Network Externalities and Internationalization:

A Four Forces Model of Internationalization for Firms Operating in Network Externality Environments

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To Casey, Becky, Mom & Dad

For their love and support

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Chapter 1

Introduction

The global economy continues to evolve into a high-density, inter-networked environment. With increasing interactions enabled by the Internet and digital communication platforms, products, firms and industries have to evolve their form and function to adapt for survival. Business network relationships are becoming increasingly important in the internationalization decision process. Inter-networking technology is changing the way firms view the international business landscape. The economics of inter-networking must be considered in effective internationalization decision making. This research endeavors to examine empirically how and why economic, relationship and technology forces uniquely associated with an network externality environment shape the internationalization behavior of high technology firms operating in network externality environments. Firms operating in network externality oriented markets face economic, technology and relationship forces that differ significantly from those firms operating in traditional non-externality environments. In addition, many of the firms operating in this type of environment are in developing high technology industries like computer peripheral equipment, pre-packaged software and related computer devices. According to Ward's business directory, these firms currently represent over $500 billion US dollars in gross sales and are fueling the global communication technology revolution.

Most current internationalization literature, theory and empirical work are based on firms operating in traditional non-externality environments. Much of the classical foreign direct investment and internationalization theory has centered on an economic theory paradigm

(Dunning 1976, Kindelberger 1969, Knickerbocker 1974, Magee 1977). Stages and process models of internationalization have relied on transaction cost principles related to international manufacturing environments. More recent internationalization theory from the networking relationship school has begun to acknowledge the importance of using an organizational behavior paradigm to help explain the complexity of the internationalization phenomena. To adequately address the internationalization of high technology firms, Coviello and McAuley (1999) suggest that a combination of paradigms be used. In my theoretical framework that follows, I use a combination of economic theory, organizational theory and network theory to explain causal relationships driving the internationalization decision strategy of high technology firms operating in network externality environments.

I present a causal model- The Four Forces Model of Internationalization for Firms Operating in Network Externality Environments- identifying causal relationships with the forces affecting firm internationalization and the associated predicted outcomes. It is suggested that these forces are unique in combination to firms operating within network externality environments and that they conspire to shape internationalization decision making and resulting outcomes. The implications for firm internationalization strategy are discussed. From this model evolved my key propositions for empirical testing.

In order to develop an empirically based explanatory dissertation with relevant causal relationships regarding the internationalization of firms operating in industries that exhibit network externalities, I will use a multiple case study research strategy. As

articulated by Yin (1994) this approach is good for complex organizational phenomena, of which firm internationalization has been described and for addressing "how" and "why" types of research questions. In order to avoid a less than rigorous contribution to theory, the multiple case study methodology that I employ is of an explanatory nature seeking to identify and confirm causal relationships among the key variables in the internationalization of these firms.

I use an experimental approach to test my theoretical framework with each case decision. By seeking non-random patterns using a pattern matching design combined with a quantitative analysis technique known as Degrees-of-Freedom analysis, I am able to collect rich qualitative data and test my model predictions empirically and quantitatively against the observed outcomes. By statistically comparing the observed and predicted patterns, I am able to determine the level of support for my model predictions and research propositions.

I. Research Problem

At the beginning of a new millennia, the world faces an ever more complex and chaotic global economic system full of challenges and opportunities. As with many natural phenomena, elegant, linear neoclassical theoretical constructs struggle to describe, model and accurately predict player interaction, market dynamics and outcome equilibrium. As natural international economic systems evolve, new approaches must be created that accurately reflect the introduction of information and networking technology into the system. The resulting effects on firm, industry and market structure and strategy can be profound. From a Darwinian perspective, new species of firms are evolving to capitalize on the new economic opportunities created by global inter-networking. What once was a world of bricks and mortar dominated by firms that controlled physical assets and managed these assets in economically productive ways, has begun to give way to new forms of international organizations that use information assets to achieve market creation and fulfillment. The new power wielded by these digitally oriented networked businesses is strategically changing the way the game is played in many industries. It is fundamentally changing the game in how firms operate in domestic and international markets. It is pioneering a new frontier in how value is created, delivered and captured.

In an international context, networks are enabling entrepreneurial technology oriented firms to compete against market incumbents. International network relationships in

particular are now facilitated by the emergence of inter-networking technologies. With this increased interconnectedness, technology oriented firms are finding new opportunities and resources for international market development that were at one time only available to large multinational enterprises. It appears that through information technology and international network relationships, firms have access to new internationalization opportunities, yet also face new types of forces.

One environment that is of particular interest is a high technology firm operating in network externality environments or industry. These firms exhibit significant technology and business network relationships. In fact, it is my supposition, that there are economic, technology and relationship forces unique to externality environments that will shape firm internationalization decision behavior. I suggest that these forces are not properly represented in current literature and theoretical models as they tend to focus on traditional manufacturing firms operating in non-externality environments. Rather, it may be that the characteristics of network relationships, network externality economics, international technology standards and current internationalization levels, are what shape the patterns of internationalization for firms operating in network externality environments. It is the purpose of this research to present an internationalization causal model which will establish propositions that will be empirically tested.

It is endeavored that the research will result in a clearer understanding of the role of economic, relationship and technology forces on the internationalization process of firms operating in network externality environments. Through the development and

subsequent empirical test of this model, I endeavor to help firms operating in these unique market conditions to maximize their international business opportunities.

II. Research Question

It is the purpose of this study to determine how and why economic, relationship and technology forces uniquely associated with network externality environment shape the internationalization decision behavior of high technology firms operating in these environments.

Chapter II

Literature Review

Definitions

Internationalization: As defined by Beamish (1990) is "the process by which firms both increase their awareness of the direct and indirect influences of international transactions on their future, and establish and conduct transactions with other countries".

Network Externality Environment: A network externality or network effect exists if the utility that a user derives from the consumption of a good increases (or decreases) with the number of other agents consuming the good. (Katz & Shapiro, 1985).

Networked firm: Firms operating in this environment that are subject to receive direct and indirect network externalities. (Chako 1998)

Literature Review

2.1 Network Theory of Internationalization

Internationalization theory and research may be categorized into three distinct schools of thought. The economic school comprised of foreign direct investment (FDI) theory, the behavioral school supported by "stages" theory and the relationship school, which derives from network theory. (Coviello and McAuley 1999). The Network theory framework suggests a system of relationships were strategic action is not completely dependent on a single firm and the established market relationships with other firms significantly influence strategic options. It is felt the network theory framework helps to capture the nonlinear nature of high technology internationalization.

Under conventional economic theory that uses a transaction cost paradigm, firms seek to exploit firm specific advantages in international markets. Models such as Dunnings' Eclectic theory suggest a firm will internalize market transactions when transaction costs are high via FDI and locate assets according to location advantages that maximize the value of firm specific assets (Dunning 1981).

Network theory offers a different view. Rather, it assumes the firm seeks access of external resources in order to augment or make up for deficiencies in firm resources (Chen and Chen, 1998). Two important areas of network theory include strategic linkage theory and the network approach. Strategic linkage theory (Nohria and Garcia-Pont, 1991) suggests that firms access certain strategic aptitudes by connecting to firms with

complementary capabilities. This interconnectedness in turn creates a new competitive orientation for the firms involved in the alliances. According to Chen and Chen (1998), "The purpose of strategic linkages through FDI is to tap into strategic resources in a foreign market, such as market intelligence, technological know-how, management expertise, or simply reputation for being established in a prestigious market. Strategic linkages as such enable investors to gain economies of scale and scope, to improve the efficiency of operations, to reduce the vulnerability to market fluctuations, and most of all, to pave the way for further growth in the future".

The network approach utilizes a more comprehensive scope. Here the entire constellation of firm relationships creates a web of interactions wereby all firms are involved in market activity fulfillment (Axelsson and Easton 1992). In the case of a FDI, this web links to a foreign web to gain access to their resources such as technology, capital, labor, market opportunities etc. The boundaries of this international engagement may be beyond the single firm, and be initiated by other web network members. Single firms' ability to catalyze resources within this network will determine its relative position in this network and dictate its internationalization process (Johanson and Mattsson, 1987). As a result, the configuration of the network and the resources contained within the network will combine with the firm specific internal resources to dictate the internationalization behavior of the firm (Chen and Chen 1998).

The Swedish school network model identifies the key participants in a network as actors, activities and resources. Actors may range from individuals to firms to groups of companies. These actors control their respective resources and seek to exert influence on the network. Each actor performs activities for which it has specific knowledge and develops relationships with other actors creating a mutually dependent interaction. (Johnsen and Johnsen 1999). As a result, each actor is woven into the fabric of the network in a way that allows it to utilize other actors' resources. In fact, its proprietary resources and activities define an actor's identity within the network. This leads to implications for firm strategy.

The Swedish School model provides identification and classification of mutual dependence relationships in a business network. The classifying principles for the Swedish School network relationship theory include 1) Structural relationships 2) Economic relationships 3) Social relationships. These define three primary layers in business networks. Within each of these three dimensions there are different relational concepts.

Concepts relating to the structural dimension include activity links that are activities which partners perform and how they are inter-linked and interdependent. Resource ties relate how partners are connected from a resource perspective. Connections relate how interconnections are made within the business network. Institutional bonds relate relationships within the network to institutional actors.

Concepts relating to the economic dimension include investments and economic bonds. These are investments made by partners and may be monetary, trust, commitment, technological or market oriented. They are generally related to creating value and for mutually beneficial profit gains. They are typically difficult to measure.

Concepts relating to the social dimension include the interactions of people within the firms and networks. They include commitment, trust, atmosphere, attraction and social bonds and describe how interpersonal behavior and perceptions play out in the business network relationship. It is noted that all three dimensions and the relational concepts contained within each are interrelated via communication processes. This communication process enables the evolution of the network over time. (Holmlund and Tornroos, 1997)

As firms join networks for internationalization purposes, strategic shifts may occur. According to McKiernan (1992) firms may shift their strategic objective of the firm's business to maintaining their network involvement and position. It is suggested that a firm shifts the focus of its competitive advantage from itself to that of the network resulting in a reduction of company specific advantages and an emphasis on the network's advantages (Mckiernan, 1992). This migration of competitive advantage from the firm to the network has ramifications for the structure of internationalization networks and the resource liability required of the participating actors.

It has been shown in previous research that small, high technology oriented firms do not follow a linear, staged approach to internationalization (Coviello and Munro 1995).

Rather, it has been shown that small, high technology oriented firms often engage in relationships with other firms to achieve access to necessary internationalization resources. The relationships allow a small firm to minimize some of the internationalization risks associated with entering new markets (Johnsen and Johnsen 1999).

A key issue in the small firm internationalization literature related to network theory discussions surround the focus of many research studies on the export side of firm activities and the resulting conclusions drawn regarding internationalization behavior. Most export studies examine the downstream value chain activities such as marketing and distribution functions in the internationalization process. This leaves out many other international activities that may reside in other value chain activities such as supplier importing, R&D, production etc. Other researchers have suggested that a more holistic view of firm internationalization activities is more appropriate in examining the internationalization phenomena. (Loustarinen 1980, 1994 and Jones 1999)

Networks may dictate the path of business partners in a network structure. This may present a "double edge sword" effect. The path (markets chosen to enter, or method of entry) may be dictated by more powerful firms in the network. This can lead to a firm's internationalization strategy being in potential conflict with other firm objectives. (Chen/Chen 1998)

2.2 Network externalities and economic implications

Firms operating in network externality environments may face economic systems that exhibit positive feedback mechanisms and increasing returns. Traditional internationalization theories (neoclassical, PLC and Eclectic) operate in traditional diminishing returns economics based on negative feedback, diminishing returns and resource based industries. Given these differences in economic characteristics and resulting forces on the firm, internationalization may be driven by different reasons, different causes and with different patterns. A specific example would be to examine location advantage as a key internationalization driver under a traditional resource based view in the context of industry agglomeration. Traditional location drivers under Ownership, Location and Internalization theory (OLI) such as lower transaction costs, may have been the primary driver for the Multinational Enterprise (MNE) internationalization behavior pattern. But under the network externality forces framework, more random events, related to evolutionary issues of a critical technology i.e. path dependency, lock-in, etc. may drive the internationalization process of a firm.

There are several unique economic characteristics that can result from complex adaptive systems that have profound implications on firm strategy within networked markets. Under traditional industrial economies that were dominated by oligopoly market structures, economies of scale was the key driver that shaped much of the firm's strategy and influenced significant parts of internationalization theory. In a virtual market environment were information goods, digital infrastructure and networks dominate, the economics of networks is key. Within this context are several unique economic

principles. First, networks. Shapiro and Varian (1999) distinguish between "real"(direct) and "virtual"(indirect) networks. Real networks are those that exist in the physical world such as airline, telephone and railroads as well as high-tech networks such as fax, email, compatible modems, ATM's and the internet. On the other hand, virtual networks may be the networks of Macintosh users, CD machines, Nintendo users, Linux developers etc. While real networks have physical linkages between nodes, virtual networks have invisible links. "The value of connecting to a network depends on the number of other people already connected to it". (Shapiro and Varian 1999) They go on to note that this value proposition is often referred to as network effects, network externalities and demand-side economies of scale.

Although the networks and their corresponding externality effects are generally associated with high technology environments, they have and do exist in more traditional industrial environments as was previously noted. In both transportation and communication, firms compete to expand their networks to provide increasing coverage, which leads to increasing value. This is true of high tech businesses and technology adoption growth itself. This suggests that bigger is better and networks need to grow. One phenomenon that helps to achieve such growth is positive feedback wereby success breeds success, and failure breeds failure.

In examining the positive feedback dynamic, a technology adoption paradigm is helpful. In a traditional resource based, diminishing returns economic environment, two firms competing each maintain market share and one competitive action is met with an

offsetting competitive response with the system achieving a single market equilibrium point. This would be properly characterized as a negative feedback system. In a network market environment that exhibits positive feedback characteristics and network externalities, the competition between two firms or technologies can experience very different dynamic interaction and outcomes. According to Shapiro and Varian (1999) "positive feedback in the marketplace leads to extremes: dominance of the market by a single firm or technology". This market tendency toward monopoly results from a "tippy" market wereby some small events can have give one firm or technology a slight market share advantage which tips the market in that firm's favor. Assuming strong positive feedback dynamics, that firm (or technology) will gain greater momentum (of say standard adoption or sales) and through increasing value created by network effects, will attract at a greater rate new-comers to the system. This self reinforcing behavior of the system creates growth for the firm or technology that is enjoying the positive feedback effects, but creates declining market share, adoption and returns for the one that is being left behind. Larger networks enjoy increasing value while smaller networks suffer from the lack of positive feedback. The process accelerates until the dominant player (largest, greater value network) achieves monopoly position.

Other important economic characteristics of networked markets that exhibit significant positive feedback forces include predictable patterns, demand side economies of scale, network externalities and collective switching costs. Although outcomes may not be predictable early on in a positive feedback system, these systems tend to exhibit a consistent pattern: the "S" shaped curve. Modis (1998) has examined technology

replacement processes (IBM+DEC verses Microsoft+Intel for example) and found that technology adoptions and replacement follow a logistic "S" curve pattern. This pattern is commonly present in natural systems from rabbit reproduction to technology diffusion models. The sigmoid curve represents 3 distinct phases of development: introduction phase were the technology is slowly adopted into the market space. As it begins to achieve critical mass, it moves into the high growth phase, which is exponential in terms of rate of growth. This is the period most exhibiting positive feedback. The third phase includes a saturation mode were growth rates decline and size reaches its natural limits. It should be noted that each system is different and the relevant time lines associated with each one vary dramatically. As a result, some technologies may take decades to replace others or some may take much shorter periods of time. (Modis 1998)

Traditional manufacturing economics focuses on supply-side economies of scale. A MNE achieves a significant unit cost advantage by achieving production scale economies. Shapiro and Varian (2000) describe the limits of supply side economies well. They note "traditional economies of scale based on manufacturing have generally been exhausted at scales well below total market dominance, at least in the large US market". They go on to say "positive feedback based on supply side economies of scale ran into natural limits, at which point negative feedback took over". This they contend is why General Motors never took over the entire automobile market. The demand-side economies part of the equation is another story. In Microsoft's case, consumer value of the operating system that is used as the standard for the industry is what drove their domination via positive feedback mechanisms.

Network externalities describe the effect that you benefit more from a network when more people join the network. There are positive and negative externalities associated with networks. Obviously, positive externalities produce a positive value reinforcing mechanism and attract additional participants. Positive externalities can be further enhanced and reinforced by complementary value offerings within the network. Complementiarities arise from the addition of products, services or features that further extend the value proposition of the network and further support positive feedback dynamics. Metcalf's Law describes the value of the network to its users is proportional to n x (n-1)= n^2-n were n is the number of people in the network. (Varian 1999)

Collective switching costs reinforce positive feedback mechanisms by making it costly to switch out of the network, technology or standard you are already in. This is a barrier to entry for start up network providers and a barrier to exit for existing network participants. Shapiro and Varian define collective switching costs as the combined switching costs of all users. These costs can be high (not only monetary but learning curve based as well) and are a distinct advantage for established networks.

These market settings pose unique conditions that may significantly affect a networked firm's strategy selection and formulation as it seeks to expand internationally. Were once the unit of focus was the firm and how it might approach internationalization, with networked markets and the resulting economic characteristics, the boundaries of value production have become more blurred. Firms are now dependent on their networks.

2.31 Market level review

To examine firms operating in network externality environments requires an understanding of the economic market environment in which they exist and how it differs from classical markets. This market environment differs greatly from the single equilibrium market model underlying most popular supply and demand force economics. Using a traditional approach, firm strategy is directed by assumptions of diminishing returns, known industry structure and rational behavior by firms. (Beinhocker 1997). However in markets characterized by dynamic technology shifts, high uncertainty and rapidly changing business processes, the single equilibrium model does not appear to hold up well under empirical scrutiny. In fact, Beinhocker argues that these are complex adaptive systems, which exhibit unique characteristics: 1. They are open dynamic systems in constant dynamic equilibrium and "a perpetual-motion machine in which patterns of behavior are constantly shifting; some patterns appear stable, others chaotic." (Beinhocker 1997). 2. The systems contain interacting agents, which create complexity that makes it difficult to predict outcomes. Interaction rules among the agents are constantly evolving (players in game theory) and create a complex adaptive system. 3. The dynamic interaction of the systems creates emerging structures and self-organization independent of single agents.

In order to distinguish between network externality market characteristics and non-network externality market characteristics, Arthur (1994) begins his increasing return theory by contrasting resource-based industries and knowledge based industries. The

former being the staple for investigation for both theoretical and empirical economic research as well as international trade theory and I posit most internationalization theory. Resource based views are of the Ricardian framework and focus on the economic principle of diminishing returns and one equilibrium point between supply and demand. On the other hand, knowledge based industries will exhibit the principle of increasing returns. In this system, competition among technologies may have several different outcomes (equilibrium) that are dependent on forces such as small, random events that dictate path dependence and lock-in, standards set by learning curves/familiarity, network externalities, and complementarily which create positive feedback loops. These forces each work at differing levels depending on the product / business. The implication of these forces implies that the best technology does not always win. (VHS vs. Beta) Complementiarities and positive feedback loops that occur when more users join the network or use the product within a network and the overall value of the network to each user increases. If this system becomes a standard, and there are complementary products or services that can be used with the network system, it will attract more users and users may experience lock-in to the standard as they wish to use the complementary products based on that standard. This leads to increasing returns.

A further examination of the market characteristics of network externality environments suggests that the price-quantity relationship in these markets differ significantly from classical theory. Arthur (1988) demonstrates that as quantity increases, price increases. This is very different from non-networked goods markets that experience an inverse relationship between price and quantity. The argument presented suggests that a firm will

take advantage of the increasing value generated by a growing network. This increasing value is derived from direct exchange benefits and indirect add-on benefits of being linked to the growing network.

Another key characteristic is the use of technology standards. Firms and consumers are interested in aligning with the standard that they perceive will prevail hoping to enjoy added externalities with future complementary products. Gandal (1994) empirically demonstrated the significance of this standard seeking affect. As a result of the importance of technology standard development, it is suggested by Gallaugher (1997) that "early influence in network markets can be significant and firms have an incentive to enter markets early and aggressively".

