5a

To test hypothesis 5a, this writer would first check if action diversity, return on assets, change in sales and sales per employee are normally distributed in the growth and meltdown samples. If normally distributed, Pearson correlation analysis would be used. If not normally distributed, Spearman correlation analysis would be used.

If one-tailed test with $p = 0.05$ of the alternative hypothesis shows that the correlation coefficient for action diversity and a performance variable is negative and significant for the meltdown sample and not significant for the growth sample, hypothesis 5a is supported.

Hypothesis 5b

To test hypothesis 5b, the writer will use the ordinary least squares procedure to estimate the regression coefficients for the following model:

$$\text{Performance} = b_0 + b_1 (\text{Action diversity}) + b_2 (\text{Action diversity})^2$$

where:

Performance = return on assets, change in sales or sales per employee.

If with $p < 0.05$, the regression coefficient b_1 was positive and significant and the regression coefficient b_2 was negative and significant for the growth and meltdown samples, hypothesis 5b is supported.

Hypothesis 6

To test hypothesis 6, this writer would first check if action volume and action diversity are normally distributed in the growth and meltdown samples. If normally distributed, Pearson correlation analysis would be used. If not normally distributed, Spearman correlation analysis would be used.

If two-tailed tests with $p = 0.05$ of the alternative hypothesis shows that the correlation coefficient for action volume and action diversity is negative and significant for the growth and meltdown samples, hypothesis 6 is supported.

Hypothesis 7a

To test hypothesis 7a, this writer would first check if the action volume variables in the growth and meltdown samples are normally distributed. If normally distributed, a one-way ANOVA test (such as Duncan's multiple range test) would be used to compare action volume in the growth and meltdown samples. If not normally distributed, a Mann-Whitney U test will be used to compare action volume in the growth and meltdown samples.

For the one-way ANOVA, if the mean difference between the action volume in the growth and meltdown samples is significant at $p < 0.05$ or for the Mann-Whitney U test, if the mean rank difference is significant at $p < 0.05$, the writer can conclude that the action volume in the growth sample is significantly greater than the action volume for the meltdown sample at $p < 0.05$.

Hypothesis 7b

To test hypothesis 7b, this writer would first check if the action diversity variables in the growth and meltdown samples are normally distributed. If normally distributed, a one-way ANOVA test (such as Duncan's multiple range test) would be used to compare the means of action diversity in the growth and meltdown samples. If not normally distributed, a Mann-Whitney U test will be used to compare the mean ranks of action diversity in the growth and meltdown samples.

For the one-way ANOVA, if the mean difference between the action diversity in the growth and meltdown samples is significant at $p < 0.05$ or for the Mann-Whitney U test, if the mean rank difference is significant at $p < 0.05$, the writer can conclude that the action diversity in the growth sample is significantly greater than the action volume for the meltdown sample at $p < 0.05$.

5. RESULTS

5.1 Sample

The overall sample is comprised of 142 company years drawn from 33 suppliers of telecommunications equipment.

A total of 442 companies were identified in the Yahoo! Finance directory under the path of: Industries > Communications Equipment > Company Index. Of these 442 companies, 216 were public companies. Of the 216 public companies, 41 sold directly to service providers. Of the 41 companies that sold to service providers, eight of the companies had missing data. This left 33 companies from which to draw data on action years.

The overall sample was split into two, growth and meltdown. The growth sample was comprised of 77 action years and the meltdown sample of 63 action years.

The data for the sample was drawn from the companies identified in Table 5. Table 5 shows the number of action years each company in the sample contributed to the overall, growth and meltdown samples.

Table 5. Companies in sample, their fiscal years, and the number of years they contributed to the growth, meltdown and overall samples

	Company Name	Fiscal year	Number of fiscal years in overall sample	Number of fiscal years in growth sample	Number of fiscal years in meltdown sample
1	Advanced Fiber Communications, Inc.	Jan. 98 – Dec. 02	5	3	2
2	Alcatel		5	3	2
3	Nokia Corp.		5	3	2
4	Redback Networks Inc.		5	3	2
5	Tekelec		5	3	2
6	Telefonaktiebolaget LM Ericsson		5	3	2
7	Tellabs, Inc.		5	3	2
8	ADTRAN, Inc.		5	3	2
9	Copper Mountain Networks, Inc.		5	3	2
10	Foundry Networks, Inc.		5	3	2
11	NMS Communications Corp.	Jan. 98 – Dec. 00 Jan. 02 – Dec. 02	4	3	1
12	Westell Technologies, Inc.	Apr.98 – Mar. 03	5	3	2
13	Stratex Network, Inc.		5	3	2
14	Extreme Networks, Inc.	Jul. 98 – Jun. 03	5	3	2
15	Verlink Corp.		5	3	2
16	Globecom Systems Inc.		5	3	2
17	Cisco Systems, Inc.	Aug. 98 – July. 03	5	3	2
18	Lucent Technologies Inc.	Oct. 98 – Sep. 03	5	3	2
19	CIENA Corp.	Nov. 98 – Oct. 03	5	3	2
20	ADC Telecommunications, Inc.		5	3	2

21	AirNet Communications Corp.	Jan. 99 – Dec. 02	4	2	2
22	AirSpan Networks Inc.		4	2	2
23	ECI Telecom Ltd.		4	2	2
24	Juniper Networks, Inc.		4	2	2
25	Carrier Access Corp.		4	2	2
26	InterWAVE Communications International Ltd.	Jul. 99 – Jun. 03	4	2	2
27	Motorola, Inc.	Jan. 00 – Dec. 02	3	1	2
28	Nortel Networks Corp.		3	1	2
29	Sycamore Networks, Inc.	Aug. 99 – July. 03	4	2	2
30	Sorrento Networks Corp.	Feb. 00 – Jan. 03	3	1	2
31	Avici Systems Inc.	Jan. 01 – Dec. 02	2	0	2
32	CoSine Communication, Inc.		2	0	2
33	Sonus Networks, Inc.		2	0	2
	Total		142	77	65