2.32 Industry level review

High technology industries differ from traditional industries. In looking at the market function, traditional industries use a perfect competition economic model were it is assumed that individual players have no market power, they are price takers and competition will drive down the price to marginal cost. Consumer welfare increases via allocative and productive efficiencies. Key assumptions include many equally efficient firms entering and exiting the industry who are facing horizontal demand curves for homogeneous product. On the other hand, high technology industries were products are heterogeneous with high differentiation, short life cycles, high sunk costs driven by

constant innovation. There may only be a few players in the market and some may dominate the industry by raising technical entry barriers to exclude competition. These high technology industries feature high capital intensity, high risk, significant economies of scale, interdependent technologies owned by multiple players, network externalities, technology standardization requirements. (Yu 1999)

Network market characteristics and the forces associated with them are reshaping industries. Firms within an industry that is networked and technologically oriented face dramatic reconfigurations of how value is generated, delivered and captured. Networked firms are migrating to areas of greatest value and were they can maximize their use of external resources while focusing business intelligence as a competitive information asset. Wereby previous industry shape would be defined by who controlled the resource based assets and how those assets were employed, networked industries are controlled by information and critical technology assets. In the old style shape, industries generated value around the center were the physical assets were. For instance, at one time, telephone networks were controlled by the infrastructure providers who had the cables and most value was generated at this center. However, with the shift to electronic network environments and away from physical asset control, primary value generation now occurs at the ends. This hollowing out effect is well described "The real value in telecommunications is shifting to the ends of the network. At the core, infrastructure providers like Sun, Cisco, Nortel and Lucent are earning big profits. And at the periphery, companies like Yahoo! Infospace, AOL and Phone.com are extracting value by controlling the user interface and managing customer relationships." (Sawhney and

Parikh 2001) This profound shift along with the increase in network relationships is causing fundamental changes in firm strategy.

This reshaping has significant implications regarding internationalization strategy. Firms operating under a pure resource paradigm might come to very different conclusion than a firm operating under a network relationship paradigm. Firms seeking location advantages under OLI may focus their internationalization decision on an outdated physical asset intensive strategy. This would be in contrast to a networked relationship paradigm that allows them to access external internationalization resources from mutually dependent technology partners. This shift in orientation goes to the heart of competitive strategy and suggests that it may not be the "core capabilities" that count but rather the "distributed capabilities" (Sawhney and Parikh 2001)

2.33 Firm level review

Networked market characteristics give rise to new configurations of firms. A useful paradigm from which to examine the firm level perspective in the business model construct.

From the perspective of the firm, information technology and business networks are blurring traditional definitions. Enterprises are now able to interact in ways that create new forms of value outside the bounded definitions of the organization's traditional

business. Whether these firms are from the technology industries or industrial sectors, they are now participants in economically interdependent webs. The organizations in these webs "must learn to manage organizations whose boundaries have become much more porous, with denser information links to other web participants". (Hagel 1996)

With the evolution of the Internet and e-business tools, businesses are creating new levels of complexity in the global market place. Those that are ingesting these technology advantages in the right way are able to create and capture value in ways unlike any organizational form of the past. Using these technologies, firms are creating inter-organizational relationships that are enabled by critical technologies and lead to external resource opportunities. The "digitization" (Slywotsky 2000) of business is enabling many firms to drastically redesign core processes in such a way that they can more effectively deploy firm assets into highly productive ways. By moving towards network integration, firms are able to enjoy important advantages. These advantages include lower transaction costs, increased efficiencies in networked suppliers infrastructure, faster market reaction, better customer service, negative working capital situations, genuine one to one product service customization, greater and more productive business intelligence. This leads to a better matching of customer needs and production output, less inventory, more streamlined operations, less physical assets, more of a focus on core competency, direct customer relationship building, and creating and entering new markets. This move towards networks also creates significant mutual technology dependency as interactions are governed by standards.

The ability of a firm and its industry to support network integration is dependent on the digital or technology state of the industry and related supplier infrastructure. The ability to interact and conduct exchange transactions is highly dependent on common standards. Hence, in a global context, international technology standards will play a vital role.

Are location advantages diminished in a networked environment? The physical firm when faced with a physical plant expansion decision or a production location decision, in the context of internationalization, will need to examine product life cycle characteristics, cost factors and a host of other considerations. Under the Eclectic (OLI) paradigm these factors (especially location) can significantly influence internationalization pattern behavior. In addition, Dunning's OLI theory is commonly used to consider internationalization in production location and capacity decisions. If firms are able to effectively outsource asset intensive and production factor intensive activities of its business via networked relationships and focus on their core activities, then location factors appear to become less relevant of a factor in the internationalization decision process. Rather, network relationship forces and exchange standards would seem to be significant.

2.4 Internationalization foundations

Much of the bedrock theory and empirical research performed on the subject of internationalization fall into two distinct areas. The Why and the How. As a result, the drivers, as well as, the decision processes, are examined. It is vitally important to note that most relevant research and theory has been developed in the context of large multinational firms producing physical products. There exists a small body of work that attempts to illuminate the differences smaller firms face in the internationalization process. Additionally, some work has been performed examining high technology, small firm internationalization.

Primary internationalization theories and research that began to examine the Why side of the internationalization equation developed out of the body of work done on multinational corporations seeking foreign direct investment. Multinational corporations posses a significant proportion of the worlds technological property. This engine of innovation generates technology at an incredible pace. The ability of a multinational corporation to strategically manage the output and exploitation of the developed technology can be a significant competitive advantage. The ultimate prize for the successful investment in and leveraging of these assets and resources is an increase in shareholder value (Morck & Yeung 1991). It has been observed that a disproportionate amount of FDI is attracted by technology industries. It is also noted that most technological developments come from a very few countries and that there is a significant amount of locational agglomeration.

The reasons and motivations of why firms seek FDI are varied. Several theories have been developed including the Market Imperfection Theory that states factors of production are not fully mobile and transferable across international boundaries. As a result, the cost of production factors may vary greatly across national borders and provide a MNC the opportunity to exploit these imperfections in a profitable way. This creates a key motivation for a firm to consider foreign direct investment and the opportunity to exploit its technology. Theory of Internalization states that a firm's competitive advantage must be firm specific and not easily copied (i.e. patented technology or processes). In addition it must be in a transferable form. In order to maintain the firm specific advantage, a firm should posses proprietary information and have control of the human capital who can generate new information and technology through expertise in R&D, management, and marketing. This theoretical paradigm utilizes transaction costs as a significant dimension.

Another key issue is what sustainable competitive advantage does a firm have that it can transfer effectively abroad in order to generate incrementally larger returns. Specifically, how can a firm create the necessary value by capitalizing on product and factor market imperfections? According to Industrial Organization theory firms have tangible and intangible assets. The nature of these assets helps determine which path a firm may choose to go down when looking at foreign direct investment. If the firm possesses primarily intangible capital, which is difficult to "unbundle" from the firm, it is likely to create a direct control situation using a wholly owned foreign affiliate. This may reflect a firm's desire to closely control its proprietary technology and maintain it within its own

organizational boundaries in order to sustain its technology competitive advantage. This would be different in the case of a firm seeking to simply exploit a technology for local market reasons through say a joint venture.

Dunning in the Eclectic theory of international production (Dunning 1988) states that a firm may serve a market via direct foreign investment, export management contract or licensing depending on specific factors. The OLI paradigm addresses the complexity of an oligopolistic environment. In an imperfect market situation were there is a market failure of the neoclassical paradigm caused by location immobility issues, government policy intervention, economies of scale, political risk factors, information asymmetries etc. a firm will have an opportunity to create a successful direct foreign investment. Specifically, ownership factors would include; market access, technology, patent and trademark issues. Dunning (1995) suggests that firms may seek foreign direct investment opportunities in order to acquire complementary technologies and to exploit existing technology based competitive advantages. Specifically, there is a "push" factor were the firm invests to exploit technology and there is a "pull" factor were the firm can seek to improve its technology base by acquiring and developing new resources and competencies. It is suggested by Shan and Song (1997) that in the US biotech industry foreign investments have been drawn to the US market, via equity participation, for the purpose of gaining access to the country's technology. They highlight two key observations for this to happen. One, the technological capability for a firm to be or remain competitive in a particular industry may reside outside the firm or countries boundaries. Two, "at the country level, technological advantages are heterogeneously

distributed and tend to persist over time". As a firm decides how it will remain technologically competitive, it must asses how much of this competitiveness is derived from internal capabilities and how much may have to come from outside. It must have a good sense of how fast technological evolution is occurring in its particular market and insure that its current internal rate of development does not get overtaken, leading to obsolete technology and possible market exit. This assessment will lead the firm to gauge whether it is in a more technology-seeking mode or a technology-exploiting mode and will influence its FDI decision paths.

As a firm seeks to acquire technological spillover knowledge, it must identify were this knowledge resides and what type of presence it will need to acquire this knowledge. Typically, country specific technology centers reside in unique areas or regions that have developed complex network systems including universities, capital markets and government agencies. These location bound institutional systems traditionally have enjoyed a hard to replicate environment constrained by the mobility of the developing engineers (i.e. Silicon Valley) (Almeida and Kogut 1995). It is interesting to note that with the continuing development of information technology, this regional area (location advantage) may begin to breakdown and the exchange of development knowledge will perhaps be less centralized.

Kuemmerle (1999) examines determinants of FDI in research and development. Although specific to this functional area, he highlights some of the key drivers that influence the decision. First, there is a distinction made in the nature of the possible

investment in R&D. As discussed in the general literature on FDI, a firm is trying to find ways to exploit some of its competitive advantage, in this case, technology from R&D in a foreign market. Several traditional drivers have been examined including; the higher the level of subsidiary autonomy, the higher the level of FDI in R&D, a high level of local R&D is used to adapt products to local markets, and to invest to gain local market knowledge. As the firm makes decisions on how it will transfer this information/knowledge within it's boundaries, it is faced with a strategic decision. The firm must decide whether to simply exploit the existing technology for local adaptation (home based exploiting HBE) or augment it's knowledge base (home based augmenting HBA) by investing in regions or nations that may have a "spill-over" effect. Each path contains a set of possible location drivers. HBE may be used if the foreign country offers important market opportunities that can be converted into high profits, which in turn justifies the high startup and operational costs for a HBE set-up. On the other hand if a country or region has a large knowledge base with high quality, a firm may seek to enhance its knowledge pool for long term future profitability.

As mentioned previously, a disproportionate share of FDI is attracted by technological industries. In addition, the pattern of investment into just a few countries and the relative sectoral distribution has lead Anand and Kogut (1997) to examine the motivations and country investment patterns for multinational corporations seeking direct investment for technology reasons. They highlight *home country effects* and *host country effects* that have a significant influence over foreign direct investment entry. As firms possess technological capabilities in the form of intangible assets and have the desire to exploit

them, they also have “rivalry” pressures. In fact, it is posited that the domestic inter-firm rivalry factor is the greater cause of “push” FDI especially when technological advantage is high. Host country “pull” effects occur when there are geographical ownership advantages and market opportunities. Various locations offer different advantages caused by institutional structures as well as their market opportunity. These locations offer access to special knowledge and firms will seek this out if the market opportunity is sufficient. Hence, sectoral concentration of FDI may be explained by a combination of push and pull motivations. It is concluded from the study that in fact the overriding motives for the FDI of a technology firm may be the rivalry (push) and market attractiveness (pull).

The second half of the internationalization equation focuses on the How. Firm internationalization behavior patterns are affected in many ways by the strength of the key drivers as discussed in the Why section. Actual internationalization behavior patterns can vary dramatically due to the complexity of the global economic environment. Two of the most common approaches firms may exhibit are a “stages” paradigm or a “process” paradigm. The “stages” perspective suggests that a firm will progress through distinct stages of international involvement within a particular market (market specific). For example, it will begin to export, then increase its commitment to the next level or mode based on the accumulation of market specific knowledge. This is an export development

process at the market level. The “process” orientation looks at the operating firm (verses the market) that learns from the internationalization “process” and focuses on the firms development of this knowledge. It suggests that as firms operate in international markets they acquire experiential knowledge that affects the mode choice of other international market entry decisions. Therefore, the selection of the mode may be influenced by other market entry decisions and experiences and are not just dependent on the accumulation of market specific knowledge as in the stage theories. (Clark, Pugh, Mallory 1997)

As a firm seeks to capitalize on its core technology competencies, it may seek to do so through a number of different modes including FDI, joint venture, licensing, or other forms of strategic partnership. When choosing an FDI path it must decide on the ownership structure-full or shared and the entry mode-acquisition or new venture. (Padmanabhan and Cho 1999) It is shown that general international business experience and country specific experience will influence the choice. In addition, it is shown that “decision specific experience” may be the most important influence. This experience is based on the past decision experience of the firm and suggests that a firm, in a situation similar to past experiences, will choose the same entry mode for FDI as in the past. Learning curve familiarity is comforting as it may reduce uncertainty. The authors use Dunnings Eclectic Paradigm to highlight decision specific experiences as being important sources of ownership specific advantages. Specifically, asset advantages and transaction cost reduction advantages. This knowledge based competitive advantage may lead firms to follow specific investment patterns. In studying international modes of technology

transfer, Davidson and McFetridge (1985) "discovered that firms with the largest number of prior technology transfers under the external mode were least likely to transfer technology internally".

Clark presents a "Logical" framework for examining the internationalization process by testing elements of the Uppsala Model. The Uppsala Model bases the internationalization process of a firm on the acquisition of market specific knowledge gained while operating in a particular market. It is the foundation of the stage school. This increase in knowledge will lead to an increase in market commitment. It is pointed out that the model generally assumes that market specific factors drive the market servicing decision and that entry/modal decisions are not influenced by decisions in other markets (general knowledge). Clark finds that the incremental path toward internationalization is not a very clean stepwise path. In fact, he found the process to be much more complex and includes a significant number of mixed marketing approaches. He concludes by suggesting that the process of internationalization is influenced not just by market specific knowledge leading to a greater commitment, but perhaps more so by the operating firm's level of general international learning and decision experience. It is interesting to note that the Uppsala model does not accommodate divestment activities or any reversal of market commitment. This may create a static model if applied to digitally oriented businesses as the dynamic nature of the market calls for frequent re-definition of business models and investment forms. However, Clark's logical model contemplates these reversible processes. The model is consistent with the "process" focus wereby the internationalization of a firm is "a process of increasing involvement within and across

national markets". This is in contrast to more "static" models were a firm's foreign expansion is "a series of static choices directed by efficiency considerations and relative costs and benefits" (Clark, Pugh, Mallory 1997)

Dunning (1995) investigated the relative relationship between low added value activities and high value-added activities of MNE and FDI. He found that early in the internationalization process, firms tended to invest in lower value chain activities. Later they begin to move up the value chain to areas like R&D. In order to accomplish this higher value chain activity, firms must create a presence in the main centers of R&D excellence to maintain their competitive advantage. He also notes that specific types of R&D should receive most of the FDI dollars. Specifically, he cites spending on efficiency and strategic asset seeking types as organizations view these activities as part of their integrated production system. Efficiency or rationalized R&D seek to improve product or process to capture economies of scale and scope. Strategic asset-seeking aim at monitoring or acquiring competitive advantages in technology or information. Those in technology oriented industry sectors appear to be pursuing strategies that allow them to develop and protect their competitive advantages by investing in areas or locations were they can "stay in touch" with what their competition is doing. Firms attempt to both acquire and exploit technology in markets that offer a rich market opportunity. While there may be push and pull factors, it appears that the protection and advancement of competitive advantage is the key to long term MNE success.

2.5 Small, high technology firm review

Small firms differ from larger firms in their foreign investment behavior in two main ways. One is the amount of capital may be significantly limited. Any capital outlays are usually disproportionate relative to the size of the firm were an outlay from a smaller firm as a percent of overall revenue will be larger than an outlay of a larger firm. This may increase the perceived risk of the investment. Second is the lack of management time/skills. Smaller firms tend to lack a designated function and management team to focus on international information gathering and decision making. As a result, decisions may lack the necessary due diligence and management time to be successful (Buckley 1989).This may result in smaller firms seeking alternative external resources such as network relationships.

The body of work on the process of internationalization has tended to fragment into two camps**;** Stages (firms engage in increasing international activities as a result of increased market knowledge and commitment i.e. managerial learning (Johanson and Vahlne 1977) and Network Relationships ("set of connected relationships a firm develops"). Coviello and Munro (1997) create a framework for small, high-tech software firms' that integrates the stage and network relationship paradigms. These firms are characterized as "high technology, knowledge based and service intensive". This integration suggests that small high technology firms face different mechanisms than do larger firms when they approach international expansion. Specifically, small firms tend to lack significant capital and limited managerial resources, which leads to a greater reliance on strategic partners.

It was empirically shown by Coviello and Munro (1997) that while strategic relationships for software developers may be primarily product development focused, they lead to opportunities for international distribution within the partner's business structure. This is characterized by a network relationship orientation.

The emphasis on network relationships is very key. Tapscott (2000) describes the development of "Business Webs" which are very related to digitally oriented businesses. He articulates these internetworked organisms into 5 business model forms. The point here is the continued evolution of business models and the resulting change in the nature of network relationships may create a robust internationalization environment for digitally oriented businesses to go global at an accelerated pace. In the early high technology software firms examined by Coviello and Munro (1997), there seemed to exist a dominant hardware partner with a fairly formalized development agreement dictating direction and scope of internationalization. In the e-business world, a transformation is occurring toward Web based strategies that utilize different parameters in alliance relationships. In fact, according to OECD there are three distinctly differing elements; 1. The relationships involve larger and more varied group of companies. 2. They are less formal in a relationship context and legal context 3. They require one or two leaders to establish standards for the rest to follow and attract. The stated reasoning for this is to diversify risk through sharing and leveraging competencies/resources.

2.6 Firm size review

Past research suggests that large multinational enterprises, based on diminishing returns economics, enjoy significant resource advantages when internationalizing over small and medium sized firms. Additionally, large manufacturing MNE's exhibit different internationalization behavior than high technology SME's who face resource constraints (Coviello and Munro 1995). The resource argument has been a long-standing pillar of firm size differential effects on internationalization behavior. It has been suggested that internationalization resource advantages of large firms may be diminished as a result of SME's network relationships (Coviello and McAuley 1999). High tech SME's are able to overcome these internationalization resource limitations via network relationships and size is not a relevant factor. As a result, high tech SME's operating in network externality environments might have a more substantial network of international businesses relationships that may enable them to be on internationalization resource on par with large businesses.

A review of export marketing studies of manufacturing firms suggests there is strong evidence to support a significant positive relationship between firm size and export intensity. The typical theoretical arguments used to support this position include international marketing economies of scale, resource limitations of small firms (financial and management), and risk perceptions. (Bonaccorsi 1992) Because firm size is a convenient proxy for firm resources, it is often used to study export behavior. It allows researchers to segment groups in order to study similar or differing internationalization behaviors. However, it is now being challenged as a relevant relational dimension. The

following discussion examines arguments for and against the firm size connection and how firm size may not hold for high technology.

Bonaccorsi (1992) conducts an exhaustive review of export / size related literature. In the review Bonaccorsi finds significant support for "the proposition that the probability of being an exporter increases with firm size". This proposition was supported by the idea that small firms may rely on domestic market growth and avoid the perceived risk of export. Large firms on the other hand will seek to export to increase sales. However, it is pointed out that high technology firms may not follow this behavior. They may begin exporting earlier or be born global because domestic markets may not support sufficient growth demand.

In examining the proposition "export intensity is positively correlated with firm size", there is less consensus. In a review by Gemunden (1991), a positive relationship between firm size and export behavior, yet when export intensity was used as a dependent variable, it failed to support the positive relationship with firm size. (Bonaccorsi 1992) Gemunden points out "Up to a certain minimum size the probability of exporting in industries with export potential rises with increasing size, but beyond this limit, there is only a weak association between size and exporting". (Gemunden 1991). The role of size may be important as a catalyst for export behavior, but to grow internationalization activity, other factors may come into play.

From another perspective, Miesenbock (1988) performs a literature review and finds that most studies support the proposition that larger firms enjoy greater ease in starting exports and in running the international business. Bonaccorsi (1992) suggests that the

causal direction is from firm size to export intensity and that although the literature supports this position, it may also be that "by being involved in exporting, companies may have larger opportunities to grow than by selling in the domestic market". Additionally, Bonaccorsi concludes, "no agreement exists about the relationship between firm size and export intensity". (Bonaccorsi 1992)

After reviewing much of the traditional export literature, it becomes evident that the general focus is on the export concept itself. This focus only allows for the inclusion of downstream value chain international activities like distribution and marketing. When investigating internationalization from a holistic network relationship perspective, the entire value chain should be considered (Jones 1999). In fact, when employing the Swedish business network relationship model, it becomes apparent the other upstream value chain activities become an important component. These activities often involve international relationships covering structural, economic and social layers of the business network. These relationship layers and their resulting influence on the internationalization behavior of the firm and network cannot be understated.

Chapter III

Theoretical Framework, Propositions and Research Design

Internationalization theory and research may be categorized into three distinct schools of thought. The economic school comprised of foreign direct investment (FDI) theory, the behavioral school supported by "stages" theory and the relationship school derived from network theory. (Coviello and McAuley 1999).

Much of the classical foreign direct investment and internationalization theory has centered on an economic theory paradigm (Dunning 1976, Kindelberger 1969, Knickerbocker 1974, Magee 1977). Stages and process models have relied on transaction cost principles related to international manufacturing environments. Using the economic paradigm model from Arthur (1994) and Katz and Shapiro (1985) I articulate why and how the unique economic forces created by a network externality environment result in significant implications for firm internationalization strategy and decision making. It should be recognized that most prior economic theories have used the firm as the primary unit of analysis. This has created a gap when one is interested in examining the influence of networks on firm's internationalization behavior. The Network theory framework suggests a system of relationships were strategic action is not completely dependent on a single firm and the established market relationships with other firms significantly influence strategic options. It is felt the network theory framework captures the nonlinear nature of high technology internationalization.

As new networked configured firms are created, economic models alone are not adequate in describing or predicting complex social interactions that may occur among networked firms. It has been noted by Granovettor (1985) that all economic activity is grounded in social contexts. As a result, the importance of incorporating a relationship network paradigm to help explain the interactions and resulting implications of these relationships on internationalization strategy is paramount. As a result of this, I use elements of a resource dependence model (Emerson 1962, Pfeffer and Salancik 1978) derived from organizational theory.

To adequately address the internationalization of high technology firms, Coviello and McAuley (1999) suggest that a combination of these paradigms be used to fully capture the complexity associated with this phenomenon. In the following theoretical framework, I use a combination of economic, organizational and network theory to explain causal relationships driving the internationalization decision of high technology firms operating in network externality environments.

3.1 The four forces model of network externality internationalization

The following presents a causal model for the forces affecting and the predicted outcomes for the internationalization of high technology firms operating in network externality environments. It is suggested that these forces are unique in combination to firms operating within network externality environments and that they conspire to shape internationalization outcomes. The implications for firm internationalization strategy and decision making will be identified and enumerated. From this model evolve my key propositions for empirical testing. Note that for each force and the resulting internationalization scenario outcome table there is also a graphical representation contained in the referenced Figures (1.2-1.6).

3.11 Force One: Technology Relationship force

A firm's reliance on inter-organizational relationships has been addressed through organizational theory. Specifically, the population ecology model (Aldrich 1979), resource dependence model (Emerson 1962, Pfeffer and Salancik 1978) and the institutionalization model (Dimaggio and Powell 1983). Banerji (1992) demonstrated the importance of prior inter-organizational relationships in the internationalization of Japanese Auto manufacturers and their "satellite" suppliers into the US market. He showed how, in exchange based relationships within inter-organizational networks, a manufacturer might influence a supplier's decision to enter a foreign market. The

resource dependence model suggests a mutual dependence relationship between the "hub" firm and the "satellite" firm.

In networked environments, whether they are direct or indirect, inter-networked relationships exist among participating firms. The various firms who constitute this organizational network each have a specific position in the network somewhat analogous to a "Hub" and "Satellite" orientation. For purposes of network externality environments, I use the term "Network leader" and "Affiliate". Network leader being defined as: the focal organization or sponsor of the network that sets up the network and actively manages the network in order to benefit from its growth in size. Affiliate being defined: as a critical technology supplier to the network leader. This affiliate relationship position may be of an output purchasing orientation, technology licensing or technical partnership supported by capital investment.

Within these relationships exists a certain level of mutual dependence as suggested by dependence theory. In the case of high technology firms operating in network externality environments, this mutual dependency, I would suggest, centers on critical technology resources. Within the network, a firm's position relative to this critical technology resource would determine its relative strength and power within the network.

Mutual dependence suggests that the network leader firm would rely on the affiliate firm and visa versa. This mutual dependence level may shift from one to the other depending on certain factors (i.e. availability, importance, scope, resource support, outputs

purchased) surrounding the critical technology resource and exchange behavior of the firms. The dependence of the affiliate firm on the network leader firm may be high if the network leader firm purchases all or most of the outputs of the affiliate firm and/or the network leader firm strongly controls and/or supports the critical technology resource. On the other hand if the affiliate firm provides a proprietary critical technology resource that the network leader firm cannot find elsewhere (low availability), the dependency may shift to a high level for the network leader firm. In addition, the scope of various critical technology resources that an affiliate supplies to the network leader firm may create an even greater dependency of the network leader firm on the affiliate supplier. The causal implications for internationalization are as follows:

Four internationalization implications for Affiliate firms:

Table 2.31

Technology relationship dependence for Affiliate	High technology dependence of Network leader firm on Affiliate firm	Low technology dependence of Network leader firm on Affiliate firm
High technology dependence of Affiliate firm on Network leader firm	4	2
Low technology dependence of Affiliate firm on Network leader firm	3	1

In outcome two (2), if the Network leader firm can find alternative critical technology resource supply in a new international market, the Affiliate firm may not get the needed internationalization support resources necessary to move into the new market (assuming a follower strategy). Hence the chances of entry for the Affiliate firm would be low. The relationship force for the Affiliate firm would be weak. The Network leader firm might begin a completely new regeneration of a network in the new market of entry.

In outcome one (1), a low technology mutual dependence for each firm would suggest a low level of internationalization support from the Network leader firm for the Affiliate firm. The resulting strength of the relationship force would be weak in both scenarios.

In outcome three (3), the Network leader firm has a high dependency on the Affiliate firm's critical technology resource and would provide significant internationalization resources to support the Affiliate firm market expansion. The Affiliate firm would need to assess whether it wants to follow. It may find that the attraction of a significant market share expansion opportunity would be hard to resist. Especially if it is seeking to set a de facto technology standard (related to the "International technology standard force" described in Force three) and therefore would choose to enter the market desired by the Network leader.

In outcome four (4), there is a very high mutual technology dependency and each firm will react to the actions of the others. If the Network leader firm internationalizes to a

particular market, then the Affiliate firm will too. The mutual relationship forces are high for both firms.

(Note Figure 1.2 for graphical representation of internationalization scenario outcomes)

Proposition # 1:

The higher the mutual technology dependence, the greater the chance an "Affiliate" firm will be influenced by the "Network leader" firm to follow it to a new market.

Four internationalization implications for Network Leader firms:

Table 2.32

Technology relationship dependence for Network Leader	High technology dependence of Network leader firm on Affiliate firm	Low technology dependence of Network leader firm on Affiliate firm
High technology dependence of Affiliate firm on Network leader firm	2	4
Low technology dependence of Affiliate firm on Network leader firm	1	3

In outcome two (2), the Network leader firm has a high dependency on the Affiliate and visa versa. If the Network Leader cannot find alternative technology supply sources in the

target market it may not enter the market if the Affiliate firm is unwilling to support it. The Network Leader may offer significant internationalization resource support to the Affiliate, but depending on the position of the Affiliate may or may not internationalize. In outcome one (1), with a low technology mutual dependence for the Affiliate but a high force for the Network Leader, this places the Network Leader at a potential high-risk disadvantage if it is unable to garner the support of the Affiliate for a new market entry. As a result, the Network Leader may choose not to internationalize unless it can source the technology from other local sources.

In outcome three (3), the mutual forces are very low and the Network leader firm is free to make an independent internationalization decision. Depending on other forces the firm will either internationalize or not.

In outcome four (4), the Network Leader has a strong position such that it can receive support form the Affiliate but not be singly bound to its technology. As a result, the Network leader has the greatest decision flexibility for internationalizing in the target market. Given the other forces, it may decide to enter or not.

(Note Figure 1.3 for graphical representation of internationalization scenario outcomes)

Proposition # 1 A:

The higher the mutual technology dependence, the greater the chance the Network Leader firm will provide internationalization resource support to the affiliate for entry to a new market.

3.12 Force Two: Strength of international network externalities affecting the firm

Firms whose products are subject to positive demand- side scale economies increase the value and utility of their product as the installed base increases (Arthur 1988). Network externality forces (direct, indirect and positive feedback) play a critical role in the pricing, adoption, diffusion and competition especially in high technology areas such as IT, hardware platforms, operating systems, software products, email networks, banking ATM networks, and inter-organizational systems. (Gallaugher 1997). It has been demonstrated that these markets differ significantly from traditional markets such that installed base development becomes more important than other factors such as price, consumer preferences or technical superiority (Economides 1996). Extreme competition may occur early in the lifecycle with the winner taking all if their network achieves a significant critical mass over a competing network. This would suggest that firms would seek to exploit market share opportunities early in their development. Significant market share opportunities reside in establishing early network advantages in international markets whereby a first mover may achieve a significant technology standard advantage. By doing so, they create a high switching cost scenario and may achieve significant lock-in effects. Early entry may also help to achieve a positive tipping effect toward one of several non-compatible standards vying for network dominance.

The international externality force would be affected by two key components. The first would be the demand for standardization. If international markets are relatively homogeneous in their technology demands and do not require significant differentiation,

a high standardization demand may be created. On the other hand, if individual markets seek to have significant technology and product differentiation, there may be low standardization demand. The second component is the level of economies of scale. Whether demand side or supply side, these are necessary to create a technology domination effect consistent with winner take all and the subsequent establishment of a single technology standard that receives maximum externality effects. When a high level of economies of scale is present in targeted international markets, the opportunity for a firm to achieve the tipping effect for its technology is present and the firm would move swiftly in order to capitalize on it.

Four internationalization implications:

Table 2.33

International network externality	Low demand side or supply side economies of scale	High demand side or supply side economies of scale
High demand for international standardization of technology	2	4
Low demand for international standardization of technology	1	3

Outcome Four (4): If a technology firm is in an industry that has strong economies of scale (demand side or supply side) and there is a demand for international technology standardization, the firm can experience very strong international network externality forces (positive feedback). If the firm's technology standard is the international standard, it will seek to internationalize very rapidly to implement this technology standard in international markets.

Outcome Three (3): The economies of scale force is strong, however the demand for international standardization is weak. In this scenario, the market may demand several different technologies allowing many to become sustainable. This may lead to pockets of technology standard domination. A firm may have to decide to internationalize into certain markets were it can still have a chance at establishing the standard. In these markets, firms would internationalize quickly, before another standard became dominant. The strength of the international externality force would depend on the individual market being considered. (Note: in this scenario, the role of the international standards deviation force may be significant, specifically, the governments policy on international technology standards adoption)

Outcome One (1): If there are weak economies of scale forces and little demand for international standardization, the international network externality force will be low. Firm internationalization based on this force would likely be low.

Outcome Two (2): Although demand for international standardization may be high, without strong economies of scale, it is less likely that a firm will be compelled to quickly seek additional markets for establishing large networks. International externality forces would be very low.

Firms that experience strong externality forces would seek to expand network market share more quickly from birth in order to achieve early network dominance in key international markets than firms facing weaker externality forces. Firms will also seek early entry to prevent the development of competing standards that ultimately may lock them out of a potentially lucrative international market. These firms would place factors such as price, consumer preferences or technical superiority second to the need to achieve network dominance. They also might engage in less formal international arrangements such as strategic alliances to achieve rapid international market development.
(Note Figure 1.4 for graphical representation of internationalization scenario outcomes)

Proposition #2

The stronger the international network externality forces on a firm, that faster it will seek to internationalize in order to gain critical network market share.

3.13 Force Three: International technology standards dependency

The development of technology standards is central to networks since networks suggest a form of exchange. Goods characterized by demand-side network effects have significant incentives to achieve compatibility. (Katz and Shapiro 1985). Firms as well as individuals seek (through forward perceptions of outcomes) a standard that they believe will prevail. (Farrell and Saloner 1986). This helps provide certainty for investments in and the development of complementary products. Gallaugher (1997) suggests that "fear of stranding" and the desire to accrue additional network externality benefits may lead to the preference in an evolving standard. He notes "the fear of stranding is particularly high in information technology products, given high fixed, development and learning costs".

In an international context, technology standards may significantly impact the ability of a firm to enter a market. When examined from the perspective of private incentives of import competing firms and social incentives of an importing country, there exist significant potential barriers that can impact the internationalization strategy of networked firms. Using an extension of Katz and Shapiro's fulfilled expectations Cournot equilibrium model, Yang (1997) demonstrates "that a domestic firm has an incentive to deviate from the international standard unless its original technology had no significant network size or the international standard is coincidentally the same as the domestic firm's". In addition, he finds that "the social incentive of an importing country to deviate from the international standard is even greater than the private one, providing incentives to adopt and enforce technical barriers to trade". This potentially significant barrier force

brings into play domestic rival firm and country level government policy issues that may impact firm internationalization strategy.

The technology standards deviation force is dependent on rival network size, level of compatibility of technology and government policy towards international technology standards agreements adoption.

The larger the network size of the domestic rival, the greater the deviation force and the less likely the internationalizing firm will choose to enter the market. The more compatible an internationalizing firm's technology is with a domestic rival's existing technology, the less the deviation force and the more likely it will choose to enter the market. The more the target market's government adopts international technology standards (participates in international technology agreements), the less the deviation force and the more likely a firm will choose to enter that market.

Internationalization implications

Table 2.34

International Standards Force	Network Size of domestic Rival is **Small**	Network Size of domestic Rival is **Large**
Low deviation force: Firm technology **compatible** and government policy **supports** international standards adoption	4	3
High deviation force: Firm technology **not compatible** and government policy **against** international standards adoption	2	1

In outcome One (1): the force to deviate from the international standard is strong. The new international market has a domestic rival with a large existing network (it wants to protect) with a technology that is different from the international technology standard (under which it can extract superior returns) of the internationalizing firm. The market force to deviate from the new international standard would be at a maximum. The domestic rival's technology would exhibit path dependency and lock in effects (were even if the new technology is superior, switching costs and social welfare maximizing behavior will create significant barriers to adopting the new technology standard). In this scenario, the government policy does not support international standards adoption (as

demonstrated in not participating in international technology standards agreements) and would reinforce the protection of domestic rival standards via technical trade barriers. As a result, the internationalizing firm may not be able to enter the targeted market with its international technology standard. Rather, the internationalizing firm may have to create a new compatible product or acquire the existing standard and network. Firm internationalization may be further repelled.

In outcome two (2): the force to deviate from the new international standard is mixed. There is a small domestic rival network and a non-compatible technology (perhaps a start up). Unless the domestic rival firm possesses the ability to maximize profits on its own, it may actually seek to adopt the international standard in order to access the larger network. In this scenario, government policy may not protect the domestic standard as the potential for the social welfare maximization may be achieved through the larger international standards based network. Firm internationalization may be attracted to the market. In this scenario, the power generated by the need for network externalities resulting from a larger network overcomes the potentially superior domestic rival technology. Both the government and the domestic rival recognize the need to be associated with a standard that allows them to access a larger network and hence achieve greater value at the firm level and the social welfare maximizing level.

In Outcome Three (3): the force to deviate from the international standard may be weak. If the technology is so similar that the firm will not be able to extract extra value from excess switching costs by developing a new technology between the old technology and

the international standards based technology it may seek to adopt the international standard in order to maximize network size. Firm internationalization may be attracted to the market.

In Outcome Four (4): the force to deviate from the international standard may be weakest. If the domestic rivals technology is very similar to the international technology standards and their network size is small, the firm would seek to maximize its network size by adopting the international standard and discarding it's old technology. Firm internationalization may be attracted to the market.
(Note Figure 1.5 for graphical representation of internationalization scenario outcomes)

Proposition #3: The stronger the technology standards deviation force for an internationalizing firm into a target market, the less likely it will enter the market.

3.14 Force Four: Current Level of Internationalization

Banerji (1992) suggests that the internationalization level of a firm is a good indicator of a firm's willingness to be involved in and ability to operate in a foreign market. In addition, in an inter-organizational network, internationalization level plays a significant role in whether a "satellite" firm follows a "hub" firm into a new foreign market. In the context of networked firms, the "willingness" and "ability" aspects of the firm toward

internationalization activities will have a causal relationship with whether a firm will follow the network leader into a new foreign market.

Using an internationalization "process" model paradigm, a firm's willingness to enter a foreign market would be dependent on its collection of past internationalization experiences. As it has successfully entered new international markets, it would then learn from these moves and be more willing to enter other similar markets. In addition, its ability to do so would be dependent on the international managerial and financial resources supporting its internationalization efforts. If a firm felt it did not posses the ability to successfully operate in a foreign market, it might chose a lower form of involvement such as export rather than a higher form of involvement like a subsidiary. Therefore, current internationalization level would be a good indication of a firm's current willingness and ability to follow a network participant into a new foreign market.

Internationalization implications

Table 2.35

Internationalization level	High level of "willingness" of firm to be involved in international activities	Low level of "willingness" of firm to be involved in international activities
High level of "ability" of firm to operate in international market	4	2
Low level of "ability" of firm to operate in international market	3	1

Outcome Four (4): With a high willingness and ability force caused by successful past internationalization efforts and confidence in its ability to operate in a foreign market the internationalization force is very strong. This would suggest that a firm would choose to enter a foreign market and use a higher form of internationalization involvement such as establishing a subsidiary or creating an international technology strategic alliance.

Outcome Three (3): With a high level of willingness based on past successful foreign market participation, but a low level of ability, a firm may choose to enter a foreign market, but using a lower level of involvement such as exporting. Depending on other forces, the internationalization level force may be mildly strong if the mutual dependency is high and existing relationships have provided the past success.

Outcome Two (2): Although a firm may poses a high ability to operate in foreign markets based on a pattern of establishing subsidiaries, it may be unwilling to expand into new markets. If the firm perceives those markets as being too different or risky from existing markets that it is successfully operating in it may lack willingness. This may be due to significantly different technology standards that will require extraordinary product modifications or unusually high investments of managerial and financial resources. In this case, the internationalization force level would be mild and somewhat dependent on other forces such as the international technology standards force.

Outcome One (1): In this outcome, the internationalization force would be weak as the firm would not posses the willingness derived from past successes nor the have the ability to internationalize based on higher levels of commitment.
(Note Figure 1.6 for graphical representation of internationalization scenario outcomes)

Proposition # 4:

A firm will be more likely to enter a foreign market if its current level of internationalization involvement is high

3.15 Four forces interactions

The four primary forces outlined in this model are not independent of each other. There are several interactions that can occur.
Force one (technology relationship force) and Force four (internationalization level) interact. If a firm has a high level of mutual dependence and has a high level of internationalization, chances are that it would enter an international market that its critical technology partner would enter. It would have a high ability to operate internationally and would seek to expand its network size. If the firm were highly mutually dependent on the critical technology, but lacked the high level of internationalization, it might receive significant international market support from its partner and would likely enter the new foreign market. If the mutual dependency around the critical technology was low and the

internationalization level was high, a firm (depending on whether it was a network leader or affiliate) would need to assess the importance of entering the market. It could do so on its own since it has the current ability to operate internationally. In the last interaction, having low dependency and low internationalization would lead the firm away from foreign market entry.

Force one (technology relationship force) and Force three (international standards deviation force) interact were the Network leader firm has a high dependency on the Affiliate firm's critical technology resource. (but the affiliate has a low dependence on the network leader) The network leader would provide significant internationalization resources to support the Affiliate firm market expansion. The affiliate firm may find that the attraction of a significant market share expansion opportunity would be hard to resist. Especially if it is seeking to set a de facto international technology standard (were international technology standardization is high) and therefore would choose to enter the market desired by the Network leader.

Force two (international externality force) and Force three (international standards deviation force). A strong demand for international technology standardization will be created were international markets are relatively homogeneous in their technology demands and do not require significant differentiation. In this case, the strength of the international externality force in a specific market will either be enhanced or diminished depending on the government policy component of the international deviation standards force. If current policy is favorable toward international standards adoption (a weak

deviation force) resulting in lower technical trade barriers, then a firm would be more attracted to the market and would choose to enter. On the other hand, if individual markets seek to have significant technology and product differentiation, resulting in low international standardization demand, government policy toward adoption may reinforce the strong international standards deviation force and further repel firms trying to enter.

3.2 Statement of Propositions and Operational Measures

This study has two sets of propositions. The first set contains Proposition # 1, 1A, 3, and 4. These deal with the entry decision into a foreign market. The second set contains proposition #2. This one deals with the timing (when) and rate (how fast) a firm will begin to conduct internationalization activities. The constructs and measures used to test these propositions are articulated below.

Proposition # 1: The higher the mutual technology dependence, the greater the chance an "Affiliate" networked firm will be influenced by the "Network leader" firm to follow it to a new market.

Proposition # 1A: The higher the mutual technology dependence, the greater the chance the Network Leader firm will provide internationalization resource support to the affiliate for entry to a new market

The dependent variable is the decision of the firm to enter the foreign market or not. Network leader being defined as: the focal organization or sponsor of the network that sets up the network and actively manages the network in order to benefit from its growth in size. Affiliate being defined: as a critical technology supplier to the network leader. This relationship may be of an output purchasing orientation, technology licensing or technical partnership supported by capital investment.

The "mutual dependence" (high or low) construct will be represented by the following measure indicators; availability, importance, scope, resource support, outputs purchased. The approach is similar to Banerji's (1992) structure used to examine the auto industry mutual dependence. The primary focus of the dependence relationship will center on a critical technology. Mutual dependency suggests the network leader will have a certain dependency on the affiliate and the affiliate will have a certain dependency on the network leader involving these factors.

First, the network leader's dependency on the affiliate will be caused by the importance of the critical technology that the affiliate supplies the network leader. Second, other sources of supply available to the network leader of this technology. Third, the scope of critical technologies (number of different ones) supplied by the affiliate to the network leader. A "high/low" rating will be used to rate each of the three elements. This rating

will be assessed using the semi-structured open-ended questionnaire (Appendix D) and according to the case study protocol in Appendix C. Ratings will be entered into the case data matrix featured in Appendix A.