5.2 Outliers and descriptive statistics

Scatter plots were used to search for outliers and explore the relationships between firm-level factors and dimension of aggressiveness as well as the relationships between dimensions of aggressiveness and measures of company performance. Two outliers were found in the meltdown sample. These outliers were found in the scatter plot for the relationship for action diversity and change in sales. Figures 4 and 5 show the scatter plot for this relationship with and without the two outliers.

Figure 4 shows the two outliers. The coordinates of the two outliers are (.809, 2.542) and (.396, 2.346).

The reason for the existence of the two outliers was examined. It was found that the reason for the outliers was low sales in the previous year. The two companies to which the outliers corresponded became public in the previous year and had low sales during that year. The next year sales picked up resulting in high growth in sales.

The two outliers were eliminated. They affected the results of the least square regressions examining the relationships between action diversity and the three performance measures.

Figure 4. Scatter plot for action diversity and change in sales for the meltdown period with outliers

Figure 5. Scatter plot for action diversity and change in sales for the meltdown period without outliers

Tables 6a, 6b and 6c show the descriptive statistics for the nine variables in the research model for the growth, meltdown and overall samples. The variables include four variables measuring three firm-level factors, TMT tenure diversity, TMT function diversity, liquidity and past performance; two dimensions of competitive aggressiveness, action volume and action diversity; and three performance measures, return on assets, change in sales, and sales per employee.

The descriptive statistics for the meltdown and overall samples excluded the two outliers.

Table 6a. Descriptive statistics for the variables in the research model: Growth sample

(Sample size = 77)

	Minimum	Maximum	Mean	Standard deviation	Skewness statistic (Std. error = .274)	Kurtosis statistic (Std. error = .541)
TMT tenure diversity	.161	2.236	.62871	.355987	2.296	8.528
TMT function diversity	.358	.840	.73179	.079554	-1.912	6.199
Liquidity	.638	14.029	3.61632	2.598111	1.677	3.605
Past performance	-1.289	.279	-.07957	.317723	-1.755	2.871
Action volume	4	545	90.00	109.365	2.487	6.560
Action diversity	.437	.820	.65627	.077630	-.464	.140
Return on assets	.005	.678	.31829	.86821	-.004	-1.150
Change in sales	-.347	190.792	5.17983	24.59658	6.643	46.540
Sales per employee	55.710	726.540	308.8886	155.2210	.767	.028

Table 6b. Descriptive statistics for the variables in the research model: Meltdown sample

(Sample size = 63)

	Minimum	Maximum	Mean	Standard deviation	Skewness statistic (Std. error=.302)	Kurtosis statistic (Std. error=.595)
TMT tenure diversity	.000	1.126	.56378	.281162	.250	-.591
TMT function diversity	.444	.840	.70281	.089089	-.830	.406
Liquidity	.598	8.790	3.33787	2.309845	.848	-.550
Past performance	-4.753	.238	-.41927	.808881	-3.557	15.527
Action volume	2	270	47.11	58.088	2.029	3.692
Action diversity	.404	.844	.68333	.100956	-.879	.218
Return on assets	-.444	.582	.17992	.188971	-.610	1.279
Change in sales	-.920	.619	-.22767	.288387	.535	1.353
Sales per employee	88.160	722.920	270.7605	136.1127	1.198	1.330

Table 6c. Descriptive statistics for the variables in the research model: Overall sample

(Sample size = 140)

	Minimum	Maximum	Mean	Standard deviation	Skewness statistic (Std. error=.205)	Kurtosis statistic (Std. error=.407)
TMT tenure diversity	.000	2.236	.59949	.324963	1.769	7.021
TMT function diversity	.358	.840	.71875	.084911	-1.327	2.513
Liquidity	.598	14.029	3.49102	2.467769	1.382	2.300
Past performance	-4.753	.279	-.23244	.613026	-4.326	25.970
Action volume	2	545	70.70	92.213	2.813	9.480
Action diversity	.404	.844	.66845	.089575	-.598	.063
Return on assets	-.444	.678	.25602	.199459	-.247	.272
Change in sales	-.920	190.792	2.74646	18.38786	8.983	85.601
Sales per employee	55.710	726.540	291.7309	147.6467	.942	.422

Examination of the skewness and kurtosis of the variables in Table 6a shows that action diversity and return on assets in the growth sample are normally distributed. Similarly, examining skewness and kurtosis of the variables in Table 6b shows that return on assets is normally distributed. For each of these variables, skewness is within two times the standard error of the skewness statistic and kurtosis is within -2 and $+2$. The other variables shown in Tables 6a and 6b are not normally distributed.

Various attempts were made to reduce the non-normality of the variables. These included transforms of the type $X: (X + C)^N$, where C is constant and N is a rational number (Garson, 2004). C was made equal to 5 and N was made equal to $1/2$, $1/3$ and $1/5$. After these attempts were made, it was decided to show the results using the original data.

5.3 Spearman correlation coefficients for firm level factors

For the market growth and meltdown samples, Tables 7a and 7b respectively provide the Spearman correlation coefficients for the firm-level factors in the research model.