The affiliate's dependency on the network leader will be caused first by the amount of critical technology support the affiliate receives from the network leader. Second, the amount of sales caused by the relationship with the network leader. (note: in this case, the network leader may "purchase" outputs directly from the affiliate or the network leader may control the sales of the affiliate indirectly through its technology standards or resulting complentiarities often seen in network externality environments). These two elements will be rated in the same way using a high/low rating.

This will produce a high/low score for the dependency level of the network leader on the affiliate and a high/low score for the dependency level of the affiliate on the network leader. After the ratings are placed in the case data matrix (Appendix A), they will be compared against the causal model prediction matrix in the Four-Force Model to predict internationalization outcomes as it relates to this relationship force resulting in a internationalization scenario outcome number (#1-4).

Proposition #2: The stronger the international network externality forces on a networked firm, that faster it will seek to internationalize

Extreme competition may occur early in the lifecycle with the winner taking all if their network achieves a significant critical mass over a competing network. This would suggest that firms would seek to exploit market share opportunities early in their

development. Significant market share opportunities reside in establishing early network advantages in international markets wereby a first mover may achieve a significant technology standard advantage. If international network externality forces are strong, networked firms will begin the internationalization process faster from birth than non-networked firms.

In order to assess the relative strength of international network effects on a firm, I will examine the level of technology differentiation required in the case decision and the level of economies of scale potential in the target international market. A high/low rating for each component will be developed and corroborated. This will represent the strength of the international externality force. An assessment of the speed of internationalization for the case decision will be determined in the questionnaire.

Proposition #3: The stronger the technology standards deviation force for an internationalizing firm into a target market, the less likely it will enter the market.

The technology standards deviation force is dependent on rival network size, level of compatibility of technology and government policy towards international technology standards agreements adoption.

The case study firms will be queried on relative network size of the domestic rival firm, the level of compatibility and government policy towards international technology standard adoption. A high/low rating will be determined for each component following the same procedure as previously described.

Proposition # 4: A networked firm will be more likely to enter a foreign market if its current level of internationalization involvement is high

The current level of internationalization of a firm provides a good indication of the foreign activities performed by the firm. Two elements will determine this level. First, the nature of the activities such as the level of involvement represented by a commitment to a subsidiary or strategic technology alliance verses just exporting. If a firm uses primarily export sales, it would be considered to have a low level of international involvement resulting in a low ability to operate in a foreign market. If the firm is operating subsidiaries or engaging in international technology strategic alliances, it would be considered to have a high level of involvement that would suggest a higher level of ability. A hi/low rating will be determined for ability.

Second, the proliferation of foreign activities in different markets. The number of international markets the firm is currently operating in through export, subsidiary or international technology strategic alliances will be an indicator of the willingness of the firm to internationalize. It is presumed that by operating in more markets, it has been historically successful and has continued to expand internationally based on past success. To measure the level of willingness, a firm's current number of international markets in which it conducts activities will be sought and a hi/low rating will be developed for willingness relative to other industry participants.

3.3 Research Design

In order to develop an empirically based explanatory dissertation with relevant causal relationships regarding the internationalization of firms operating in industries that exhibit network externalities, I use a multiple case study research strategy. As articulated by Yin (1994) this approach is good for complex organizational phenomena, of which firm internationalization has been described and addressing "how" and "why" types of research questions. In order to avoid a less than rigorous contribution to theory, the multiple case study methodology that I employ is of an explanatory nature seeking to identify and confirm causal relationships among key variables in internationalization. Having developed a priori theoretical constructs and propositions, I am following the inductive theory building process articulated by Eisenhardt (1989) and Eisenhardt (1991). Additionally, I am testing my theory according to the confirmatory case method highlighted in Johnston, Leach and Liu (1999). My primary test procedure will use the Degrees-of-Freedom analysis proposed by Campbell (1975) and applied in practice by Wilson and Woodside (1999). This procedure will allow me to quantitatively connect and analyze my qualitative data and determine the strength of my pattern matching between the observed and predicted realms (figure 1.7). Using the degrees-of-freedom analysis technique and corresponding critical value tests such as Sign Tests, chi-square and Z-Tests, I am able to provide quantitative rigor to my qualitative data. This pattern matching approach has been described and evolved by several researchers as a way of

applying quantitative analysis to qualitative data (Trochim 2000). In addition, each theoretical topic will be examined in the context of the multiple cases. A well disciplined cross case analysis will be used wereby my theoretical propositions will be used as a template with which to compare empirical results. It is suggested that "if two or more cases are shown to support the same theory, replication may be claimed" (Yin 1994). My goal using this methodology is to create multiple sources of evidence that will enable my narrative to generate a highly valid and reliable replication logic supported by a chain of evidence. This evidence will align with my overall analytic strategy which will rely on my theoretical propositions and not on a descriptive case study approach. Multiple case studies will be performed in concert with a case study protocol (Appendix C) that will support additional reliability. Using an "analytical generalization" approach suggested by Yin (1994), I will endeavor to connect the case study results to my theory.

To ensure a high quality research effort, I will take explicit steps throughout the research project to proactively address construct validity, Internal validity, external validity and reliability. Specifically, for construct validity, I will use multiple sources of evidence, establish a chain of evidence, and have interview sources review the draft case report. These exercises will be performed during the data collection and composition phases of the research. To establish internal validity, I will use a pattern matching technique during the data analysis phase. To achieve external validity, I will use a replication logic approach within the multiple case study design. And to introduce rigorous reliability, I will develop a case study protocol and create a case study database during the data collection phase. (Yin 1994)

My case study design will use a multi-case embedded design. This approach allows for multiple units of analysis, which I believe is necessary to properly capture the scope and understanding of the internationalization phenomena to be examined. I intend on utilizing various units of analysis that reflect the complex nature of this topic. First, my intent is to study why and how the firm internationalizes with the organization being the first unit of the analysis and what I consider the main unit of analysis. As a sub unit of analysis, I will focus on specific internationalization decisions of the firm. In order to keep the organization as the intended object of the study and not become the context of the study, I will use data from the industry level, organizational level and individual level.

Under the analytic generalization framework suggested by Yin (1994), multiple case studies are viewed not as sampling units as under a "statistical generalization" approach, but rather as individual experiments. Viewed in this way and in the context of my theory development, this approach seeks to create replication logic similar to multiple experiments of the same phenomena. Since my theoretical framework considers multiple decision outcomes for the internationalization of networked firms, I have stated my theory from a literal and theoretical perspective. From a literal perspective, I state under which conditions internationalization is likely to be found in these firms as well as conditions when it is not likely to be found. The replication logic I am pursuing is to predict similar results among 2-3 case decisions (for literal replication logic). In addition, I am seeking 2-3 case decisions that produce contrasting results but for predictable reasons (for theoretical replication logic).

I have developed a case study protocol shown in Appendix C containing the procedures and general rules followed in conducting each individual case study. This helps to improve reliability. The protocol includes the following key elements:

1. Overview of the project with objectives, issues and relevant readings on topic
2. Field procedures including specific case selection, company information and reminders
3. Case study questions to guide the investigation
4. An outline guide for the case study report

One of the strengths of a multiple case study strategy is the ability to use multiple sources of evidence. I have focused on three key sources.

First, interviews with key executives at the selected case companies. The executives have participated first hand in the internationalization decision making process for the firm. The goal of these interviews is to generate important facts on why and how these firms internationalization occurred and get opinions on which forces and factors were most important and how important the relative forces were in shaping their internationalization decision making. The interview procedure is outlined in the case study protocol.

Second, I have reviewed archival data on international expansion and sales activities from annual reports, 10K, 10Q, online resources, press releases and third party sources such as former employees, consultants and published books.

Third, I will seek documentation such as business plans, international sales strategy plans, and other archival records as suggested by Welch (2000) that could corroborate these other forms of evidence. In order to achieve a high level of quality in my data collection, I will focus on developing the multiple sources of evidence to increase construct validity. Using these multiple sources of evidence will allow me to create a triangulation approach (Yin 1994), wereby I achieve a convergence of information to support my theoretical propositions. I will also focus on maintaining a clear chain of evidence from my research question through conclusions. While not only increasing reliability, I hope to craft a compelling narrative that builds strong, empirically based causal support for my theoretical propositions and ultimate framework.

Case decision data will be gathered from firms selected on the following criteria. First, consistent with the "analytical" approach (Yin 1994), cases will be viewed as individual experiments. First, two firms will be selected who represent high technology "network leaders". Network leader being defined as: the focal organization or sponsor of the network that sets up the network and actively manages the network in order to benefit from its growth in size. The individual case firms are being drawn from three industries suggested by Chacko (1998) that exhibit network externalities. These network industries are; Semiconductors and Related Devices (SIC code 3674), Prepackaged Software (SIC code7372) and Computer Communications Equipment (SIC code 3577). By selecting from this targeted population, external validity will be increased by limiting extraneous variation. Since an "analytic approach" (Yin 1989) is being used rather than a statistical approach, random sampling is not a requirement. In addition, cases were selected based

on their theoretical usefulness and are treated as individual experiments for testing my a priori theoretical constructs and Four Forces Theory of Internationalization. Second, one firm representing high technology "affiliates" will be selected. Affiliate being defined: as a critical technology supplier to the network leader. This relationship may be of an output purchasing orientation, technology licensing or technical partnership supported by capital investment. The firm will be selected from the above industries. From each of the 3 firms, 3 internationalization decisions will be examined. In summary, a total of 9 "experimental" decision cases will be collected in order to test my Four Forces theoretical framework. This approach will be consistent with the analytical approach suggested by Yin (1994) and will focus on causal effects and explanatory outcomes.

3.31 Individual case methodology

The case study method for testing theory in business to business research is supported by Johnston, Leach and Liu (1999). Utilizing Eisenhardt (1989) and Yin (1989) recommended procedures for case study methodology, the following describes the methodology for the individual case studies. As previously discussed, the overall research design uses a multiple case study approach. To help increase reliability of the overall research, consistency across individual case research is being sought by using the following methodology. The case study protocol is displayed in Appendix C.

3.32 Instruments and Evidence

In order to achieve construct validity and increase reliability in this case study methodology, I have created multiple data collection methods to triangulate evidence. I am using a combination of qualitative and quantitative data to more fully capture the complex internationalization process being studied. While I will be the primary investigator, I will use a research assistant and faculty member knowledgeable in the material at hand. I will engage their strong academic backgrounds to suggest alternative perspectives and review key procedures.

By creating my Four Forces model, I have developed a priori constructs for my emerging theory as suggested by Eisenhardt (1989). This has helped to shape my research design in such a way as to enable the testing and building of the theory via an inductive process. Through this research process, I will have a firmer empirical grounding for my theory.

Using the constructs, propositions and their subsequent operational measures/indicators, I created causal model prediction matrix (Table 2.10) which displays the high or low aggregate intervening variable construct rating derived from my model. This prediction matrix was assembled with the guidance provided by Wilson and Vlosky (1997) and Fontenot and Wilson (1997). It predicts the internationalization scenario outcome based on the intervening variable rating (high or low). This matrix and the resulting model outcome scenarios (#1-4) are consistent with the graphical representations of the Four Forces model in Figures 1.2-1.6.

I have developed a data matrix (Appendix A) in order to collect and format the data from the various sources of evidence. The organizing of qualitative data enables the researcher to draw more valid meaning from the data and will subsequently improve the data analysis process (Miles and Huberman 1994). This data matrix provides the forum for determining the final observed intervening variable construct high /low rating for each primary construct under investigation. In turn, this rating is used to determine the internationalization outcome scenario predicted by my Four Forces model that is then compared to the actual internationalization outcome. A prediction hit (yes) or miss (no) is then determined by comparing the observed and predicted outcome scenarios. This hit/miss data is used in the quantitative degrees of freedom analysis (pattern matching) to assess the level of strength of the model and the propositions being tested. (Campbell 1975, Wilson and Woodside 1999)

In the data matrix (Appendix A) column one displays the primary constructs under investigation. Column two displays the measures/indicators used to operationalize the primary constructs. Column three indicates the high or low rating for the measure/indicator resulting form the various data sources. Column four displays the aggregate intervening variable construct rating assessed by the judge. The judge is the primary investigator who, based on the multiple sources of evidence available for each of the intervening variable construct, assigns a high or low rating. This rating is reviewed independently by the associate reviewer with supporting evidence available. The key informant reviews the final rating for each of the three decisions. This is done in order to maintain objective assessment and minimize researcher bias. Column five displays the

internationalization scenario as predicted by the Four Forces model based on the aggregate intervening variable construct rating (column four). Column six displays the actual internationalization scenario as reported by the case informant (the informant and investigator will jointly asses which scenario #1-4 most accurately describes the actual outcome and that number will be assigned to the data matrix) or as determined by other sources of evidence. Additional corroborating secondary data is sought. Column seven displays the hit or miss (yes or no) determined by comparing actual and predicted internationalization outcome.

There are three decisions per case resulting in three data matrices per case. Each data matrix has a high or low measure /indicator rating for each measure/indicator used to operationalize the primary constructs. Each measure/indicator has a high / low rating based on the informants response to the semi structured, open ended questionnaire (the informant is specifically asked during questioning to provide a high or low rating for the measure/indicator) as well as secondary data sources. The secondary data sources are used to corroborate informant ratings as well as suggest alternative explanations for data contradictions.

While the data matrix is used to format the data for later use in the degrees of freedom analysis, additional qualitative and quantitative evidence is recorded on a supplemental data collection sheet (Appendix B). This sheet is organized into five sections representing the 4 primary construct areas (relationships, network externalities, technology standards and internationalization) and one section (V) for “other”. Each case decision data matrix

has this data collection page attached to it. This page allows for additional evidence and data sources to be recorded and organized according to the relevant construct. This information is used to corroborate measure/indicator high/low ratings as well as provide for the collection of rich contextual data. In order to support the collection of data for the organization as the unit of analysis (and not just the internationalization decision), I have also used this page to collect "general" data about the case firm that is relevant to the phenomena in its context. This page will be included in the case database.

3.33 Case Questionnaire

An open-ended questionnaire (Appendix D) was developed to provide a semi-structured approach to the interview. This questionnaire features open-ended questions addressing each cell of the data matrix measure/indicator column. This questionnaire differs from the one outlined in the case study protocol, were the intent is to guide the researcher and focus on all sources of evidence and were it will come from to answer the question. Rather, this questionnaire provides a direct means from which to derive high/low ratings for the data matrix based on direct respondent input. Additionally, it allows for the structured probing of additionally relevant contextual information necessary for a thorough understanding of the internationalization phenomena of firms operating in complex network externality environments.

The questionnaire is divided into three sections. The first section solicits key descriptive information about the case under examination. Section two represents four subcategories of questions organized around the four primary constructs. Within each subcategory (i.e. relationships, network externalities, technology standards and internationalization) a series of questions addresses each measure/indicator from the data matrix. At least one part of the question specifically asks the respondent to rate the measure/indicator as high or low (i.e. high or low importance of critical technology). Section three asks the respondent to describe the actual outcome scenario of the internationalization decision under review as well as other generalized questions about the decision. The purpose of these general questions is to gather broader context dependent information and seek other contributing factors that may be significant to this decision process. Design of the instrument was guided by input from Dillman (1994).

The respondent is asked to addresses three internationalization decisions made by the case firm in the last three years and to answer all of the questions for each of the three decisions. It is suggested to the respondent that at least one decision be a "did not internationalize" decision. (Firm decided not to enter the foreign market with the technology or business under consideration)

The questionnaire was reviewed in a pilot interview and reviewed by faculty familiar with international business research.

3.34 Case Protocol

A case study protocol was developed (Appendix C) for use during data collection to ensure consistency and improve reliability. As suggested by Yin (1994) the protocol "contains the procedures and general rules that should be followed in using the instrument. Having a case study protocol is desirable under all circumstances, but it is essential if you are using a multiple-case design." The protocol I developed consisted of five sections. Section one is an overview of the research project briefly describing the relevant body of literature, a description of the Four Forces model and a description of the case study methodology and design. In addition, I provide my research question and propositions under investigation. Section two displays the letter of introduction for my project. Section three provides the field procedures guidelines for the collection of interview data and secondary sources. Section four provides the "case study questions" I am trying to ultimately answer. As noted by Yin (1994) "Two characteristics distinguish these questions from those in a survey interview. First, the questions are posed to you, the investigator, not to a respondent". "Second, each question should be accompanied by a list of probable sources of evidence."

Section five outlines my guide for the case study report.

3.4 Analytical Strategy

My general analytic strategy relies on my theoretical propositions and not a descriptive format. Hence, I use a theoretical orientation to guide the case study analysis. As noted above, these theoretical propositions are suggested answers to the how and why questions I have raised and are attempts at creating causal relationships among the variables. Specifically, I will be using a technique called Pattern Matching. This approach

"compares and empirically based pattern with a predicted one (or several alternative predictions). If the patterns coincide, the results can help a case study strengthen its internal validity" (Trochim 1989 and Yin 1994). Since my research strategy is explanatory in nature, the patterns are related to my dependent and/or independent variables. In order to achieve a higher level of quality in my analysis, I rely on relevant evidence that fits into the defined scope of this study. Within this scope however, I am exhaustive in my review of evidence and seek rival hypothesis.

3.41 Case study report

The compositional structure I am choosing is a cross case analysis covering explanatory topics with individual case study comments in each topic section. The format is described as a "Linear-Analytic" structure and follows a more traditional research report consistent with the needs of my dissertation structure. I will start with the statement of the problem with associated questions; review of relevant literature, method, and findings from analysis of data collected conclusions and implications. This approach is especially relevant to an explanatory format such as mine.

Chapter 4

Analysis and Results

4.1 Degrees-0f-Freedom Analysis of Case Data

The following analytical technique was first put forth by Donald Campbell (Campbell 1975). The DFA technique allows for the use of a "quantitative framework to gain insight and understanding about qualitative case data" (Wilson and Woodside 1999). I will use this approach to test the "pattern matching" between my theoretical propositions and observational realm data (Figure 1.7). Campbell (1975) suggests that this pattern matching is similar to having degrees of freedom in statistical tests:

> In a case study done by an alert social scientist who has thorough local acquaintance, the theory he uses to explain the focal differences also generates predictions or expectations on dozens of other aspects of the culture, and he does not retain the theory unless most of these are also confirmed. In some sense, he has tested the theory with degrees of freedom [emphasis added] coming from the multiple implications of one theory (pp. 181-182)

I created a pattern based on my Four Forces Theory represented by the causal model prediction matrix in Table 2.10. This predicted pattern for each force is compared to the observed pattern based on case data collected. Data was collected, rated and entered into the data matrix I developed in Appendix A. Using this data matrix for each case decision, I was able to determine the observed pattern for each decision and the resulting internationalization outcome. There are three decisions per firm (3 firms) creating a total

of nine data collection matrices (representing 9 internationalization decisions). The case study protocol (Appendix C) and procedure outlined in the individual case study methodology were used to conduct data collection and ensure reliability. Multiple sources of evidence were included in developing each as outlined in the research strategy section.

The qualitative case data contained in the nine case decision data matrices were transformed into a quantitative framework using "hits and misses" (Table 2.21). Meaning the observed pattern was compared to the predicted pattern from the model. This information was transferred into a single Degree-of-Freedom analysis matrix shown in Table 2.20. The hit percentage for each predicted internationalization scenario outcome correctly predicted is displayed for each row (Table 2.21). This hit % represents how well the observed outcome was predicted by the model for the specific intervening variable construct represented by that row. In order to determine if the level of pattern match is greater than that which could be expected by chance alone, statistical tests such as Sign Tests, Chi Square and Z-Test were conducted. The Sign Test and Chi Square tests were used to assess whether the pattern of hits and misses could occur through chance or whether there is an underlying pattern produced by the individual force under investigation. The Z-Test was used to test the entire table to determine the level of overall pattern matching for the model. By using this approach, I am able to better determine whether my theoretical propositions are supported while engendering a higher degree of objectivity and validity in this testing procedure.

The Sign Test uses plus and minus signs instead of quantitative measures as its data. According to Siegel (1956), "It is particularly useful for research in which quantitative measurement is impossible or infeasible, but in which it is possible to rank with respect to each other the two members of each pair." I use the application in this research to test whether the similarities between the expected outcome patterns and the observed outcome patterns could occur by chance or are due to the underlying forces suggested in the model propositions. The null hypothesis tested is: $p(Xa > Xb) = p(Xa < Xb) = ½$. Xa and Xb are the two hit scores (yes or no). According to Siegel, "In applying the sign test, we focus on the direction of the differences between every Xa and Xb, noting whether the sign of the difference is plus or minus. Under Ho we would expect the number of pairs which have Xa > Xb to equal the number of pairs which have Xa < Xb. That is if the null hypothesis were true, we would expect about half of the differences to be negative and half to be positive. Ho is rejected if too few differences of one sign occur." By subjecting the ratio of hits and misses to a binomial test with an associated p-level (one-tailed), I am able to determine the probability of the yes/no pattern distribution under Ho. From this I am able to evaluate the directional and statistical level for each outcome pattern match. In the context of this research, predicted directionally would mean that the construct under consideration accurately predicted the internationalization outcome which resulted in a yes under the hit column. Under the sign test (Siegel 1956), the following are the significance indicators: ++ Predicted Internationalization scenario outcome for intervening variable construct is supported both directionally and statistically ($p<0.05$); +, prediction is supported directionally; -, prediction is not supported directionally. The

resulting sign indicators are displayed in column 7 of the degrees of freedom analysis matrix (Table 2.20) and (Sign Test Data Table 2.21).

Chi Square test provides the opportunity to test the hypothesis that the frequency of occurrence in two categories will differ. Specifically, "The technique is of the goodness-of-fit type in that it may be used to test whether a significant difference exists between an observed number of objects or responses falling in each category and an expected number based on the null hypothesis." (Siegel 1956). In my case the null hypothesis Ho: there is no difference in the expected number of hits or misses (correct predictions or missed predictions), and any observed differences are chance variations to be expected in a random sample.

Using a One Sample chi-square test I have an expected frequency for the random sample of 4.5 (1/2 of 9). The formula I use for the calculation of the chi-square test statistic is represented in Siegel pp. 43, equation 4.5. "The larger the chi square value the more likely it is that the observed frequencies did not come from the population on which the null hypothesis is based." I have used a chi square critical value of 2.71 from Table VIII, pp.1012 and the procedure for testing a binomial proportion with chi-square testing for goodness of fit (pp. 585) for k-2 degrees of freedom. $\alpha = .10$, df (v)=1, (Watson, Billingsley, Croft and Huntsberger 1993). The resulting critical test comparisons are numerically represented in column 8 of the degrees of freedom analysis matrix (Table 2.20). If the probability associated with the occurrence under Ho of the obtained Chi

Square value for df=k-1 is equal to or less than the previously determined value of α, then Ho may be rejected. If not Ho is accepted.

A Z-Test is used to evaluate the overall results of the degrees of freedom analysis data matrix. By doing so, I am examining the gross pattern from all of the constructs involved in the model. This includes a total of 72 yes/no outcomes from the pattern matching analysis between the observed and predicted outcomes. The Z-test is used to determine whether the ratio of yes (accurate predictions) and no (missed predictions) is not significantly different from chance (a 50% ratio of yes to no's). The procedure for the test I am using is outlined in Watson, Billingsley, Croft and Huntsberger (1993), pp. 409. The null hypothesis Ho: The difference in the two distributions occurs by chance. By rejecting the null hypothesis, I will accept that there is a non-random pattern. This conclusion would further support my overall model.

4.2 Cross Case Analysis

The following narrative is an integrated cross-case analysis composition style suggested by Yin (1989). This approach is especially relevant for the multiple-case study approach and focuses the report on the cross case content rather than on individual cases. I will organize the analysis around the four forces in the model to facilitate a logical chain of evidence and support the explanatory topics with individual case citations. The use of the

chain of evidence approach improves construct validity. This approach is also consistent with Miles and Huberman (1994) usage of pattern matching techniques to build a logical chain of evidence for factor support in inductive theory building and testing. Using the pattern matching techniques and including the multiple case design with a replication logic increases internal and external validity respectively.

Individual cases were conducted according to the case study protocol outlined in Appendix C. This was done to insure consistency across individual cases and improve overall research reliability. Cases are defined as specific internationalization decisions conducted by a firm selected from the SIC industries under investigation. Three internationalization decisions per firm were analyzed. Three firms participated providing nine case decisions in total. Decisions to internationalize and decisions to not internationalize were captured. Confidentiality of some case firm information was necessary as a condition of data collection from some of the participating informants. When references are made to specific markets, firm identification has been limited were required.

4.21 Case firms

Case firms represented SIC code 3674 (Semiconductors and related devices) and 3577 (Computer communications equipment). Participant firms ranged in annual sales of $200

million to over $22 billion. Two of the firms are publicly traded; Cisco Systems and Lucent Technology. The third firm, Alpha Technologies, is private.
Participating interview informants consisted of vice president and director level executives.

Evidence was gathered from interviews, archival records, public filing documents (annual reports, 10k, 10Q and firm Web sites) and third party sources (former employees, consultants and published books). Multiple sources of evidence were used to corroborate information that supported intervening variable construct ratings in each decision data matrix.

4.21.1 Mutual Dependency force

My a priori model suggested that mutual dependency force construct would be represented by five measure indicators. These measure indicator ratings led to the creation of an intervening variable construct rating for the mutual dependency construct and I causally connected it to the internationalization scenario outcomes. (see Figures 1.2 and 1.3). Hence, how and why this influenced the internationalization decision were tested.

In the case firm's internationalization decision process, the strength of the mutual dependency varied from firm to firm and market to market. The force was not equally distributed among the participating partner firms. Some firms noted that their technology "partners" may not provide the core critical technology, but rather, complementary, support technology that was as critical as the core technology itself. For instance Cisco Systems noted that they rely on very few core technology partnerships, but peripheral service providers for international market support services are very important to the successful implementation of internationalization efforts. Without access to these support services, Cisco may not enter a target market with the critical technology. Mutual dependency on these service providers was very significant.

Case firm decision analysis supported the five measure indicators (importance of technology, availability, scope, resource support and outputs purchased) as relevant to the determination of the mutual dependence force strength (as indicated by high or low ratings). A key revelation was the non-symmetrical nature of the force distributed among the firms. Network leader firms (Cisco and Lucent) tended to rely on the first three factors- Importance of technology, Availability, Scope were as Affiliate firms (Alpha Technologies) involved in the decision process tended to rely more on the resource support and the outputs purchased factors. As a result of this, I had to inductively modify my model to include an additional causal matrix to differentiate between whether a firm was a Network leader or Affiliate. This process is consistent with Eisenhardt (1989) who suggests the use of inductive grounded theory building from rich qualitative case data.

4.21.2 Network Externalities Force

Case firms reflected this force in all decisions. While supply side economy of scale was important, demand side economy of scale factors seemed to predominate. One informant made it clear that strength of this force depended on whether their technology was "revolutionary" or "evolutionary". This product / technology characteristic context impacted the resource allocation to support the potential internationalization effort. Firms clearly based their economies of scale analysis on a potential for profitable returns on the critical technology into the targeted foreign market.

Another stream of commentary that surrounded the product context and affected the potential for economies of scale was the perceived position taken by the firm related to follower or leader strategy. If the firm thought that it could "march your army over a bridge someone else built", then it could strike quickly with a new evolutionary technology. The strength of the economies of scale force also rested on whether the technology was considered a "mass" technology and enjoyed a reasonably high standardization that enabled large-scale implementations. This would lead a firm to internationalize and leverage an existing technology opportunity more quickly if it could minimize some of the perceived technology introduction risk. This risk seemed to be much higher if the technology was more "revolutionary technology" and a high amount of resource effort needed to be put behind it's introduction into the new market.

While establishing a de facto standard was considered important for revolutionary technologies, it was the “decay” rate of a technology life span that primarily drove these technology firms to rapid internationalization efforts. In fact, in an in-depth discussion surrounding the product development side of their technology, one case firm indicated they consider their technology life span to be very short and primarily focused their product development on 1 to 1.5 year timelines. Beyond that, the firm indicated that the potential life span was too short and additional investment was unwarranted. This need for rapid deployment of the technology/business into the international marketplaces created several statements that “speed was critical” for international market introductions and expansions.

4.21.3 Technology Standards Force

In the discussions surrounding international technology standards, an interesting research point developed. During the first few interviews it became apparent that the state of word art created a gap between theory and practice. It was necessary to align definitions such as technology standards and international technology standards with commonly used phrases in the respective technology businesses. Two key phrases for the technology standards dimension used in practice are “homologation” and “compliance”. Case firms referred to “technology homologation” as equivalent to “technology standardization” in the context of creating common technology platforms for which internetworking can be

achieved. Compliance often referred to alignment with target market in-country standards necessary for entry. While my model called for compatibility with international standards as a key component of the standards deviation force, it appears to represent these two components. Another subtle distinction proposed by case firms was the term for "international" standards. Given the US domination of internetworking technology, these firms often referred to "US" and "Non-US" technology standards as key differentiation phrases.

Technology standards and the demand for compliance was key in the internationalization decision making process. Firms in several cases suggested that the need for "local" compliance was a temporal requirement prior to assessing other forces. In particular, this compliance was influenced by the nature of the customer. A distinction was made between "government" customers and "corporate" customers for technologies in international markets of interest. Although this distinction was cited for definitional purposes, it was agreed that compliance requirements for each were similar and no additional model adjustments were needed.

In two specific cases, (decision entry into Brazil and Japan), the internationalizing case firms reflected that while there may be adoption of international technology standards (for example case #1 and #3 specifically cited adoption of IEEE standards as a typical "technology consortium" example), it was government trade policy that appeared to determine the bulk of this force. So while technical trade barriers were not the primary forces, other government barriers created resistance. The firm's were very aggressive at

suggesting that they focused on government related technology contracts to help ensure that they created relationship capital on which to build future technology pathways into those targeted international markets. This was also somewhat evident in a case entry to China, but using different tactics.

In examining the network size of a domestic rival, case firms indicated that it was of somewhat marginal importance. While at certain points in a technologies lifecycle this might be important, because technology decay rates are so rapid, it was likely that the case firm could create an "evolutionary technology" that would allow them to access the existing network and perhaps take it over in time. Relative to government force elements and compliance elements, this was secondary.

4.21.4 Internationalization Force

This force was clearly a background force that influenced the internationalization decisions of case firms. It appears that given the high level of internationalization that two of the three case firms had, it was often the case that a decision was made in the context of a high international ability to start. However, the willingness component came into play in market specific decisions. The consensus across case firms was that if there was a particular market that demonstrated technology entry difficulty in the past, it would carry this persistence throughout decision making on future technology entries.

4.3 Results Discussion

The model pattern matching results using the Degrees-of-Freedom analysis are presented in Table 2.20. The mutual dependency force created by the shared critical technology between the network leader and the affiliate was evident and supported statistically as shown in row one and two. The intervening variable constructs "network leader dependence" and "affiliate dependence" as measured by importance of technology, availability, scope, resource support and outputs purchased, received model outcome scenario matching eighth of nine times representing an 89% hit rate and nine of nine times representing 100% hit rate respectively. Using a one tailed Sign test, this achieved a $p=.02$ and $p=.002$ respectively, which was less than the required critical test at $p<.05$. This result supported the predicted outcome both directionally and statistically ($p<.05$) for each and is represented in the table with "++". In addition, the chi-square value computed for the observed and expected frequencies of hits and misses was 5.44. The critical value with alpha at .1 and 1 degree of freedom (v) is 2.71. The result from $5.44>2.71$ allows me to reject the null hypothesis that the difference in the two distributions occurred by chance. From this I my conclude that my first two propositions are supported.

Proposition # 1:

The higher the mutual technology dependence, the greater the chance an "Affiliate" firm will be influenced by the "Network leader" firm to follow it to a new market.

Proposition # 1 A:

The higher the mutual technology dependence, the greater the chance the Network Leader firm will provide internationalization resource support to the affiliate for entry to a new market.

In addition, from the cross case analysis, my qualitative narrative finds consistent support for these conclusions leading to a triangulation of evidence to support this claim. As was previously suggested, given the rich nature of the qualitative information, I was able to gain insight into the relative strengths of the constituent components of the force. It became clear that the component "Importance of critical technology" seemed to dominate in the context of whether it was "revolutionary" or "evolutionary". Additionally, the sphere of what defined the technology included critical support services.

In row three and four (Table 2.20), the international externality force is represented with the demand for standardization and economies of scale components. Support for this force is mixed but for explainable reasons. The intervening variable construct "international standardization demand" was not supported. Only three of nine correct prediction matches were made resulting in a $p=.9$ which exceeds $p<.05$ for significance. The Sign test is not supported statistically or directionally and received a "-" indicator. The chi-square test value was computed as 1 and was less than the critical value of 2.71. As a result I could not reject the null hypothesis and conclude that this pattern could

happen by chance. However, the "economies of scale" component of this force was strongly supported. Nine of Nine predicted matches occurred creating a 100% hit rate and a "++" Sign test. This was statistically and directionally supported. In addition, the chi-square test value of 9 is greater than the critical value of 2.71 and I can reject the null hypothesis. The explanation for this mixed support centered on the "compliance" and 'homologation" of technology. My model and proposition suggested that firms would view international standardization demand as an attraction to a specific international market given that it would be easier to comply and little additional investment would be need for differentiation. The reality is that the case firms viewed their ability at developing and delivering evolutionary technology solutions as a core competency and accepted that non-standardization was an accepted fact of entering new international markets. Additionally, because of the presence of fairly dominant technology platforms, each firm was familiar enough with the competing solutions that they constantly evolved their own solutions to comply. With respect to the economies of scale component, this was clearly the dominant component of the force and was central to the decision making process. Without demand side effect opportunities, firms were consistent in there reluctance to consider the market. When demand side opportunities were determined to be present, the case firms moved very quickly to internationalize in order to avoid "decay rate" effects that would limit their profit opportunities for the technology and market. In other words, they needed to launch the new technology into the new market before it became obsolete. While there were a few "strategic" decisions to enter a market when the demand side economies of scale were marginal, most decisions rested soundly on the

potential profit returns analysis. Given the mixed evidence for this force I can only claim partial support for my proposition.

Proposition #2

The stronger the international network externality forces on a firm, that faster it will seek to internationalize in order to gain critical network market share.

Row four and five represent the international technology standards deviation force with the domestic rival threat and trade & technical barriers as the respective intervening variable constructs. The measure indicators for these are rival network size for rival threat, level of compatibility and government policy for trade and technical barriers. Rival threat achieved 6 out of 9 predicted scenario outcome matches (67% hit rate) and trade and technical barriers achieved a 78% hit rate with seven out of nine matches. These represented a p=.254 and p=.090 respectively. According to the Sign test, these achieve a directional support only (+) as they exceed the p<.05 standard. The chi-square test value for the domestic rival component is 1 which less than the critical value of 2.71 and thus I cannot reject the null hypothesis. The chi-square test value for the trade and technical barrier component is 2.78, which exceeds the critical value of 2.71, and I can reject the null hypothesis. The domestic rival force gained directional support under the Sign test but I could not reject the null hypothesis under the Chi-square test. Relying on additional evidence, an explanation for this outcome rests on the temporal nature of the technology. Case firm's felt that a rivals network size may be a relevant force to contend with if it is a newly established "revolutionary" technology. If the case firm's technology is not evolutionary and the case firm cannot "march over the bridge created by another

army" then it considers the force to be potentially strong. But, if the rivals large network is based on older technology that can be overcome with the introduction of a new "evolutionary" technology, then the case firms perceived the rival threat as minimal. The misses in the predictions resulted primarily from firms who identified the rival networks as large, but still proceeded to internationalize because they possessed an evolutionary technology that allowed them to minimize the domestic rival threat. Hence, while the outcome scenario was not predicted, it was so for predictable reasons. (Theoretical replication logic).

The trade and technical barrier component received statistical (chi-square) and directional (Sign test) support. Case analysis was consistent and provided additional insight into the causal nature of this force component. Government policy played a significant role in most of the decisions. In a few of the markets (China, Brazil and Russia) a temporal effect was displayed. These markets and their respective governments are in the early stages of internetwork infrastructure development. Given the case firms I selected, they were in a fairly unique time period as governments in these markets were actively seeking technology infrastructure arrangements. As a result, one of the key strategies of case firms was to establish a direct technology agreement with the government in order to pave the way for future technology entries into the market. Given that these countries possessed limited internal technology and deployment resources, the attraction of external providers was high. The result of this early stage technology market infrastructure development was that, although government barriers may be perceived as high, clearly the case firm would internationalize into the market if it could secure a favorable government contract or venture.

Based on the statistical and directional support, combined with the qualitative nuance provided from case firm decision review, I claim overall support for my proposition.

Proposition #3: The stronger the technology standards deviation force for an internationalizing firm into a target market, the less likely it will enter the market.

Row six and seven represent the components of the level of internationalization force. Specifically, the intervening variable construct is "ability" using the measure indicator level of involvement and "willingness" using number of markets entered. The "ability" component achieved eight out of nine matches for an 89% hit rate. This represents a $p=.02$ for the Sign test and is less than the required $p<.05$. This provides statistical and directional significant (++). In addition, the chi-square test value of 5.44 exceeds the critical value of 2.71 and I can reject the null hypothesis. The "willingness" component achieved six out of nine achieving a 67% hit rate. This represents $p=.254$ which is greater than the required $p<.05$ for statistical significance under the Sign test. However, it did receive directional support (+). The chi-square test computation produced a value of 1, which is less than the 2.71 critical value required and I could not reject the null hypothesis. This force represents the process side of my model. My case firms have represented a strong ability to operate in international markets as evidenced by their existing operations and current success. This was clearly reflected in the data. Willingness, according to my model, was relatively dependent on past successes or failures. Given the fairly recent nature of the case firms, many had no real significant failures that would suggest a lack of willingness to enter a new market. The data that

suggested misses in my model seemed to be explained by case firm decisions were willingness centered on the technology at hand rather than past internationalization success/failure experience of the firm. In fact case decision review suggests that while there may be a high willingness to enter the market, other forces take on a more powerful role and force interactions occur. For example, compliance issues may temporally dominate technology internationalization decision making before other factors enter the process. It appears, at least at this stage, that the internationalization force is a background force to the others in the model. In addition, for the current firms under investigation, its strength may be dependent on the stage of firm development, which is consistent with "process" theory. Given the full statistical support for the ability component and the directional support of the willingness component in addition to the contextual evidence support from case firm decision reviews, I claim support for my proposition.

Proposition # 4:

A firm will be more likely to enter a foreign market if its current level of internationalization involvement is high

I next performed an overall model pattern matching test using a Z-test analysis. The procedure for the Z-test described above generated a test value of 4.714. The critical test value for Z .005 is 2.576. Since 4.714 > 2.576, I can reject the null hypothesis Ho and conclude that my overall model has produced a pattern of predicted internationalization outcomes that could not be generated by chance alone and this would produce statistical support for my model as a whole.

Chapter V

Conclusions

5.1 Summary of Findings

This research lends strong support for the Four Forces Model of Internationalization for technology firms operating in network externality environments. Using the framework I developed, I have been able to successfully predict and explain some of the key forces significantly influencing the internationalization decision making of these firms. I have tested the model empirically using a multiple case research design. By integrating the quantitative data analysis technique Degrees-of Freedom (DFA) I have been able to quantitatively and statistically assess the strength of my model. The pattern matching approach has enabled me to transform qualitative data into a quantitative format. First, my proposition that the higher the mutual technology dependence, the greater the chance that an affiliate firm will be influenced by the network leader firm to follow it to a new market is supported. If there exists a strong mutual dependence between a network leader firm and affiliate firm surrounding a critical technology this leads both firms to strongly consider their network ties in relation to their internationalization decisions. This is consistent with the network theory approach to internationalization presented in the extant literature. Additionally, I have found support for network leader firms providing resource support to firms it deems necessary to successfully deliver its technology to the targeted international market. Inductively adding to my model, it was found that the definition of critical technology included a sphere of services to support the technology and that companies within this sphere are network participants with high network power. These findings are supported statistically.

My proposition that the stronger the international network externality forces on a firm, the faster it will seek to internationalize was partially supported. This represents the economic component of my model. Importantly, it was shown that demand side potential economies of scale was a primary factor in the internationalization decision making process of these firms. Consideration of this component of the international network externality force by firms in their internationalization decision making was paramount and exceeded the demand for the standardization component. This finding both supports and helps to clarify the role of economic forces within a network externality environment. My proposition that the stronger the technology standards deviation force for an internationalizing firm into a target market, the less likely it will enter the market was supported. My research showed that the primary components of this force were government policy and compatibility (though compliance and homologation) while rival network size was only significant if the rival possessed a truly "revolutionary" technology that could not easily be overcome with an "evolutionary" technology. Although my proposition that a firm will be more likely to enter a foreign market if its current level of internationalization involvement is high sounds intuitive, it was none the less important in the context of the other forces. This force represented the process side of my model. Given the recent nature of these case firms and their subsequent internationalization, I have suggested that we are viewing the early stages of their process development. The evidence suggests that these firms have based their willingness to enter international markets more to rapidly exploit technologies they have developed in the present (before they decay) and are less dependent on a "stages" approach to international market development. My case firms have represented a strong ability to

operate in international markets as evidenced by their existing operations and current success.

The overall model was tested using a Z-test. Results suggest that there was a significant pattern match between observed outcomes and predicted outcomes from the model. This lends additional support and validation for the Four Forces Model as these pattern matches could not happen by chance alone.

5.2 Research limitations and Future Research

This study makes important contributions to our understanding of how and why technology firms operating in network externality environments internationalize. There has been strong consistency across results supported by the various tests outlined above lending credibility to the various interpretations outlined in the analysis and conclusions. However, like most research there are limitations in the method employed, cases selected and analysis performed. Hopefully, these limitations will lead to further research opportunities. It is hoped that the current research findings will stimulate further inquiry into this very interesting and unique internationalization environment. First, while I have briefly acknowledged that there are force interactions and suggested a few explanations, my research did not specifically address these in the model or in the methodology. Throughout the inquiry, case firms alluded to interactions among the forces, but in order to limit my scope of project and focus on the testing of the primary propositions, specific steps were not taken to incorporate these results into this study. Future research might investigate these interactions from a longitudinal and temporal perspective.