Table 7a. Spearman correlations for the firm-level factors: Growth sample

(Sample size = 77)

	TMT tenure diversity	TMT function diversity	Liquidity	Past performance
TMT tenure diversity	1.00			
TMT function diversity	.255* (.025)	1.00		
Liquidity	-.143 (.214)	.056 (.4630)	1.00	
Past performance	.415** (.000)	.291* (.010)	.111 (.338)	1.00

*p < 0.05 (2 tailed)

**p < 0.01 (2 tailed)

For the variables in the growth sample, two tailed tests of the alternative hypothesis at $p < 0.05$ showed that (i) TMT tenure diversity is associated with past performance (ii) TMT function diversity is associated with past performance and (iii) TMT tenure diversity is associated with TMT function diversity (Table 7a).

Table 7b. Spearman correlations for the firm-level factors: Meltdown sample

(Sample size = 63)

	TMT tenure diversity	TMT function diversity	Liquidity	Past performance
TMT tenure diversity	1.00			
TMT function diversity	.195 (.126)	1.00		
Liquidity	-.224 (.078)	-.092 (.475)	1.00	
Past performance	.070 (.587)	.039 (.764)	.167 (.191)	1.00

*p < 0.05 (2 tailed)

**p < 0.01 (2 tailed)

Table 7 shows that two tailed tests of the alternative hypothesis at $p < 0.05$ showed no associations for the variables in the meltdown sample.

For the overall sample, Tables 7c provides the Spearman correlation coefficients for the firm-level factors in the research model.

Table 7c. Spearman correlations for the firm-level factors: Overall sample

(Sample size = 140)

	TMT tenure diversity	TMT function diversity	Liquidity	Past performance
TMT tenure diversity	1.00			
TMT function diversity	.240** (.004)	1.00		
Liquidity	-.177* (.036)	-.009 (.915)	1.00	
Past performance	.263** (.002)	.245** (.004)	.159 (.061)	1.00

*p < 0.05 (2 tailed)

**p < 0.01 (2 tailed)

Table 7c shows that two tailed tests of the alternative hypothesis at $p < 0.05$ resulted in the following associations:

- TMT tenure diversity is associated with TMT function diversity
- TMT tenure diversity is associated with Past performance
- TMT function diversity is associated with Past performance

Table 7c also shows that two tailed tests of the alternative hypothesis at $p < 0.05$ resulted in TMT tenure diversity being associated with liquidity.

Appendices C and D show the Spearman correlations for the firm level factors for the

meltdown and the overall periods when the two outliers are included. The writer observed no significant differences in the results when outliers were included in the meltdown and overall samples.

5.4 Spearman correlations for performance measures

Table 8 provides the Spearman correlation coefficients for the three performance measures for the growth, meltdown and overall samples.

Table 8. Spearman correlation coefficients for performance measures for each sample in the study

	Growth sample (N = 77)	Meltdown sample (N= 63)	Overall sample (N=140)
Return on assets and change in sales	.009 (.467)	.394** (.001)	.339** (.000)
Return on assets and sales per employee	.273** (.008)	.482** (.000)	.392** (.000)
Change in sales and sales per employee	.307** (.003)	.348** (.005)	.304** (.000)

*p < 0.05 (2 tailed)

**p < 0.01 (2 tailed)

Two tailed tests of the alternative hypothesis at $p < 0.05$ show that two relationships hold for the growth, meltdown and overall samples: (i) return on assets is associated with sales

per employee and (ii) change in sales is associated with sales per employee.

Two tailed tests of the alternative hypothesis at $p < 0.05$ show one additional relationship holds for the meltdown and overall samples: (i) return on assets is associated with change in sales.

Appendix E shows the Spearman correlations for the performance measures for after adding the two outliers. The writer observed no significant differences in the results when outliers were included in the meltdown and overall samples.

5.5 Firm level factors and dimensions of competitive aggressiveness

The first three hypotheses relate firm-level factors with two dimensions of competitive aggressiveness, action volume and action diversity. For the market growth and meltdown samples, Tables 9a and 9b provide the Spearman correlation coefficients for the firm-level factors and the two dimensions of competitive aggressiveness.

Table 9a. Spearman correlation coefficients relating firm-level factors and competitive aggressiveness: Growth sample

(Sample size = 77)

Firm-level factors	Competitive aggressiveness	
	Action volume	Action diversity
TMT tenure diversity	.267* (.019)	.076 (.510)
TMT function diversity	.053 (.646)	.119 (.304)
Liquidity	-.395** (.000)	-.034 (.768)
Past performance	.419** (.000)	-.071 (.538)

*p < 0.05 (1 tailed)

**p < 0.01 (1 tailed)

Table 9b. Spearman correlation coefficients relating firm-level factors and competitive aggressiveness: Downturn sample

(Sample size = 63)

Firm-level factors	Competitive aggressiveness	
	Action volume	Action diversity
TMT tenure diversity	.332** (.004)	-.063 (.312)
TMT function diversity	.241* (.028)	-.041 (.375)
Liquidity	-.468** (.000)	-.019 (.442)
Past performance	.260* (.020)	-.186 (.072)

*p < 0.05 (1 tailed)

**p < 0.01 (1 tailed)

For the growth and meltdown samples, one tailed tests of the alternate hypothesis at $p < 0.05$ show the following associations:

- TMT tenure diversity is positively related to action volume
- Liquidity is negatively related to action volume
- Past performance is positively related to action volume

For the meltdown sample, one tailed tests of the alternate hypothesis at $p < 0.05$ show that TMT function diversity is positively related to action volume.