There have been limitations in past internationalization research that are relevant here. First, the timeframe over which previous internationalization studies cover varies and may not provide insight into early stage internationalization processes. For some studies such as Barkema 1996; Turnbull 1987; Turnbull and Valla 1986, the time frames selected are for a specific period of years of operations. This does not include the beginning of the internationalization process and only focuses on some middle period. According to Clark, Pugh and Mallory 1997, this does not adequately addresses the "impact in this time period of accumulated knowledge which may have been built up as a result of expansion into foreign markets in earlier time periods." My study has addressed this early stage period. However, given that I am only focused on this stage, my research does not capture the mature middle stages that could reflect more failure outcomes. Significant failures could impact the Four Forces Model especially in the internationalization level area. (i.e. willingness and ability)

Another area of concern surrounds studies that focus on one particular market expansion. For example, Hedlund and Kverneland (1985); Turnbull (1987); and Millington and Bayliss (1990) limited the number of markets to which expansion occurred possibly excluding the full range of markets actually internationalized by the firms. Again Clark points out that this can distort the overall picture of firm internationalization since only part of the general knowledge regarding the firm internationalization process is represented. This gap leaves out important influences that may significantly impact firm

internationalization behavior (i.e. mode of entry choice). As was discussed in the "process" literature, "knowledge accumulated in other (i.e. excluded) nations may have an impact on the type of institutional arrangement found in those national markets which are the focus of the study, but it's impact will be ignored". (Clark, Pugh and Mallory 1997). While my current research did cover three decisions per firm, this may not have been an ample representation of overall firm internationalization decision making.

Chetty (1996) highlights limitations of research in exporting. Most has been limited to exploratory and quantitative which places a limit on certain relationships. The emphasis is on content and lacks an in depth look at the process. Aaby and Slater (1989) suggest that "The majority of export studies reviewed here utilize cross-sectional research designs." They go on to suggest that in order to examine causation, a more longitudinal approach is necessary. While the decision analysis may have captured some longitudinal aspects of the decision process, again, it was primarily focused on early stages. In addition, since I have sought to achieve a richer investigation by using a multi-case research design I could have focused more on the complete decision network. This would have entailed developing detailed causal displays for multiple network partner decision analysis as outlined by Miles and Huberman (1994). This would have required extensive participation by the network leader and several affiliate firms in the decision sphere and would have moved beyond the didactic relationship analysis I have performed. Future researchers could use the larger network sphere as the unit of analysis.

The current research under consideration has additional limitations. First, given the recent nature of the digital business phenomenon, we are most probably observing the first stage of evolution. Only recently have there been a significant number of market failures from which some judgements about success can be made. Additionally, many of the firms that are operating in this space today have only do so under ideal macroeconomic conditions (i.e. the US bull market of the 1990's). Only since March of 2000, have they begun to experience a declining business cycle. This may significantly impact many aspects of the business including internationalization and the strategies associated with it. The generalizabiltiy of the findings of this research may be somewhat limited to positive macroeconomic environments.

5.3 Implications for Theory and Management

The fundamental theoretical contribution of this dissertation is the development of a framework that encompasses the unique economic, technology and relationship forces associated with network externality environments and relates them to the internationalization decision making process of a technology firm operating in this environment. The Four Forces Model of Internationalization that I have developed and empirically tested, fills a gap in the current theoretical internationalization models. This

gap was created by a singular focus on and the use of independent paradigms for economic, behavioral and relationship forces. I have represented the three paradigms in such a way as to help explain the "why" and "how" of high technology firm internationalization in network externality environments.

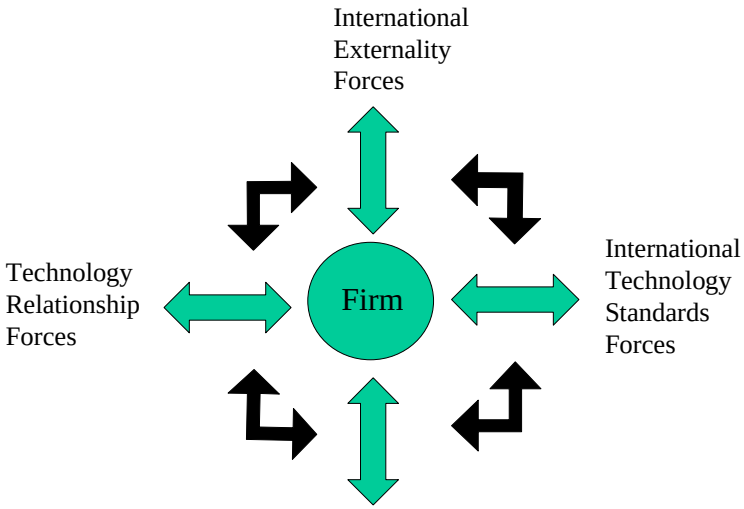
This dissertation makes several contributions to management research. There has been almost no empirical research to date done in the area of internationalization and network externalities. Given that the network industries experience significantly different dynamics than non-network industries (Katz and Shapiro 1986), internationalization decision strategy is lacking well-informed, empirically backed information. In this dissertation, I showed that the level of mutual dependency center on a critical technology and support services are a very significant factor for internationalization decision making. Unilateral entry decisions by firms without proper understanding or awareness of critical network relationships may be ill conceived and result in less than optimal outcomes.

Several of the classical internationalization models use supply-side economies of scale as a key internationalization driver. I have shown that for firms operating in network externality environments, demand side economies of scale may be a more dominant force. This has significant managerial implication for international business planning and resource allocation. Firms operating in these environments will focus on speed of entry, decay rates of technology and the nature of the product (revolutionary or evolutionary) and how best to plan for and deploy these technologies before the opportunity passes. Significant market share opportunities reside in establishing early network advantages in international markets wereby a first mover may achieve a significant technology standard

advantage. By doing so, they create a high switching cost scenario and may achieve significant lock-in effects. Early entry may also help to achieve a positive tipping effect toward one of several non-compatible standards vying for network dominance. This may suggest that product development decisions will limit development timelines and significant resource deployment for international markets will be considered early in the product development investment cycle in order to optimize compliance and homologation opportunities in foreign markets.

While government trade barriers have always been a significant part of the internationalization equation, the addition of technology standards and technology infrastructure development can play a significant role in the tactical choices of firms operating in these network markets. A small technology platform lead via a specialized government technology contract can provide a firm with a strategic advantage in early infrastructure deployment. This can create some forms of path dependency for the specific market. This is likely to weigh heavily on managerial decision making and force firms to proactively engage means for accessing these opportunities. (i.e. early planning for and participation in private business council forums that enable and facilitate government and technology relationship interfaces).

Figure 1.1
Depicts Four Forces Model Theoretical Framework



Hecox

Figure 1.2

A causal model: Outcome pattern matching with 4 outcomes arrayed ordinally from higher internationalization likelihood to lower internationalization likelihood. This represents the ordering of effects for predicted theoretical pattern outcomes

FORCE ONE: TECHNOLOGY DEPENDENCY FORCE for Affiliate

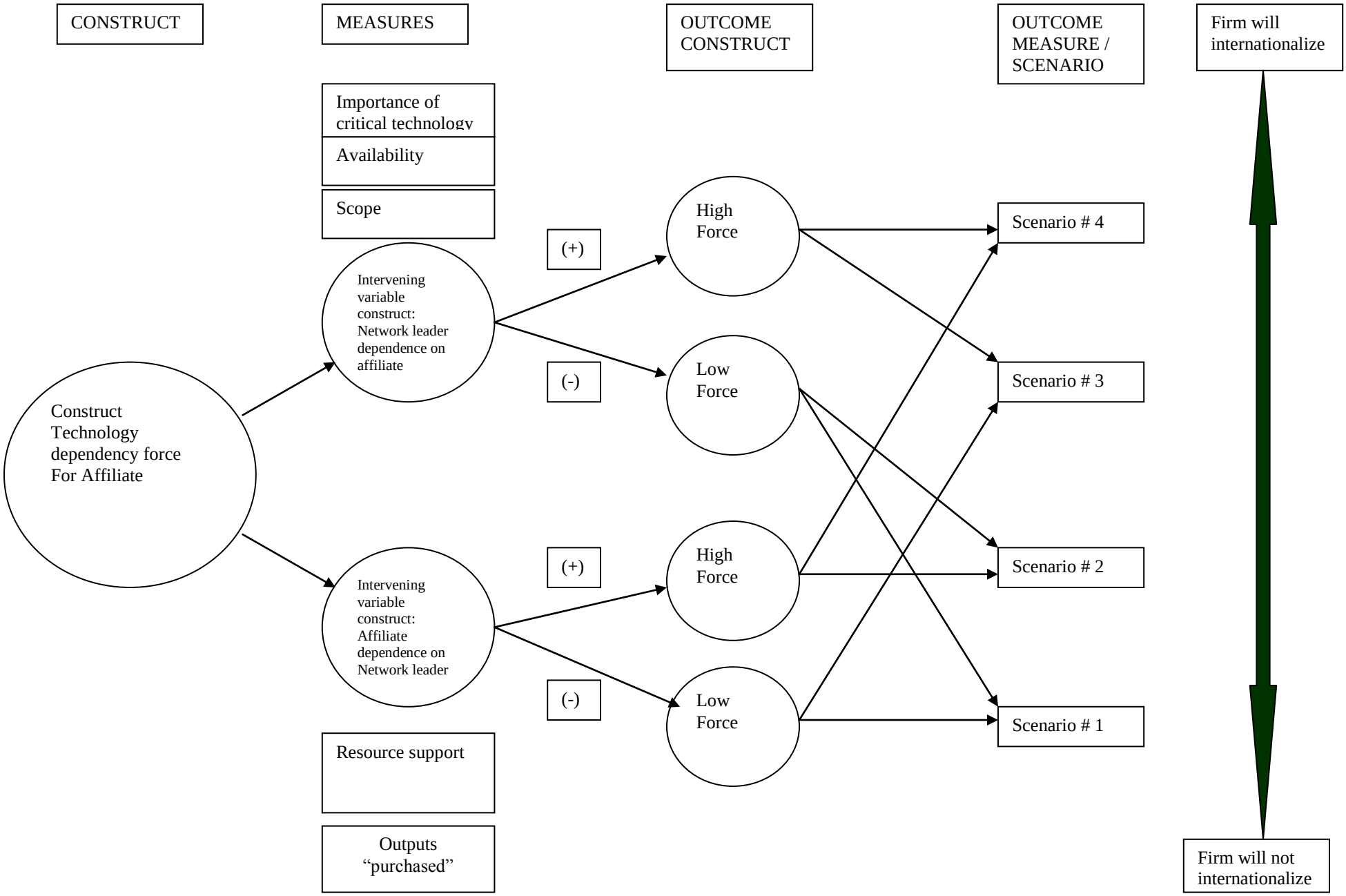


Figure 1.3

A causal model: Outcome pattern matching with 4 outcomes arrayed ordinally from higher internationalization likelihood to lower internationalization likelihood. This represents the ordering of effects for predicted theoretical pattern outcomes

FORCE ONE: TECHNOLOGY DEPENDENCY FORCE for Network Leader

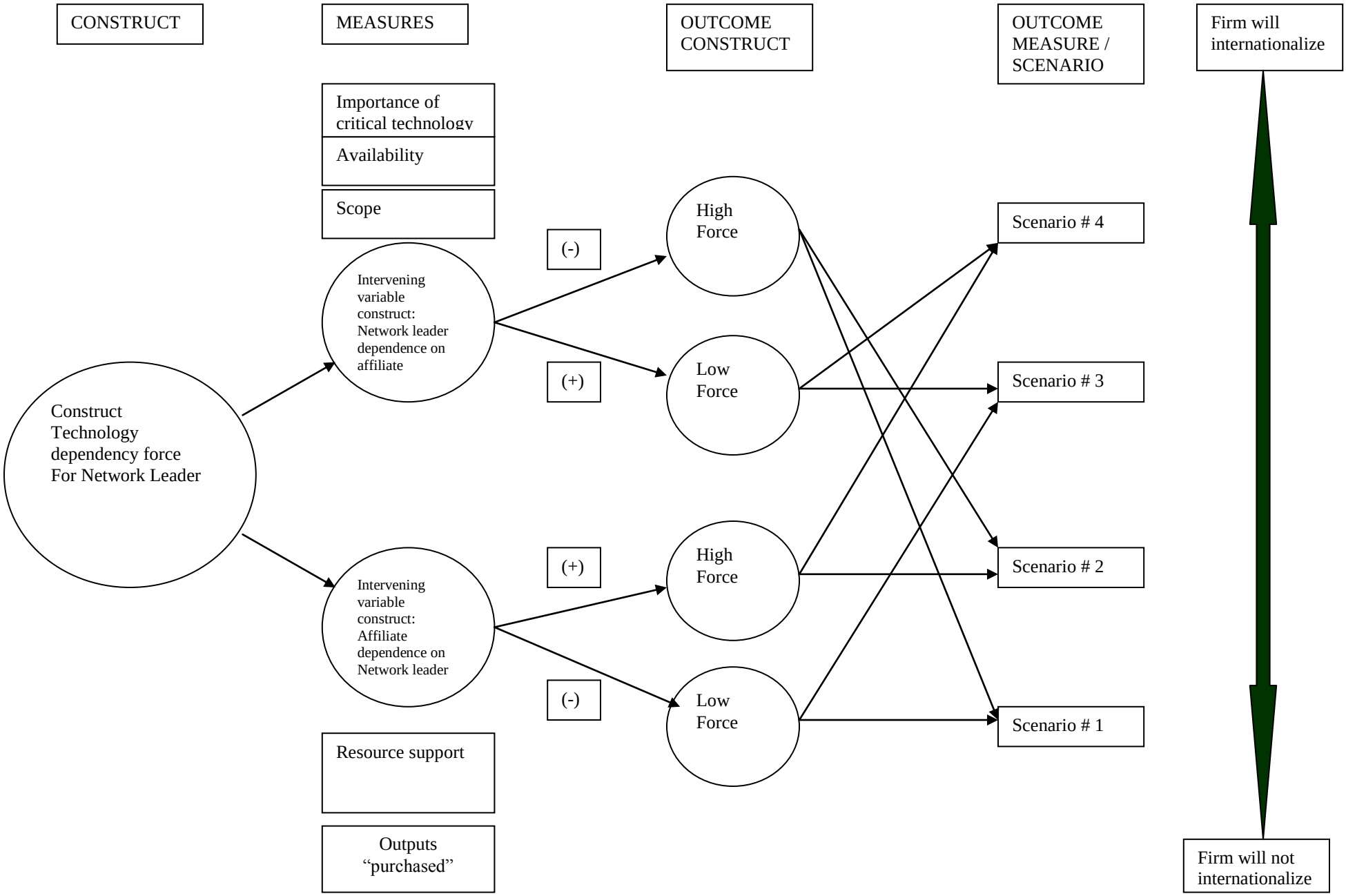


Figure 1.4

A causal model: Outcome pattern matching with 4 outcomes arrayed ordinally from higher internationalization rate and speed to lower internationalization rate and speed. This represents the ordering of effects for predicted theoretical pattern outcomes

FORCE TWO: INTERNATIONAL NETWORK EXTERNALITIES

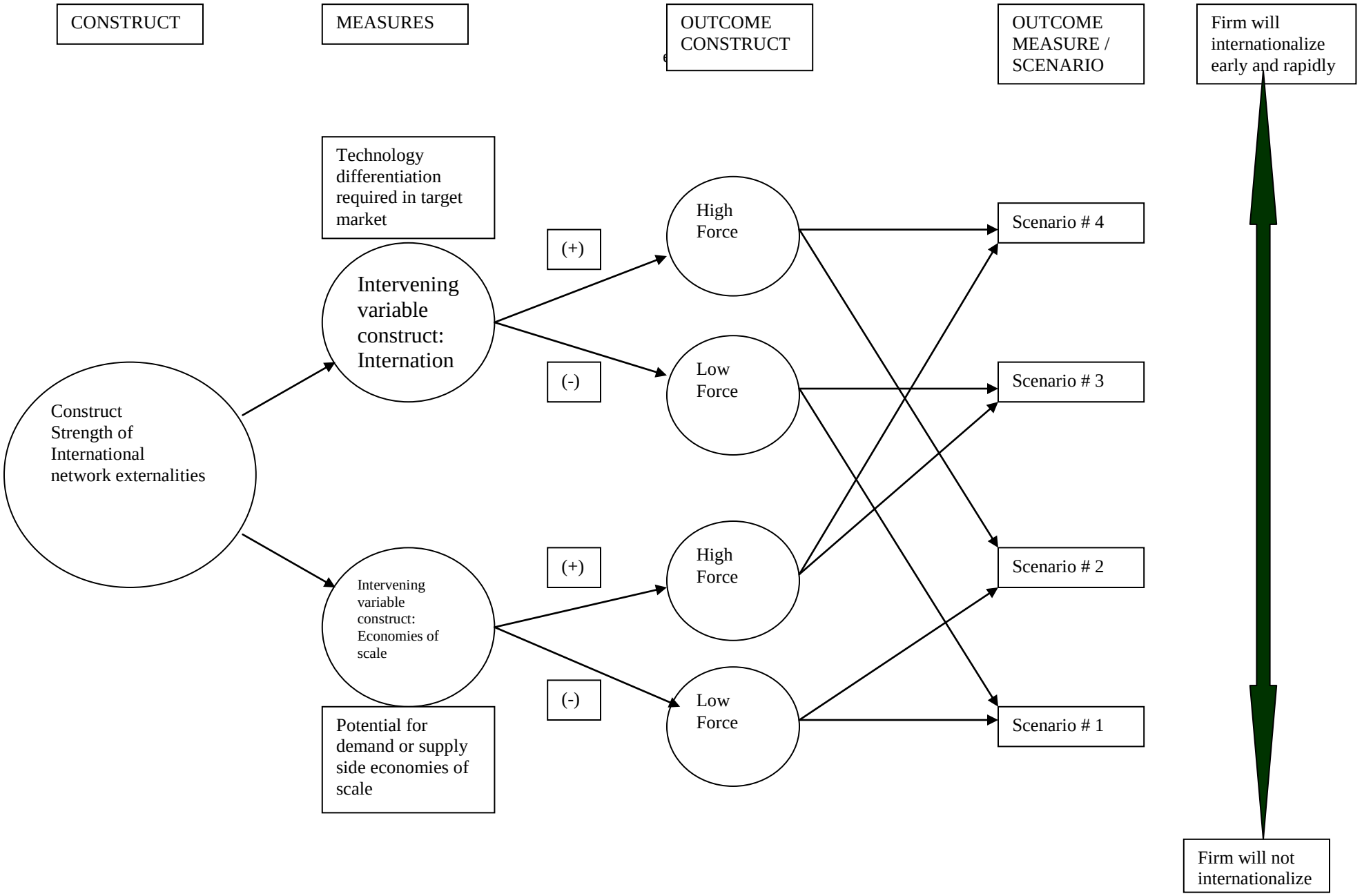


Figure 1.5

A causal model: Outcome pattern matching with 4 outcomes arrayed ordinally from higher internationalization likelihood to lower internationalization likelihood. This represents the ordering of effects for predicted theoretical pattern outcomes