Appendix F shows the Spearman correlation coefficients relating firm-level factors and competitive aggressiveness during the downturn period with the two outliers included in the sample. The writer observed no significant differences in the results when outliers were included in the meltdown and overall samples.

Competitive aggressiveness and company performance

Hypotheses 4 and 5 relate action volume and action diversity with company performance. For the market growth and meltdown samples, Tables 10a and 10b provide the Spearman correlation coefficients for the two dimensions of competitive aggressiveness and the three dimensions of company performance.

Table 10a. Spearman correlation coefficients competitive aggressiveness with company performance: Growth sample

(Sample size = 77)

Company performance	Competitive aggressiveness	
	Action volume	Action diversity
Return on assets	.365** (.001)	-.179 (.060)
Change in sales	-.208* (.035)	-.061 (.299)
Sales per employee	-.124 (.141)	-.044 (.351)

*p < 0.05 (1 tailed)

**p < 0.01 (1 tailed)

Table 10b. Spearman correlation coefficients competitive aggressiveness with company performance: Meltdown sample

(Sample size = 63)

Company performance	Competitive aggressiveness	
	Action volume	Action diversity
Return on assets	.403** (.001)	-.505** (.000)
Change in sales	.114 (.186)	-.353** (.002)
Sales per employee	.204 (.055)	-.388** (.001)

*p < 0.05 (1 tailed)

**p < 0.01 (1 tailed)

For both the growth and meltdown samples, one tailed tests of the alternative hypothesis at $p < 0.05$ show that action volume is positively related to return on assets.

For the growth sample, one tailed tests of the alternative hypothesis at $p < 0.05$ show that action volume is negatively related to change in sales.

For the meltdown sample, one tailed tests of the alternative hypothesis at $p < 0.05$ show the following associations:

- Action diversity is negatively related to return on assets
- Action diversity is negatively related to change in sales
- Action diversity is negatively related to sales per employee

Appendix G shows the Spearman correlation coefficients for competitive aggressiveness and company performance for the meltdown period after adding the two outliers. The writer observed no significant differences in the results when outliers were included in the meltdown sample.

5.6 Regressions with action volume as the dependent variable

Action volume was regressed against the firm level factors using ordinary least squares regression. Tables 11a to 11d show the results of the regressions for the growth and meltdown samples.

For the growth sample, Tables 11a, 11b and 11c show the results of regressing action volume against the firm level factors that have no significant correlations between them.

The following three regressions were performed:

- Action volume = $b_0 + b_1 \times \text{TMT tenure diversity} + b_2 \times \text{Liquidity}$ (Table 11a)
- Action volume = $b_0 + b_1 \times \text{TMT function diversity} + b_2 \times \text{Liquidity}$ (Table 11b)
- Action volume = $b_0 + b_1 \times \text{Liquidity} + b_2 \times \text{Past performance}$ (Table 11c)

Table 11a. Results of the regression with Action volume as the dependent variable and TMT tenure diversity and Liquidity as the independent variables: Growth sample

Explanatory Variables included	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R square	Std. error of the estimate
	B	Std. Error	Beta				
(Constant)	107.985	31.754		3.401	.001	.089	104.363
TMT tenure diversity	47.015	34.109	.134	1.202	.233		
Liquidity	-12.104	4.674	-.288**	-2.590	.012	F	Sig.
						4.730 **	.012

* p < 0.10

** p < 0.05

*** p < 0.01

Table 11b. Results of the regression with Action volume as the dependent variable and TMT function diversity and Liquidity as the independent variables: Growth sample

Explanatory Variables included	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R square	Std. error of the estimate
	B	Std. Error	Beta				
(Constant)	200.902	112.809		1.781	.079	.076	105.143
TMT function diversity	-87.114	151.604	-.063	-.575	.567		
Liquidity	-13.039	4.642	-.310***	-2.809	.006	F	Sig.
						4.113**	.020

* p < 0.10

** p < 0.05

*** p < 0.01

Table 11c. Results of the regression with Action volume as the dependent variable and Liquidity and Past Performance as the independent variables: Growth sample

Explanatory Variables included	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R square	Std. error of the estimate
	B	Std. Error	Beta				
(Constant)	153.030	20.097		7.615	.000	.179	99.100
Liquidity	-14.957	4.418	-.355***	-3.385	.001		
Past performance	112.364	36.130	.326***	3.110	.003	F	Sig.
						9.280***	.000

* p < 0.10

** p < 0.05

*** p < 0.01

For the meltdown sample, Tables 11c and 11d show the results of regressing action volume against the three firm-level factors. The following two regressions were performed:

- Action volume = $b_0 + b_1 \times \text{TMT tenure diversity} + b_2 \times \text{Liquidity} + b_3 \times \text{Past performance}$ (Table 11d)
- Action volume = $b_0 + b_1 \times \text{TMT function diversity} + b_2 \times \text{Liquidity} + b_3 \times \text{Past performance}$ (Table 11e)

Table 11d. Results of the regression with Action volume as the dependent variable and TMT tenure diversity, Liquidity and Past Performance as the independent variables: Meltdown sample

Explanatory Variables included	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R square	Std. error of the estimate
	B	Std. Error	Beta				
(Constant)	98.017	21.053		4.656	.000	.235	50.798
TMT tenure diversity	-.820	24.056	-.004	-.034	.973		
Liquidity	-12.364	2.969	-.492***	-4.165	.000	F	Sig.
Past performance	21.884	8.248	.305**	2.642	.011	7.357***	.000

* p < 0.10

** p < 0.05

*** p < 0.01

Table 11e. Results of the regression with Action volume as the dependent variable and TMT function diversity, Liquidity and Past Performance as the independent variables: Meltdown sample

Explanatory Variables included	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R square	Std. error of the estimate
	B	Std. Error	Beta				
(Constant)	33.021	52.536		.629	.532	.255	50.127
TMT function diversity	90.365	71.633	.139	1.262	.212		
Liquidity	-12.088	2.822	-.481***	-4.283	.000	F	Sig.
Past performance	21.634	8.041	.301**	2.691	.009	8.085***	.000

* p < 0.10

** p < 0.05

*** p < 0.01

Appendices H and I show the regressions shown in Tables 11d and Table 11e after adding the two outliers. The writer observed no significant differences in the results when outliers were included in the meltdown and overall samples.