FORCE THREE: INTERNATIONAL TECHNOLOGY STANDARDS DEVIATION

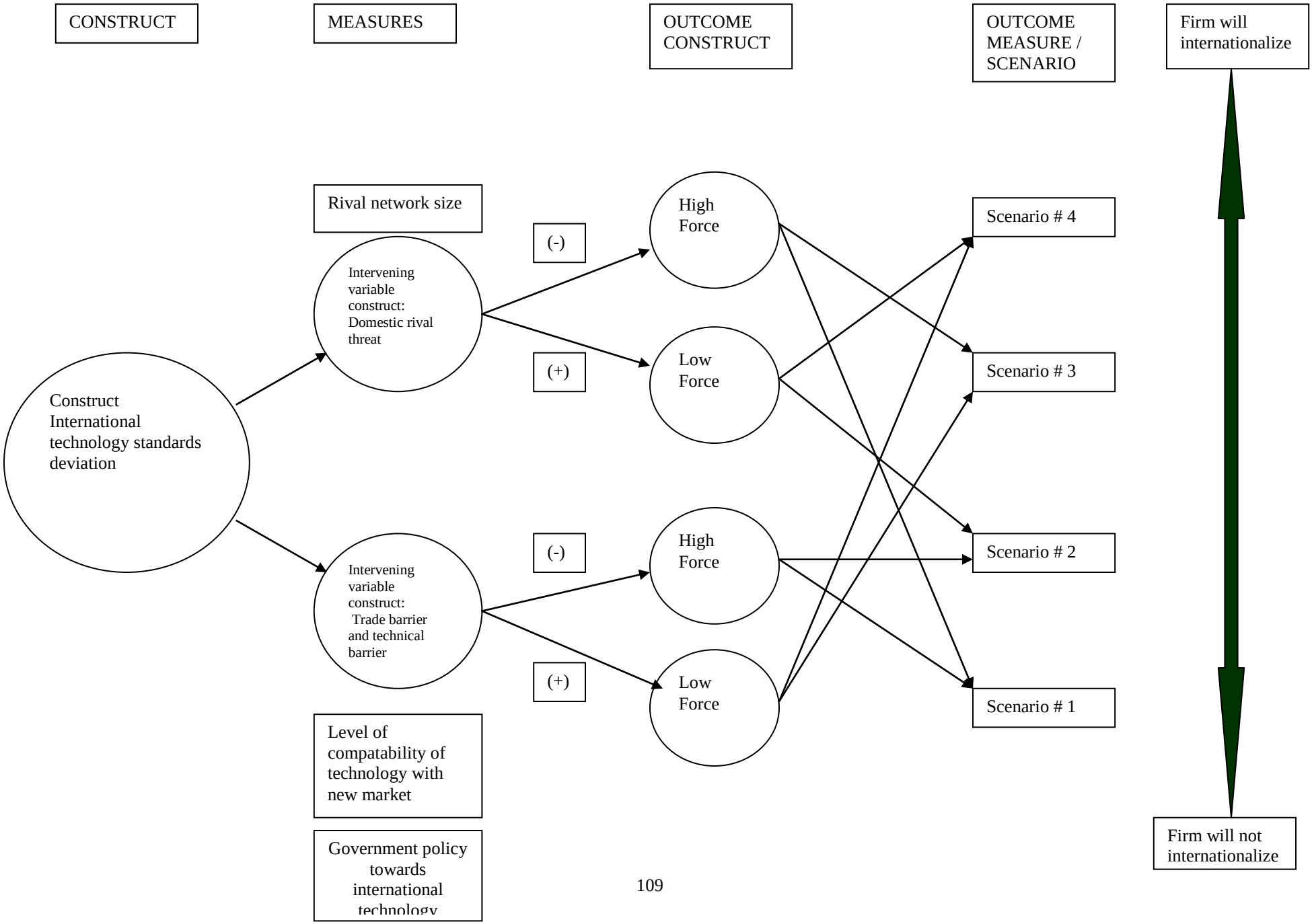


Figure 1.6

A causal model: Outcome pattern matching with 4 outcomes arrayed ordinally from higher internationalization likelihood to lower internationalization likelihood. This represents the ordering of effects for predicted theoretical pattern outcomes

FORCE FOUR: LEVEL OF INTERNATIONALIZATION

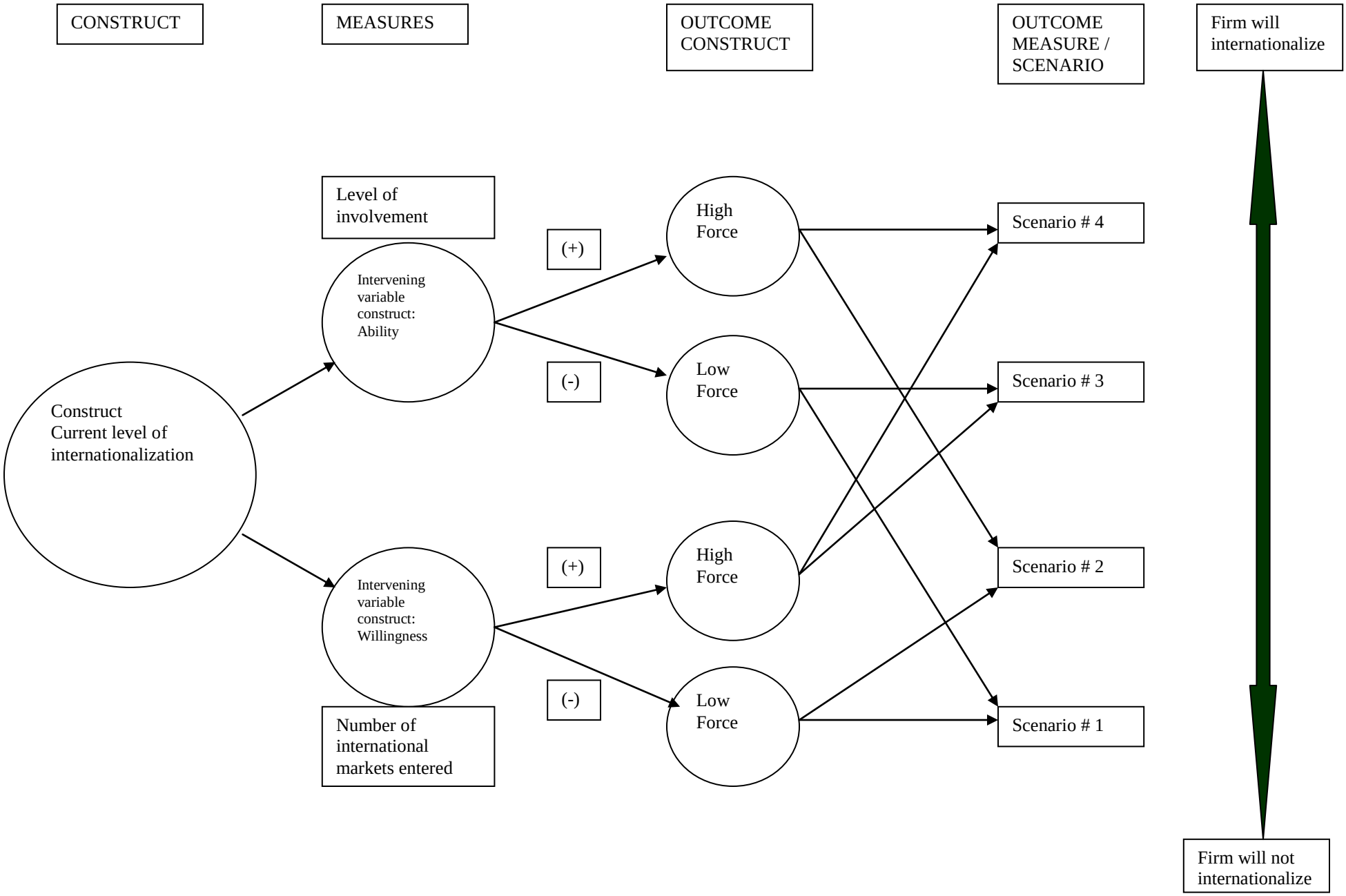


Figure 1.7

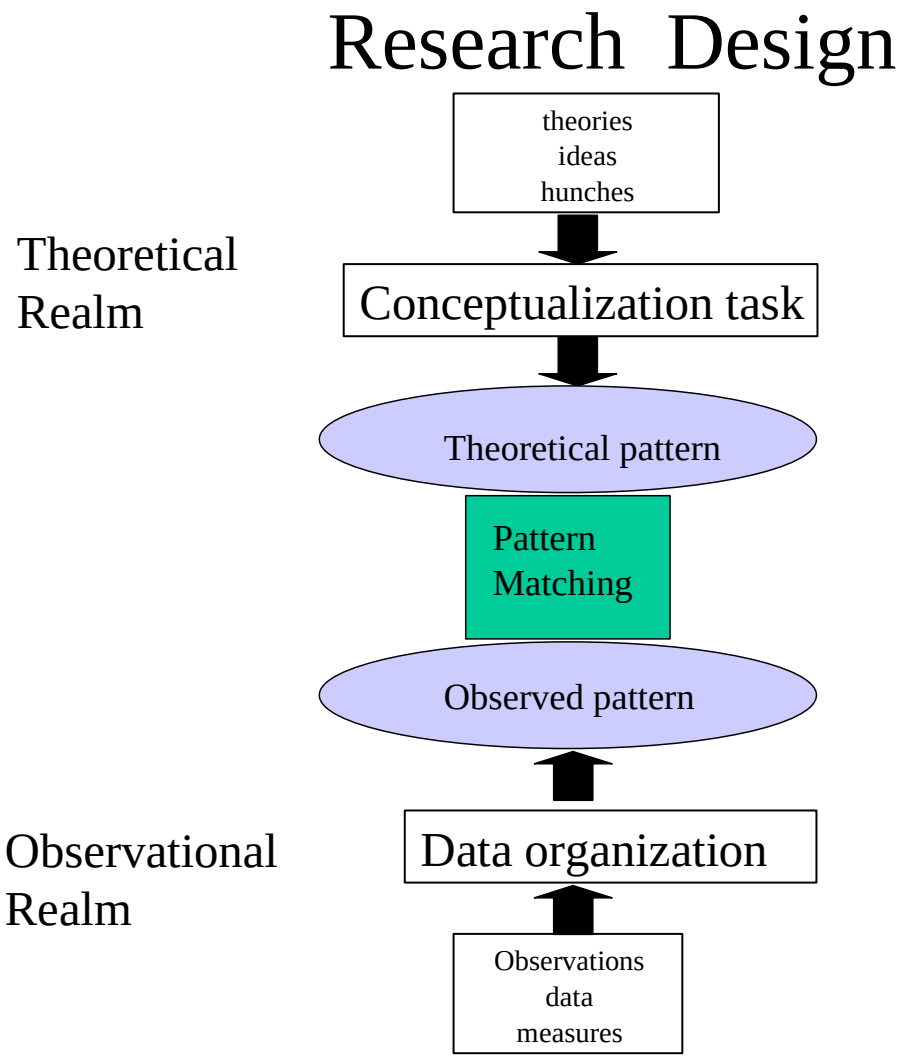

Research Design
theories
ideas
hunches
Theoretical
Realm
Conceptualization task
Theoretical pattern
Pattern
Matching
Observed pattern
Observational
Realm
Data organization
Observations
data
measures

Figure 1.8

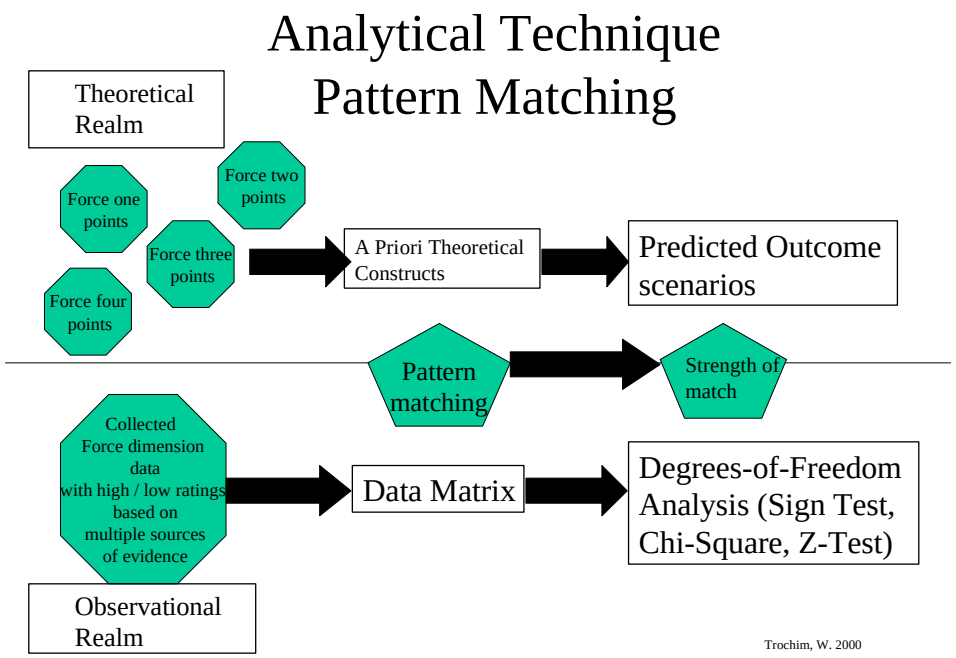

Analytical Technique
Pattern Matching
Theoretical Realm
Force one points
Force two points
Force three points
Force four points
A Priori Theoretical Constructs
Predicted Outcome scenarios
Pattern matching
Strength of match
Collected Force dimension data with high / low ratings based on multiple sources of evidence
Data Matrix
Degrees-of-Freedom Analysis (Sign Test, Chi-Square, Z-Test)
Observational Realm
Trochim, W. 2000

Table 2.10

Causal model prediction matrix for general constructs

Aggregate rating of indicators assessed by evaluator/judge based on multiple sources of evidence

Construct	Intervening variable construct	Intervening variable construct rating (high or low)	Predicted Internationalization Scenario Outcome (# 1-4 for each construct)
	Network leader dependence on affiliate	H-High L-Low	#3 or #4/1or2-NL #1 or #2/3or4-NL
Mutual Dependency Force			
	Affiliate dependence on Network Leader	H-High L-Low	#2 or #4/1or3-NL #1 or #3/2or4-NL
	International demand for standardization	H-High L-Low	#2 or #4 #1 or #3
International Network Externality Force			
	Economies of scale	H-High L-Low	#3 or #4 #1 or #2
	Domestic rival threat	H-High L-Low	#1 or #3 #2 or #4
International Technology Standards Deviation Force			
	Trade and technical barriers	H-High L-Low	#1 or #2 #3 or #4
	Ability	H-High L-Low	#2 or #4 #1 or #3
Level of Internationalization			
	Willingness	H-High L-Low	#3 or #4 #1 or #2

Degrees of freedom analysis - Pattern matching

Table 2.20

Construct	Intervening variable construct	Intervening variable construct rating (high or low)	Predicted Internationalization Scenario Outcome (# 1-4 for each construct)	Hits (%)	N number of cases	Significance Sign test*	Significance Chi test $X^{2}_{.1,1}$
Row # 1	Network leader dependence on affiliate	H-High L-Low	#3 or #4/1or2-NL #1 or #2/3or4-NL	89%	9	++	5.44>2.71 reject Ho**
Mutual Dependency Force							
	Affiliate dependence on Network Leader	H-High L-Low	#2 or #4/1or3-NL #1 or #3/2or4-NL	100%	9	++	9.0>2.71 reject Ho
	International demand for standardization	H-High L-Low	#2 or #4 #1 or #3	33%	9	_	1<2.71 cannot reject Ho
International Network Externality Force							
	Economies of scale	H-High L-Low	#3 or #4 #1 or #2	100%	9	++	9.0>2.71 reject Ho
	Domestic rival threat	H-High L-Low	#1 or #3 #2 or #4	67%	9	+	1<2.71 cannot reject Ho
International Technology Standards Deviation Force							
	Trade and technical barriers	H-High L-Low	#1 or #2 #3 or #4	78%	9	+	2.78>2.71 reject Ho
	Ability	H-High L-Low	#2 or #4 #1 or #3	89%	9	++	5.44>2.71 reject Ho
Level of Internationalization							
	Willingness	H-High L-Low	#3 or #4 #1 or #2	67%	9	+	1<2.71 cannot reject Ho

Siegel (1956) Sign Test for significance indicators: ++ Predicted Internationalization scenario outcome for intervening variable construct is supported both directionally and statistically ($p<0.05$); +, prediction is supported directionally; -, prediction is not supported directionally. ** Ho: there is no difference in the expected number of hits or misses (correct predictions or missed predictions), and any observed differences are chance variations to be expected in a random sample.

Data Table 2.21 Sign Test

Intervening variable construct (row # 1-8 from Table 2.20)	Number of Hits "Yes"	Number of Misses "No"	Ratio of Hits	P value the ratio of hits to misses to a binomial test with an associated p-level (one-tailed) $\alpha = .01$	Sign Test Indicator
#1	8	1	.89	.02	++
#2	9	0	1.00	.002	++
#3	3	6	.33	.910	-
#4	9	0	1.00	.002	++
#5	6	3	.67	.254	+
#6	7	2	.78	.090	+
#7	8	1	.89	.02	++
#8	6	3	.67	.254	+
Total	58	14			

Siegel (1956) Sign Test for significance indicators: ++ Predicted Internationalization scenario outcome for intervening variable construct is supported both directionally and statistically ($p<0.05$); +, prediction is supported directionally; -, prediction is not supported directionally. ** Ho: there is no difference in the expected number of hits or misses (correct predictions or missed predictions), and any observed differences are chance variations to be expected in a random sample.

Appendix A

Data Matrix Case #_____ Decision #_____

Construct	Measure/ indicator	Measure/indicator Rating (from interview, questionnaire and/or secondary data sources)	Intervening variable construct rating (high or low rating determined by judge based on aggregate data)	Predicted Internationalization Scenario from four forces model based on outcome construct force rating (each high or low rating of intervening variable results in a scenario combination from scenarios # 1-4)	Observed/actual Internationalization Scenario Based on assessment of evaluator / judge, actual decision scenario outcome is determined (# 1-4 for each construct)	Prediction Hit or Missed Yes or no
Mutual Dependency Force	Importance of critical technology		(aggregate rating)			
	Availability					
	Scope					
	Resource support		(aggregate rating)			
	Outputs purchased					
International Network Externality Force	Technology differentiation required					
	Potential for economies of scale					
International Technology Standards Deviation Force	Rival network size					
	Level of compatibility		(aggregate rating)			
	Government policy towards adoption					
Level of Internationalization	Level of involvement					
	Number of international markets entered					

Appendix A

Degrees of freedom analysis - Pattern matching

Construct	Intervening variable construct	Intervening variable construct rating (high or low)	Predicted Internationalization Scenario Outcome (# 1-4 for each construct)	Hits (%)	N number of cases	Significance Sign test	Significance Chi test $X^{2}_{.1,1}$
	Network leader dependence on affiliate	H-High L-Low	#3 or #4/1or2-NL #1 or #2/3or4-NL				
Mutual Dependency Force							
	Affiliate dependence on Network Leader	H-High L-Low	#2 or #4/1or3-NL #1 or #3/2or4-NL				
	International demand for standardization	H-High L-Low	#2 or #4 #1 or #3				
International Network Externality Force							
	Economies of scale	H-High L-Low	#3 or #4 #1 or #2				
	Domestic rival threat	H-High L-Low	#1 or #3 #2 or #4				
International Technology Standards Deviation Force							
	Trade and technical barriers	H-High L-Low	#1 or #2 #3 or #4				
	Ability	H-High L-Low	#2 or #4 #1 or #3				
Level of Internationalization							
	Willingness	H-High L-Low	#3 or #4 #1 or #2				

Appendix B

Case #_____ Decision #_____

Data collection:
Additional data/evidence collected relevant to the judging of the Intervening variable construct rating (high or low) in the data matrix.

I. Relationships:

II. Network externalities:

III. Technology standards:

IV. Internationalization:

V. Other

Appendix C

Case Study Protocol

I. Overview

This research endeavors to examine empirically how and why economic, relationship and technology forces uniquely associated with network externality environment shape the internationalization behavior of high technology firms. Firms operating in network externality oriented markets face economic, technology and relationship forces that differ significantly from those firms operating in traditional non-externality environments. In addition, many of the firms operating in this type of environment are in developing high technology industries like computer peripheral equipment, pre-packaged software and related computer devices.

Most current internationalization literature, theory and empirical work are based on firms operating in traditional non-externality environments. Much of the classical foreign direct investment and internationalization theory has centered on an economic theory paradigm. Stages and process models of internationalization have relied on transaction cost principles related to international manufacturing environments. More recent internationalization theory from the networking relationship school has begun to acknowledge the importance of using an organizational behavior paradigm to help explain the complexity of the internationalization phenomena. To adequately address the internationalization of these high technology firms, Coviello and McAuley (1999) suggest that a combination of paradigms be used. In my theoretical framework, I use a

combination of economic theory and organizational theory to explain causal relationships driving the internationalization decision strategy of high technology firms operating in network externality environments.

I present a causal model- The Four Forces Model of Internationalization for Firms Operating in Network Externality Environments- identifying causal relationships with the forces affecting firm internationalization and the associated predicted outcomes. It is suggested that these forces are unique in combination to firms operating within network externality environments and that they conspire to shape internationalization outcomes. The implications for firm internationalization strategy are discussed. From this model evolved my key propositions for empirical testing.

In order to develop an empirically based explanatory dissertation with relevant causal relationships regarding the internationalization of firms operating in industries that exhibit network externalities, I will use a multiple case study research strategy. As articulated by Yin (1994) this approach is good for complex organizational phenomena, of which firm internationalization has been described and addressing "how" and "why" types of research questions. In order to avoid a less than rigorous contribution to theory, the multiple case study methodology that I will employ will be of an explanatory nature seeking to identify and confirm causal relationships among the key variables in the internationalization of these firms.

The multiple case study methodology that I will employ will be of an explanatory nature seeking to identify and confirm causal relationships among key variables in internationalization. Each theoretical topic will be examined in the context of the multiple cases. It is suggested that "if two or more cases are shown to support the same theory, replication may be claimed" (Yin 1994). Using an "analytical generalization" approach suggested by Yin (1994), I will endeavor to connect the case study results to my theory.

Research Question

It is the purpose of this study to determine how and why economic, relationship and technology forces uniquely associated with network externality environment shapes the internationalization behavior of high technology firms.