5.7 Quadratic fit for performance variables

Hypothesis 5b posits that performance will increase with action diversity at a decreasing rate during market meltdown and will not be related to action diversity during market growth. Each performance measure was regressed against a quadratic form of action diversity. The function regressed was:

$$\text{Performance} = b_0 + b_1 (\text{Action diversity}) + b_2 (\text{Action diversity})^2$$

where:

Performance = return on assets, change in sales or sales per employee

Tables 12a and 12b provide the results of the regressions with the quadratic function for the growth and meltdown samples. The adjusted R squares of the regressions in Table 12a are very low. At $p < .01$, none of the F statistics shown for the growth sample in Table 12a are significant, while all the F statistics shown for the meltdown sample in Table 12b are significant.

Appendix J shows the results of regressing performance measures against the quadratic function of Action diversity after adding outliers to the meltdown sample. It was found

that the F statistics for all the three relationships of action diversity and measures of performance are significant. The quadratic and linear functions are significant only when performance is measured as change in sales. The direction of the coefficients of the linear and quadratic terms was opposite to those predicted. Without outliers the linear term is positive direction and the quadratic term is negative. After adding the two outliers the linear term is negative whereas the quadratic term is positive.

Table 12a. Results of regressing performance measure against the quadratic function of Action diversity: Growth sample

(Degrees of freedom = 74)

	Adjusted R square	F	Sig.	b1 Action diversity	b2 Action diversity²
Return on assets	.039	2.528*	.087	2.195 (.115)	-2.366 (.090)
Change in sales	.031	2.205	.117	-1.694 (.224)	1.496 (.282)
Sales per employee	.008	1.305	.277	-2.191 (.121)	2.139 (.130)

* p < 0.10

** p < 0.05

*** p < 0.01

Table 12b. Results of regressing performance measure against the quadratic function of Action diversity: Meltdown sample

(Degrees of freedom = 60)

	Adjusted R square	F	Sig.	b1 Action diversity	b2 Action diversity²
Return on assets	.22	9.807**	.002	2.173* (.0822)	-2.619** (.0373)
Change in sales	.098	4.373***	.017	-.584 (.660)	.228 (.863)
Sales per employee	.219	9.7***	.000	-1.413 (.255)	.93 (.452)

* p < 0.10

** p < 0.05

*** p < 0.01

5.8 Spearman correlations for action volume and action diversity

Hypothesis 6 posits that action volume and action diversity are negatively related without implying directionality. Table 13 provides the Spearman correlation coefficients for the two dimensions of competitive aggressiveness for the growth, meltdown and overall samples. Two tailed tests of the alternative hypothesis, $p < 0.05$, shows that action volume and action diversity are associated in the growth sample and overall samples, but not in the meltdown sample. Spearman correlation coefficient for action volume and action diversity in the meltdown sample shown in Table 13 is significant at $p < .10$.

For each sample in the study, Appendix K shows the Spearman correlation coefficients for action volume and action diversity after adding the two outliers. The writer observed no significant differences in the results when outliers were included in the meltdown sample.

Table 13. Spearman correlation coefficients for action volume and action diversity for each sample in the study

Growth sample (N = 77)	Meltdown sample (N= 63)	Overall sample (N=140)
-.281** (.013)	-.210* (.099)	-.298*** (.000)

* $p < 0.10$ (2 tailed)

** $p < 0.05$ (2 tailed)

*** $p < 0.01$ (2 tailed)

5.9 Mann-Whitney U test

Hypothesis 7a predicted that action volume for the market growth sample was greater than action volume for the market meltdown sample. Table 14a shows the results of using the Mann-Whitney U test to compare action volume in the growth and meltdown samples. The results indicate that the mean rank size of action volume in the growth sample is significantly greater than the mean size of action volume in the meltdown sample at $p < .01$.

Table 14a. Mann-Whitney U test comparing action volume between market growth and meltdown samples

	Sample	N	Mean rank	Sum of ranks
Action volume	Growth	77	82.93	6385.50
	Meltdown	63	55.31	3484.50
	Total	140		

Test Statistics

	Action volume
Mann-Whitney U	1468.500
Wilcoxon W	3484.500
Z	-4.009
Asymp. Sig. (2 tailed)	.000

Hypothesis 7b predicted that action diversity for the market growth sample was greater than action diversity for the market meltdown sample. Table 14b shows the results of using the Mann-Whitney U test to compare action diversity in the growth sample and the meltdown sample. The results indicate that the mean rank size of action diversity in the growth sample is smaller than the mean size of action diversity in the meltdown sample at $p < .05$.

Table 14b. Mann-Whitney U test comparing action diversity between market growth and meltdown samples

	Sample	N	Mean rank	Sum of ranks
Action diversity	Growth	77	63.18	4865.00
	Meltdown	63	79.44	5005.00
	Total	140		

Test Statistics

	Action volume
Mann-Whitney U	1862.000
Wilcoxon W	4865.000
Z	-2.360
Asymp. Sig. (2 tailed)	.018

Appendices L and M shows how the results in Table 14a and Table 14b change when the two outliers are included in the meltdown sample. The writer observed no significant

differences in the results when outliers were included in the meltdown sample.

6. SUMMARY AND DISCUSSION OF RESULTS

This section is organized into two parts. The first section summarizes the results of this research. In the second section, the results are discussed.

6.1 Summary of results

The objective of this research was to identify the differences in the relationship between firm-level factors and competitive aggressiveness and the relationship between competitive aggressiveness and firm performance during growth and meltdown periods.

The first three hypotheses examined the relationship between firm-level factors and action volume illustrated in Figure 2. Hypotheses 1a and 1b predicted that TMT tenure heterogeneity and TMT function heterogeneity were positively related to action volume. Overall, the results of the Spearman correlation analysis support this hypothesis set. As indicated in Tables 9a and 9b, the Spearman correlation coefficients for TMT tenure diversity and action volume were positive and significant for the growth (.267, $p < .05$) and meltdown (.332, $p < .05$) samples. Table 9b shows that the Spearman correlation coefficient for TMT function diversity and action volume was positive and significant for the meltdown sample (.241, $p < .05$) sample. The results of regressing action volume against firm-level factors do not support Hypotheses 1a and 1b. As indicated in Tables 11a and 11b the coefficients for TMT heterogeneity were not significant at $p < .05$. However, the Adjusted R squares of these two regressions are quite low (.089 and .076

respectively).

Hypothesis 2 predicted that liquidity is positively related to action volume, as reported by Ferrier (2001), during periods of growth and that it was negatively related to action volume, as reported by Hao (2004), during periods of market meltdown. This prediction was not supported. The results show that liquidity is negatively related to action volume for both market growth and meltdown. Tables 9a and 9b show that the Spearman correlation coefficients for liquidity and action volume are negative and significant for the growth ($-.395, p < .01$) and meltdown ($-.468, p < .01$) samples. Moreover, the regression coefficients for liquidity were negative and significant in Tables 11a ($-.288, p < .05$), 11b ($-.310, p < .01$), 11c ($-.355, p < .01$), 11d ($-.492, p < .01$) and 11e ($-.481, p < .01$).

Hypothesis 3 predicted that good past performance was positively related to action volume during market growth and meltdown. The results of both the Spearman correlation analysis and the regressions support this hypothesis. Tables 9a and 9b show that the Spearman correlation coefficients for past performance and action volume were positive and significant for the growth ($.419, p < .001$) and meltdown ($.260, p < .005$) samples. The results of regressing action volume against the three firm-level factors also support Hypothesis 3. The regression coefficients for past performance were positive and significant in Table 11c ($.326, p < .01$), 11d ($.305, p < .05$) and 11e ($.301, p < .05$).

Hypotheses 4 and 5 examine the relationship between competitive aggressiveness (i.e., action volume and action diversity) and company performance (i.e., return on assets,

change in sales, and sales per employee). Hypothesis 4 predicted that action volume was positively related to performance during market growth and meltdown conditions. The results of the Spearman correlation analysis provide support for Hypothesis 4 when return on assets is used to measure performance. The Spearman correlation coefficients for action volume and return on assets shown in Tables 10a and 10b are positive and significant for the growth (.365, $p < .01$) and meltdown (.403 $p < .01$) samples.

The results of the Spearman correlation analysis do not provide support for Hypothesis 4 when performance is measured as change in sales or sales per employee.

Hypothesis 5a predicted that action diversity was negatively related to performance during market meltdowns, but not related to performance during market growth. Results of the Spearman correlation analysis provide support for Hypothesis 5. Tables 10a and 10b provide the Spearman correlation coefficients for action diversity and the three performance measures for the growth and meltdown samples respectively. As indicated in Table 10a, action diversity is not correlated with any of the three performance measures and as shown in Table 10b, action diversity is negatively correlated with all three measures of performance at $p < .01$.

Hypothesis 5b predicted that during market meltdowns a quadratic function of action diversity is related to performance and that this relationship would not be present during periods of market growth. The results in Tables 12a support that there is no quadratic relationship between action diversity and performance during market growth. The

adjusted R squares are low and the F is not significant at $p < .05$. The results shown in Table 12b suggests that a quadratic relationship exists between action diversity and return on assets. The relationship is in the predicted direction, the coefficient for the linear term is 2.173 at significant at $p < .10$. and the coefficient for the quadratic term is -2.619 and significant at $p < .05$. For a function to increase at a decreasing rate a positive b_1 and a negative b_2 are required.

Hypothesis 6 predicted that action volume and action diversity are negatively related and not independent variables. Results in Table 13 lend support to Hypothesis 6. The Spearman correlation coefficients for action volume and action diversity shown in Table 13 are negative and significant for the growth (-.281, $p < .05$), meltdown (-.210, $p < .10$) and overall (-.298 $p < .01$) samples.

Hypotheses 7a and 7b predict that action volume and action diversity during market growth are greater than the action volume and action diversity in market meltdown. The Mann-Whitney results reported in Table 14a support Hypothesis 7a, action volume in the growth sample is greater than action volume in the meltdown sample.

The Mann-Whitney results reported in Table 14b do not support Hypothesis 7b. The results are contrary to those predicted. Action diversity in the market meltdown sample is greater than action diversity in the growth sample.