- **Proposition #1:** The higher the mutual technology dependence, the greater the chance an "Affiliate" firm will be influenced by the "Network leader" firm to follow it to a new market.

  Proposition # 1 A:

  The higher the mutual technology dependence, the greater the chance the Network Leader firm will provide internationalization resource support to the affiliate for entry to a new market.

- **Proposition #2:** The stronger the international network externality forces on a firm, that faster it will seek to internationalize in order to gain critical network market share.

- **Proposition #3:** The stronger the technology standards deviation force for an internationalizing firm into a target market, the less likely it will enter the market.

- **Proposition #4:** A firm will be more likely to enter a foreign market if its current level of internationalization involvement is high

II. Letter of Introduction from Dr. Nicholas Nugent (attached)

III. Field Procedures guideline:

For each of the case decisions, 3 primary sources of evidence will be sought:

1. senior level executive involved in international business decision making

- identify key contact at case site
- arrange introductory phone call and/or interview and send letter from Dr. Nugent- provide "overview" section of this case study protocol if respondent requests additional information on topic and research
- Establish time and/or place to conduct open ended semi structure interview using guided questionnaire for 3 internationalization decisions
- Request additional materials (non-confidential) for review

- Request internal documentation on international strategy (if confidential, sign non-disclosure form and discuss confidential information strategy with required personnel)
- If respondent will allow, record discussion, and create transcripts of discussion. If not, record notes and request a review/follow-up call with respondent

2. Archival data from publicly available reports. Annual reports, 10K, 10Q

- prior to the interview, conduct preliminary secondary data search and extract relevant data on key question topics
- Have research assistant and Dr. Nugent review case protocol

3. Other external or internal documentation relevant to internationalization strategy

- Conduct online search for other text forms of data, include a review of current web site

IV. Case study questions

In addition to the semi-structured open-ended questionnaire that has been developed to guide the interview, the following is a selection of key questions I am trying to answer by conducting these individual case studies and subsequent interviews. These questions are referred to as level 1 or 2 questions (according to Yin (1994) classification pg. 71). In order to be consistent in aligning the unit of analysis, with the proper level of questions, the interview will only serve as one component of the evidence being gathered to answer

the research question relating to the organization. As noted above, other corroborating data will be sought through the other sources mentioned.

1. How important are the four forces I have identified in my model in shaping the internationalization decision making within this firm? How have they affected the decision making process of 3 internationalization decisions within the firm

Sources of data:

-interview international technology executives and managers

-search Lexis Nexis and other relevant electronic data bases for international expansion information and press releases

-seek internal international strategy documents

-seek network partner information via interview or other third party sources

2. How dependent is the firm on other network partners with whom they share a critical technology, for entering the new foreign market?

Sources of data:

-interview

-seek announcements of international technology partnerships with specific technology

-review annual report, 10k and 10Q for elaboration on partnership activities

3. How and why does the strength of international network externalities impact the internationalization decision of the case firm? How does the firm measure this force? Are these measures consistent with the components I have described? (economies of scale and level of international standardization of technology) As market potential? How does this impact the speed of entry into an international market?

Sources of data:

-interview

-seek announcements of specific technology and how the technology will be used (business to business or consumer products)

-review annual report, 10k and 10Q for citations on growth potential in new markets for specific technology

4. What is the impact of foreign market competition of rival firms in targeted foreign market? Do they have an established rival network that could prevent technology entry into this market? Are they receiving government help to protect this local market from incoming competitive technologies?

Sources of data:

-interview

-review WTO reports on international technology standardization agreement adoption

-review annual report, 10k and 10Q

5. How does the current level of internationalization of the firm affect its view of entering new markets and how will they as a result?

Sources of data:

-interview

-review annual report, 10k and 10Q for statements on the past success or failure of international operations or partnerships

V. Guide for case study report

- Brief description of individual case
- One data matrix for each internationalization decision investigated (total of 3 per firm)
- Collection of respondents answers to the semi-structured open interview questionnaire
- Summary narrative for each force

Appendix D

SOUTHERN NEW HAMPSHIRE UNIVERSITY

Sunday, January 27, 2002

To whom it may concern,

This is to introduce Mark Hecox a highly qualified individual with wide experience in international business. Mark is conducting his dissertation research in fulfilling the final requirement as a doctoral candidate in international business here at Southern New Hampshire University Graduate School of Business. He is conducting a series of case studies in order to collect empirical data for research on firm internationalization in network externality environments.

Ultimately, by means of this cases study approach, we hope to identify and document answers to questions like; how and why economic, relationship and technology forces uniquely associated with network externality environment shapes the internationalization behavior of high technology firms operating in this environment.

We are asking for your time, experience and patience in conducting limited interviews regarding this subject matter. Our goal is to have you comment on three internationalization decisions as they relate to a series of open-ended questions presented by the interviewer.

On behalf of Southern New Hampshire University and Mark, I wish to express our gratitude for your assistance. We will be happy to provide you a final report copy of the research upon completion.

Again, thank you very much,

Sincerely,

Dr. Nicholas Nugent
Professor of International Business
Southern New Hampshire University

Appendix D

SOUTHERN NEW HAMPSHIRE UNIVERSITY

Mark Hecox

Doctoral Candidate

Semi structured open-ended interview questionnaire guide

Data collection

The following is a series of semi open-ended questions examining the internationalization decision making process of firms operating in network externality environments. The goal is to gain a better understanding of how and why certain relationship, economic and technology forces affect the decision of a firm to enter or not enter a new foreign market.

Instructions:

1. Please answer the following questions for 3 separate internationalization decisions that your firm has considered. The interviewer will address all questions to each of the 3 decisions. It would be helpful to include both instances were the decision was made to enter a market and a decision was made not to enter a market.

Section one

Company name: _____ Date: _____

Address: _____

_____

Respondent contact info:

Name: _____

Phone: _____

Foreign market entry decision # _____

(Respondent's answers recorded on separate page)

Section two:

I. Relationships:

1. When considering the internationalization decision, does your company share or use a critical technology with /from an "affiliate" firm (technology provider) relative to the targeted foreign market? If yes, please describe. (please keep this company in mind as the following questions are asked)

2. How important is/was this technology to your company when you enter /entered a new foreign market? High importance or Low importance. Please describe why.

3. How available is this critical technology from other sources/companies in the new foreign market?
   High availability or low availability

4. Would you describe the current breadth/scope of technology shared/used with the "affiliate" company as high or low? Please describe why.

5. What is the level of foreign market entry resource support you receive from the "affiliate" company? High level or Low level. Please describe what type of support

6. Is a significant amount of your company's output (products/technologies) purchased /used by the "affiliate" company? High or Low level Please estimate a percent

7. Would you characterize the level of mutual dependency between your firm and the affiliate firm as high or low? (as related to entering this foreign market)

II. Network externalities:

1. In the targeted foreign market, is/was it important for your firm to establish early network advantages for the technology /product? (by establishing an installed base for the technology early would it create a competitive advantage in the market) If yes, please describe.

2. Is there a high or low level of technology differentiation required in the target foreign market?

3. Does /did your company feel there is/was a high or low level of demand side or supply side economies of scale for your product/technology in the foreign market entered or sought to be entered? (Did you perceive there to be significant economies of scale opportunity in the new market?)

4. Was speed to this market an important consideration? Yes or no. Why?

III. Technology standards:

1. Did you have to consider a rival technology already in (or about to be in) the target foreign market?

2. Is your primary competitor in the foreign market a domestic or international rival? How would you describe the current size of their existing network in the foreign market under consideration (as it relates to the critical technology under discussion)?

3. How would you rate the current level (high or low) of compatibility of your technology/product with the current network technology in the foreign market? Please elaborate.

4. Do you know what the foreign government policy is towards international technology standards agreements? I.e. has your firm experienced any difficulty with government policy related to the adoption of your technology?

IV. Internationalization:

1. Would you consider your firms' current level of internationalization (relative to your primary competition) high or low?

2. How would you describe your firms' ability to operate in international markets? What is your firms' typical form of foreign market involvement? (High involvement form like subsidiary /JV or low involvement form like licensing or exporting) Please describe.

3. Would you consider the number of international markets your firm has entered as high or low? (relative to your primary competition) Can you provide the number?

V. Concluding questions:

1. Please describe the result of the internationalization decision:

We decided not to enter the market. Why not? Please explain.

We entered the market. How quickly? Fast or Slow
With what method (export, license, JV, acquisition)

Did you enter because your network partner did? Yes/no

2. What 3 other key factors contributed significantly to the internationalization decision?

1.
2.
3.

Selected Bibliography

Aaby, N.E., and Slater, S.E., "Management Influences on Export Performance: A Review of the Empirical Literature, 1978-1988", International Marketing Review, 1989, v.6 no.4, pp. 7-23

Aldrich, Howard E., Organizations and Environments, Prentice-Hall, Englewood Cliffs, NJ. 1979

Amit, R. and Zott, C., "Value Drivers of E-commerce Business Models", working paper, July, 2000

Anand, Jaideep and Kogut, Bruce, "Technological capabilities of countries, firm rivalry and foreign direct investment", Journal of International Business Studies, 1997, June.

Arthur, Brian W., Increasing Returns and Path Dependence in the Economy, The University of Michigan Press, 1994.

Axelsson, Bjorn and Easton, Geoffrey Industrial Networks: A New View of Reality, Routledge, NY, 1992

Banerji, Kunal., "Organizational Networks and International Market Entry: Japanese Entry into the United States Auto Ancillary Industry", Dissertation, University of Kentucky, 1992

Barkema, H.G., Bell, J.H.J and Pennings, J.M., "Foreign entry, cultural barriers and learning", Strategic Management Journal, 1996, 17, pp. 151-166.

Beamish, P.W., "The Internationalization Process for smaller Ontario firms: a research agenda. In Research in Global Strategic Management-International Business Research for the 21st Century: Canada's new research agenda", ed. A.M. Rugman, 1990, pp.77-92. JAI Press, Greenwich.

Beinhocker, E.D., "Strategy at the Edge of Chaos", The McKinsey Quarterly, Number1, 1997, pp.109-118.

Bonaccorsi, A., "On the Relationship Between Firm Size and Export Intensity". Journal of International Business Studies, 4, 4, 1992, pp. 605-635.

Buckley, Peter J., "Foreign Direct Investment by Small and Medium-sized Enterprises: The Theoretical Background", Small Business Economics, 1989, 1, pp.89-100

Campbell, D., "Degrees of Freedom and the Case Study", Comparative Political Studies, 1975, v.8 no. 2, pp.178-193

Chako, M. Modale, "Network Effects, Organizational Size and Organizational Growth", Dissertation, University of Michigan, 1998.

Chen, H. and Chen, T-J., Network Linkages and Location Choice in Foreign Direct Investment, Journal of International Business Studies, 29, 3, 1998, pp. 445-478.

Clark, Timothy, and Pugh, Derek S. and Geoff Mallory, "The Process of Internationalization in the Operating Firm", International Business Review, 1997, 6(6), pp605-609.

Coviello, N. E. and Munro, H. J., "Growing the Entrepreneurial Firm: Networking for International Market Development", European Journal of Marketing, 29, 7, 1995, pp. 49-61.

Coviello, Nicole and Munro, Hugh, "Network Relationships and the Internationalization Process of Small Software Firms", International Business Review, 6(4), 1997, pp361-386

Coviello, N. E. and McAuley, Andrew., "Internationalisation and the Smaller Firm: A Review of Contemporary Empirical Research", Management International Review, v39, i3, 1999, pp. 223-239.

Davidson, W.D., and McFetridge,D.G., "Key Characteristics in the Choice of International Transfer Mode". Journal of International Business Studies, 1985, 16

Dillman, Salant, P., How to Conduct Surveys, 1994.

DiMaggio, P.J. and Powell, W.W., "The Iron-Cage revisited: Institutional Isomorphism and Collective Rationality in Organizational fields", American Sociological Review, 1983, v.48, pp:147-160

Dunning, John, H., Toward an Eclectic Theory of International Production: Some empirical tests", Journal of International Business,1976, v.11,1,pp:9-31

Dunning, J. H., International Production and the Multinational Enterprise. London: Allen & Unwin 1981.

Dunning, John, H., "The Eclectic Paradigm of International Production: A Restatement and some Possible Extensions", JIBS Spring 1988, pp1-31

Dunning, John H. and Narula, Rajneesh, "The R7D activities of foreign firms in the US", International Studies of Management & Organization, Spring-Summer 1995, v25 n1-2, pp: 39(36)

Economides, N. "The Economics of Networks", International Journal of Industrial Organization, December, 1996, v.14:6, pp:673-693

Eisenhardt, Kathleen M., "Building Theories from Case Study Research", Academy of Management Review, 1989, v.14 no.4, pp.532-550

Eisenhardt, Kathleen M., "Better Stories and Better Constructs: The Case for Rigor and Comparative Logic", Academy of Management Review, 1991, v.16 no.3, pp.620-627

Emerson, Richard M., "Power Dependence Relations", American Sociological Review, 1962, pp:31-41

Farrell, J. and Saloner, G., "Installed Base and Compatibility: Innovation, Product Preannouncements, and Predation", The American Economic Review, December 1986, v.76:5, pp:940-955

Farrell, J. and Saloner, G., "Standardization, Compatibility and Innovation", Rand Journal of Economics, Spring 1985, v.16:1, pp:70-83

Fontenot, Renee J. and Wilson, Elizabeth J., "Relational Exchange: A Review of Selected Models for a Prediction Matrix of Relationship Activities", Journal of Business Research, 1997, v. 39 pp. 5-12

Gallaugher, John,. "Network Externalities and Vertical Integration: The Case of the World Wide Web Software Market", Dissertation, Syracuse University, 1997

Gandal, N., "Hedonic Price Indexes for Spreadsheets and an Empirical Test of the Network Externalities Hypothesis", Rand Journal of Economics, Spring 1994, v.25:1, pp:160-170

Gemunden, Hans-Georg., "Success Factors of Export Marketing: A Meta-analytic Critique of the Empirical Studies. In ed. S.J. Paliwoda, New Perspectives on International Marketing, London: Routledge, 1991.

Granovettor, Mark, "Economic Action and Social Structure: The Problem of Embeddedness", American Journal of Sociology, 1985, v.91, 3, pp:481-510

Hagel III, John, "Spider versus Spider", The McKinsey Quarterly, Number 1, 1996, pp.71-80

Hedlund, G. and Kverneland, A., "Are Strategies for Foreign Markets Changing? The Case of Swedish Investment in Japan", International Studies of Management and Organization, 1985, v.15, pp.41-59.

Holmlund, M. and Tornroos, J., "What are Relationships in Business Networks?", Management Decision, 35/4, 1997, pp.304-309.

Johanson, J. and Vahlne, J-E., "The Internationalisation Process of the Firm - A Model of Knowledge Development and Increasing Foreign Market Commitments", Journal of International Business Studies, Spring/Summer 1977, pp. 23-32.

Johanson, J. and Mattsson, L. G., "Interorganizational Relations in Industrial Systems: A Network Approach Compared with the Transaction Costs Approach", International Studies of Management and Organization, XVII, 1, 1987, pp. 34-48.

Johnsen, J.E. and Johnsen, T.E.,"International Market Development Through Networks: The case of the Ayrshire knitwear sector", International Journal of Entrepreneurial Behavior and Research, v.5, No.6, 1999, pp. 297-312.

Johnston, Wesley J., Leach, Mark P. and Liu, Annie H., "Theory Testing Using Case Studies in Business to Business Research", Industrial Marketing Management, 1999, v.28 pp. 201-213

Jones, Marian V., "The Internationalization of Small High-Technology Firms". Journal of International Marketing, v.7, 4, 1999, pp. 15-27.

Katz, M. and Shapiro C., "Network Externalities, Competition and Compatibility", American Economic Review, 75(3), 1985, pp.424-440.

Katz, M. and Shapiro C., "Technology Adoption in the Presence of Network Externalities", Journal of Political Economy, 94(4), 1986, pp.822-841.

Kindelberger, C.P, "American Business Abroad: Six Lectures on Direct Investment" New Haven: Yale University Press, 1969

Knickerbocker, F.T., Oligopolistic Reaction and Multinational Enterprise, Cambridge, MA. HBS, 1974

Kuemmerle, Walter, "The drivers of foreign direct investment into research and development: an empirical investigation", Journal of International Business Studies, Spring 1999 v30 i1 pp.(2)

Magee, S.P., "Information and the Multinational Corporation: An Appropriability Theory of Foreign Direct Investment" The International Economic Order, 1977, MIT Press, pp: 317-340

McKiernan, P., Strategies of Growth, Maturity, Recovery and Internationalisation, Routledge, London, 1992.

Merrilees, Bill and Tiessen, James H., "Building Generalizable SME International Marketing Models using Case Studies", International Marketing Review, 1999, v.16 no. 4/5, pp. 326-344

Modis, Theodore, Conquering Uncertainty, A Business Week Book, McGraw Hill, 1998.

Miesenbock, Kurt J., "Small Business Internationalization: A Literature Review", International Small Business Journal, v.6, 1988, pp. 42-61.

Miles, Matthew B. and Huberman, Michael A., Qualitative Data Analysis: An Expanded Sourcebook, 2nd edition, Sage Publications, 1994

Millington, A.I. and Bayliss, B.T., "The Process of Internationalization: UK Companies in the EC", Management International Review, 1990, v.30, pp.151-161.

Nohria, Nitin and Garcia-Pont, C.,"Global Strategic Linkages and Industry Structure", Strategic Management Journal, v.12(Special Issue), 1991, pp. 105-124.

OECD Online: 1998 OECD Report: The Economic & Social Impact of Electronic Commerce: Chapter 3, pg. 85

Padmanabhan, Prasad and Cho,Kang Rae., "Decision Specific experience in foreign ownership and establishment strategies: evidence from Japanese firms", Journal of International Business Studies, 30, 1 quarter 1999, pp:25-44.

Paulson, Ed., Inside Cisco: The Real Story of Sustained M&A Growth, John Wiley & Sons, 2001

Pfeffer, Jeffrey and Salancik, Gerald., The External Control of Organizations: A Resource Dependence Perspective, Harper and Row, 1978

Randall Morck & Bernard Yeung "Why Investors Value Multinationality", Journal of Business, 1991, vol. 64, no.2.

Sawhney, M. and Parikh, D., "Were Value Lives in a Networked World" in The Digital Enterprise, ed. Nicholas G. Carr, pp.35-50, HBS Press, 2001

Shapiro, Carl and Varian, Hal R., Information Rules: A Strategic Guide to the Network Economy. Harvard Business School Press, 1999

Shan, Weijian and Song,Jaeyong. "Foreign direct investment and the sourcing of technological advantage: evidence from the biotechnology industry", Journal of International Business Studies, Summer 1997, v28 n2 pp:267(18)

Siegal, Sidney, Nonparametric Statistics for the Behavioral Sciences, McGraw-Hill, New York, NY. 1956

Slywotzky, A.J. and Morrison, D.J., How Digital is your Business? Crown Business, NY, 2000

Tapscott, Don, and Ticoll, David and Lowy, Alex, Digital Capital: Harnessing the Power of Business Webs, Harvard Business School Press, 2000

Trochim, William M. The Research Methods Knowledge Base, 2nd Edition. Internet WWW page, at URL:http://trochim.human.cornell.edu/kb/index.htm **(version current as of August 02,2000)**

Turnbull, P.W., Strategies for International Industrial Marketing. Croom Helm, London, 1986.

Turnbull, P.W., "A Challenge to the Stages Theory of the Internationalization Process. In Managing Export Entry and Expansion. Eds P.J. Rosson and S.D. Reid, pp. 21-40. Praeger, New York, 1987.

Varian, Hal R., "Market Structure in the Network Age" in Understanding the Digital Economy, ed. Erik Brynjolfsson and Brian Kahin, Understanding the Digital Economy: Data, Tools, and Research. MIT Press, 2000.

Watson, C.J., Billingsley, P., Croft, D.J., Huntsberger, D.V., Statistics For Management And Economics, 5th Edition, Allyn and Bacon, 1993

Welch, Catherine, "The Archaeology of Business Networks: the use of archival records in case study", Journal of Strategic Marketing, 2000, v.8 pp. 197-208

Wilson, Elizabeth J. and Vlosky, Richard P., "Partnering Relationship Activities: Building Theory from Case Study Research", Journal of Business Research, 1997, v.39, pp. 59-70

Wilson, Elizabeth J. and Woodside, Arch G., "Degrees of Freedom Analysis of Case Data in Business Marketing Research", Industrial Marketing Management, 1999, v.28 pp. 215-229

Yang, Yi-Nung., "Essays on Network Effects", Dissertation, Utah State University, 1997

Yin, Robert K., Case Study Research: Design and Methods, Second Edition, Sage Publications, Thousand Oaks California, 1994

Yin, Robert K., Applications of Case Study Research, Sage Publications, Thousand Oaks California, 1993

Yu, Chi-chang., "International Strategic Alliances in High Technology Industries: A Law and Economic Analysis from an Antitrust Perspective", Dissertation, Stanford University, 1999