6.2 Discussion of results

Relating results to Ferrier's and Hao's findings

The results of this research suggest that three of Hao's (2004) findings apply to periods of market growth as well as market meltdowns:

- liquidity is negatively related to action volume
- past performance is positively related to action volume
- action volume is positively related to return on assets

The finding that action diversity is negatively related to performance in the meltdown sample is consistent with Hao's findings (Hao, 2004). The lack of relationship between action diversity and company performance in the growth sample is consistent with Ferrier's findings (Ferrier, 2001).

The results support Ferrier's finding that TMT heterogeneity is positively related with action volume and that a quadratic relationship links action diversity and company performance (Ferrier, 2001). The results do not support Ferrier's findings that liquidity is positively related to action volume.

6.3 Action volume and action diversity

The results of this research suggest that action volume and action diversity are negatively related in periods of market growth and meltdown. Previously, action volume and action diversity have been thought of as being two independent constructs. However the results of this research suggest that these two constructs are related. A company that carries out more actions will execute less action types and a company which carries out more action types, executes fewer actions.

The results suggest that action volume is greater during market growth than during market meltdown. This finding is in line with previous studies which posit that company and industry growth are positively related (Dess & Beard, 1984).

The results suggest that action diversity during market meltdown is greater than action diversity during market growth. This was an unexpected result that deserves further attention. The results may indicate that during market meltdowns some firms reduce the diversity of their actions much faster than others, and that those that reduce their action diversity more perform better.

6.4 Firm level factors and action volume

Results suggest that TMT tenure heterogeneity and TMT function heterogeneity are positively related to action volume. High TMT heterogeneity benefit from a high level of cognitive and experiential breadth. This increases their decision making ability and helps plan and execute complex and unpredictable attacks (Ferrier, 2001).

Good past performance is positively related to action volume during market growth and meltdown. Companies with good past performance are better prepared and more motivated to undertake action in comparison with companies with poor past performance during both market growth and market meltdown. The managers that experience failure often have more negative outcomes in the shape of reluctance to undertake a greater number of actions (Staw, 1976; Staw, et al., 1981; Brockner, 1992).

7. CONCLUSIONS, LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

7.1 Conclusions

The results support four conclusions. First, the relationship between firm-level factors and action volume during market growth is similar to that during market meltdown. For market growth and meltdown, TMT diversity and past performance are positively related to action volume, while liquidity is negatively related to action volume.

Second, the relationship between action diversity and company performance during market growth is different to that during market meltdown. Action diversity is not related to performance during market growth, however, action diversity is negatively related to performance during market meltdown. A quadratic relationship exists between action diversity and company performance during the market meltdown. However, this relationship does not exist during market growth.

Third, there is a negative relationship between action volume and action diversity. The companies that take more actions carry out fewer action types, whereas companies that take more action types try to keep the volume of actions they undertake low.

Fourth, action diversity during market meltdown is greater than action diversity during market growth.

7.2 Limitations

The first limitation is that the sample includes companies in one industry, telecommunications. It is difficult to generalize the results to industries with competitive dynamics different to that of the telecommunications industry.

The results would be stronger if multiple periods of growth and meltdown could have been studied. This was not possible due to the lack of data prior to 1996.

7.3 Suggestions for future research

Researchers can use the research model shown in Figures 1 and 2 to examine the firm level factors-competitive aggressiveness-company performance relationships in industries other than that comprised of telecommunication equipment suppliers.

Secondly, researchers can examine the causes for the increase in action diversity during meltdown periods relative to growth periods.

LIST OF APPENDICIES

Appendix A. Descriptive statistics for the variables in the research model: Meltdown sample (After adding outliers)

(Sample size = 65)

	Minimum	Maximum	Mean	Standard deviation	Skewness statistic (Std. error=.297)	Kurtosis statistic (Std. error=.586)
TMT tenure diversity	.000	1.126	.56103	.277450	.279	-.526
TMT function diversity	.444	.840	.70378	.087902	-.868	.520
Liquidity	.598	8.790	3.40994	2.338692	.804	-.649
Past performance	-4.753	.238	-.41463	.796577	-3.622	16.124
Action volume	2	270	46.43	57.302	2.080	3.938
Action diversity	.396	.844	.68085	.106790	-.935	.289
Return on assets	-.444	.582	.18258	.192203	-.521	1.075
Change in sales	-.920	2.542	-.14546	.545033	3.419	14.824
Sales per employee	88.160	722.920	269.7254	134.4483	1.222	1.443

Appendix B. Descriptive statistics for the variables in the research model: Overall sample (After adding outliers)

(Sample size = 142)

	Minimum	Maximum	Mean	Standard deviation	Skewness statistic (Std. error=.203)	Kurtosis statistic (Std. error=.404)
TMT tenure diversity	.000	2.236	.59773	.323098	1.789	7.146
TMT function diversity	.358	.840	.71897	.084348	-1.342	2.594
Liquidity	.598	14.029	3.52185	2.476216	1.347	2.145
Past performance	-4.753	.279	-.23294	.608679	-4.353	26.353
Action volume	2	545	70.06	91.716	2.838	9.648
Action diversity	.396	.844	.66752	.092604	-.661	.200
Return on assets	-.444	.678	.25617	.200458	-.238	.202
Change in sales	-.920	190.792	2.74220	18.25702	9.046	86.830
Sales per employee	55.710	726.540	290.9618	146.8839	.956	.466

Appendix C. Spearman correlations for the firm-level factors: Meltdown sample

(After adding outliers)

(Sample size = 65)

	TMT tenure diversity	TMT function diversity	Liquidity	Past performance
TMT tenure diversity	1.00			
TMT function diversity	.199 (.112)	1.00		
Liquidity	-.224 (.073)	-.075 (.551)	1.00	
Past performance	.071 (.576)	.041 (.747)	.154 (.220)	1.00

*p < 0.05 (2 tailed)

**p < 0.01 (2 tailed)

Appendix D. Spearman correlations for the firm-level factors: Overall sample.

(After adding outliers)

(Sample size = 142)

	TMT tenure diversity	TMT function diversity	Liquidity	Past performance
TMT tenure diversity	1.00			
TMT function diversity	.242** (.000)	1.00		
Liquidity	-.178* (.034)	-.005 (.949)	1.00	
Past performance	.265** (.001)	.245** (.003)	.148 (.080)	1.00

*p < 0.05 (2 tailed)

**p < 0.01 (2 tailed)

Appendix E. Spearman correlation coefficients for performance measures for each sample in the study. (After adding outliers)

	Growth sample (N = 77)	Meltdown sample (N= 65)	Overall sample (N=142)
Return on assets and change in sales	.009 (.467)	.375** (.002)	.327** (.000)
Return on assets and sales per employee	.273** (.008)	.493** (.000)	.399** (.000)
Change in sales and sales per employee	.307** (.003)	.329** (.007)	.292** (.000)

*p < 0.05 (2 tailed)

**p < 0.01 (2 tailed)

Appendix F. Spearman correlation coefficients relating firm-level factors and competitive aggressiveness: Downturn sample. (After adding outliers)

(Sample size = 65)

Firm-level factors	Competitive aggressiveness	
	Action volume	Action diversity
TMT tenure diversity	.333** (.003)	-.052 (.340)
TMT function diversity	.243* (.026)	-.022 (.431)
Liquidity	-.454** (.000)	.008 (.475)
Past performance	.261* (.018)	-.183 (.072)

*p < 0.05 (1 tailed)

**p < 0.01 (1 tailed)

**Appendix G. Spearman correlation coefficients competitive aggressiveness with
company performance: Meltdown sample. (After adding outliers)**

(Sample size = 65)

Company performance	Competitive aggressiveness	
	Action volume	Action diversity
Return on assets	.392** (.001)	-.539** (.000)
Change in sales	.118 (.175)	-.328** (.004)
Sales per employee	.199 (.056)	-.404** (.000)

*p < 0.05 (1 tailed)

**p < 0.01 (1 tailed)

Appendix H. Results of the regression with Action volume as the dependent variable and TMT tenure diversity, Liquidity and Past Performance as the independent variables: Meltdown sample. (After adding outliers)

Explanatory Variables included	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R square	Std. error of the estimate
	B	Std. Error	Beta				
(Constant)	95.776	20.537		4.664	.000	.234	50.158
TMT tenure diversity	.689	23.647	.003	.029	.977		
Liquidity	-11.959	2.845	-.488***	-4.204	.000	F	Sig.
Past performance	21.590	8.168	.300**	2.643	.010	7.510***	.000

* p < 0.10

** p < 0.05

*** p < 0.01

Appendix I. Results of the regression with Action volume as the dependent variable and TMT function diversity, Liquidity and Past Performance as the independent variables: Meltdown sample. (After adding outliers)

Explanatory Variables included	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Adjusted R square	Std. error of the estimate
	B	Std. Error	Beta				
(Constant)	30.665	51.543		.595	.554	.255	49.468
TMT function diversity	92.204	70.442	.141	1.309	.195		
Liquidity	-11.799	2.704	-.482***	-4.363	.000	F	Sig.
Past performance	21.448	7.930	.298***	2.705	.009	8.292***	.000

* p < 0.10
 ** p < 0.05
 *** p < 0.01

Appendix J. Results of regressing performance measure against the quadratic function of Action diversity: Meltdown sample. (After adding outliers)

(Degrees of freedom = 62)

	Adjusted R square	F	Sig.	b1 Action diversity	b2 Action diversity²
Return on assets	.244	11.347***	.000	1.405 (.216)	-1.688 (.096)
Change in sales	.159	7.065***	.002	-3.698*** (.003)	3.440*** (.005)
Sales per employee	.196	8.819***	.000	-.587 (.615)	.117 (.920)

* p < 0.10
 ** p < 0.05
 *** p < 0.01

Appendix K. Spearman correlation coefficients for action volume and action diversity for each sample in the study. (After adding outliers)

Growth sample (N = 77)	Meltdown sample (N= 65)	Overall sample (N=142)
-.281*	-.203	-.293**
(.013)	(.105)	(.000)

*p < 0.05 (2 tailed)

**p < 0.01 (2 tailed)

Appendix L. Mann-Whitney U test comparing action volume between market growth and meltdown samples. (After adding outliers)

	Sample	N	Mean rank	Sum of ranks
Action volume	Growth	77	84.44	6501.50
	Meltdown	65	56.18	3651.50
	Total	142		

Test Statistics

	Action volume
Mann-Whitney U	1506.500
Wilcoxon W	3651.500
Z	-4.079
Asymp. Sig. (2 tailed)	.000

Appendix M. Mann-Whitney U test comparing action diversity between market growth and meltdown samples. (After adding outliers)

	Sample	N	Mean rank	Sum of ranks
Action diversity	Growth	77	64.19	4943.00
	Meltdown	65	80.15	5210.00
	Total	142		

Test Statistics

	Action volume
Mann-Whitney U	1940.000
Wilcoxon W	4943.000
Z	-2.303
Asymp. Sig. (2 tailed)	.021

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