

STRATEGIC IMPACT OF COMMUNICATION NETWORKS
ON THE FINANCIAL SERVICES INDUSTRY

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Abstract

This thesis examines the hypothesis that communication networks are changing methods of competing in the financial services industry (FSI). The focus of this thesis is on the strategic issues of communication networks, and not the technical issues, as they apply to the financial services industry. Even though the discussion in the thesis uses examples mainly from the securities industry, most of it also applies to the other segments of the FSI.

Three questions form the heart of the thesis:

1. How have the communication networks impacted the strategies of the financial services companies?
2. How have they impacted the competition?
3. How is the communication technology managed?

Fidelity Management and Research Company, and Reuters Holdings PLC provide two excellent cases for this study. This thesis examines the role of communication networks in the products and services of these two companies. It also examines how this technology gives these two companies a competitive advantage over their competitors. The thesis concludes with an analysis of the impact of this technology on creation of value.

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Title: Assistant Professor of Management.

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Chapter 1

Introduction

The Financial Services Industry (FSI) has gone through a major transition in the last decade. Both the external environment and the internal structure of the industry have evolved dramatically during this transition phase. The extent of the changes is such that the transition phase can be called a “revolution” rather than an “evolution”. Whatever it is called, it is clear that the implications of these changes are far-reaching.

Communication networks technology has been pivotal in these changes. By communication networks, I mean both data communication and telecommunication networks. Some refer to these networks as information networks because they carry information crucial for business.

In this thesis, I examine the role of communication networks in the financial services industry. I examine how they are used and what value they provide to the financial services companies. The questions at the heart of this thesis are:

1. How has this technology impacted the strategies of the financial services companies?
2. How has the the way they compete with each other changed?
3. How do these companies manage this technology?

The basic premise is that this technology has changed the ground rules of competition in this industry.

The focus of this thesis is on the strategic issues of using communications technology, not on the technical issues.

The term “Financial Services Industry (FSI)” includes commercial banks, insurance companies, security trading and brokerage companies, money management companies, exchanges and trading floors, etc. Any institution that manages and/or trades money and/or money related tools is included in this definition of FSI. The definition of FSI is extended to include companies providing services to financial services companies. Thus, Dow Jones, Reuters Information Services, etc., are considered to be part of FSI.

I have chosen Fidelity Management and Research Company (FMR, parent of Fidelity Investments), and Reuters Holdings PLC (parent of Reuters Information Services) as examples of companies that use communication networks technology aggressively. This thesis is not a case study of Fidelity or Reuters. Instead, Fidelity and Reuters are used extensively as examples throughout to illustrate certain key points. Fidelity is a money management and brokerage company. It uses networks for internal operations and integrates them with certain product offerings. Reuters, on the other hand, is an information service provider that uses networks not only for internal operations and information gathering, but also to deliver financial information to its clients. This thesis will examine the use of communication technology by these two very different companies.

Chapter 2 examines the changes in the environment in which financial services companies compete today. Chapter 3 describes the critical success factors for the FSI and then analyzes where and how networks help companies meet their critical objectives. The emphasis of these two chapters is on the environment that is changing the basis of competition in the FSI.

Chapters 4 and 5 present the cases of Fidelity and Reuters to describe how these two companies rely on communication networks to compete in the changing

environment.

Chapter 6 presents an analysis of how this technology should be managed and what role it plays in developing competitive strategies. Chapter 7 addresses the limitations of networking technology.

Chapter 8 summarizes the impact of the networks on creation of value, and concludes the thesis by pointing out key factors about the directions in which the FSI and networking technology are heading.

This thesis is based on literature survey, field interviews and author's analysis of the data from literature and interviews. The list of references in the Bibliography includes literature reviewed and used in this thesis. Appendix C provides names of people interviewed for this thesis.

Chapter 2

Changes in the Competitive Environment

Evidence is clear that the environment of competition for financial services companies has changed. By environment, I mean both external and internal to a financial services company. This chapter reviews the changes in the environment that are changing the way financial services companies compete today.

2.1 Increasing Competition

In the regulatory environment of the past, the competition within the FSI was more or less restricted to different industry segments. For example, a security trader competed only with another security trader, and not with a commercial bank. However, increase in deregulation has changed this. There has been an astronomical increase in the number of competitors in the FSI because of the globalization of the markets. One is not only competing against a broker in the same town, but also with brokers in other states and other countries. Technology has impacted significantly the ability to compete. At the same time, technology has fueled the competition by removing the barriers of physical distance.

Examples of mergers and acquisitions are numerous. Merger of Shearson and Lehman, acquisition of Shearson-Lehman by American Express, Sears' acquisition of Allstate Insurance and Dean Witter Reynolds, are a few examples. Because of

this consolidation, FSI is becoming more concentrated with large amounts of assets held by a few large companies. Consolidation is another factor that is changing the structure of the industry, and hence also the basis of competition.

2.2 Changes in the Industry

There are three basic changes happening in this industry. They are, as shown in the Figure 2.1:

1. expansion in geographic reach,
2. compression of time horizon, and
3. dilution of industry boundaries.

“Expansion in Geographic Reach” means that financial services companies are expanding the territory in which they used to do business. For example, Fidelity has offices in London, Tokyo, Sydney and Hong Kong. Citicorp has offices in 97 countries. Reuters has presence in 80 countries. Within the U.S., companies like Merrill Lynch and Sears Financial Network have offices in almost every major city.

“Compression of Time Horizon” means that the life of a financial instrument is shorter now than it used to be. Price of a security changes almost every minute. Mutual funds that were priced once in a day are now priced once every hour. Portfolio managers are forced to keep a continuous watch on the components of the portfolio. The response time to a change in the market has become much shorter.

“Dilution of Industry Boundaries” means that the companies that were not considered part of the financial services industry are now solid players in that industry. For example, Sears is no more just a chain of retail stores, it has a strong presence in almost every segment of the financial services industry. Reuters is no more just a media service. Only 9% of Reuters’s total revenues came from media services in 1987; the rest came from financial information services. Citicorp is now as much of an “investment bank” as it is a “commercial bank.”

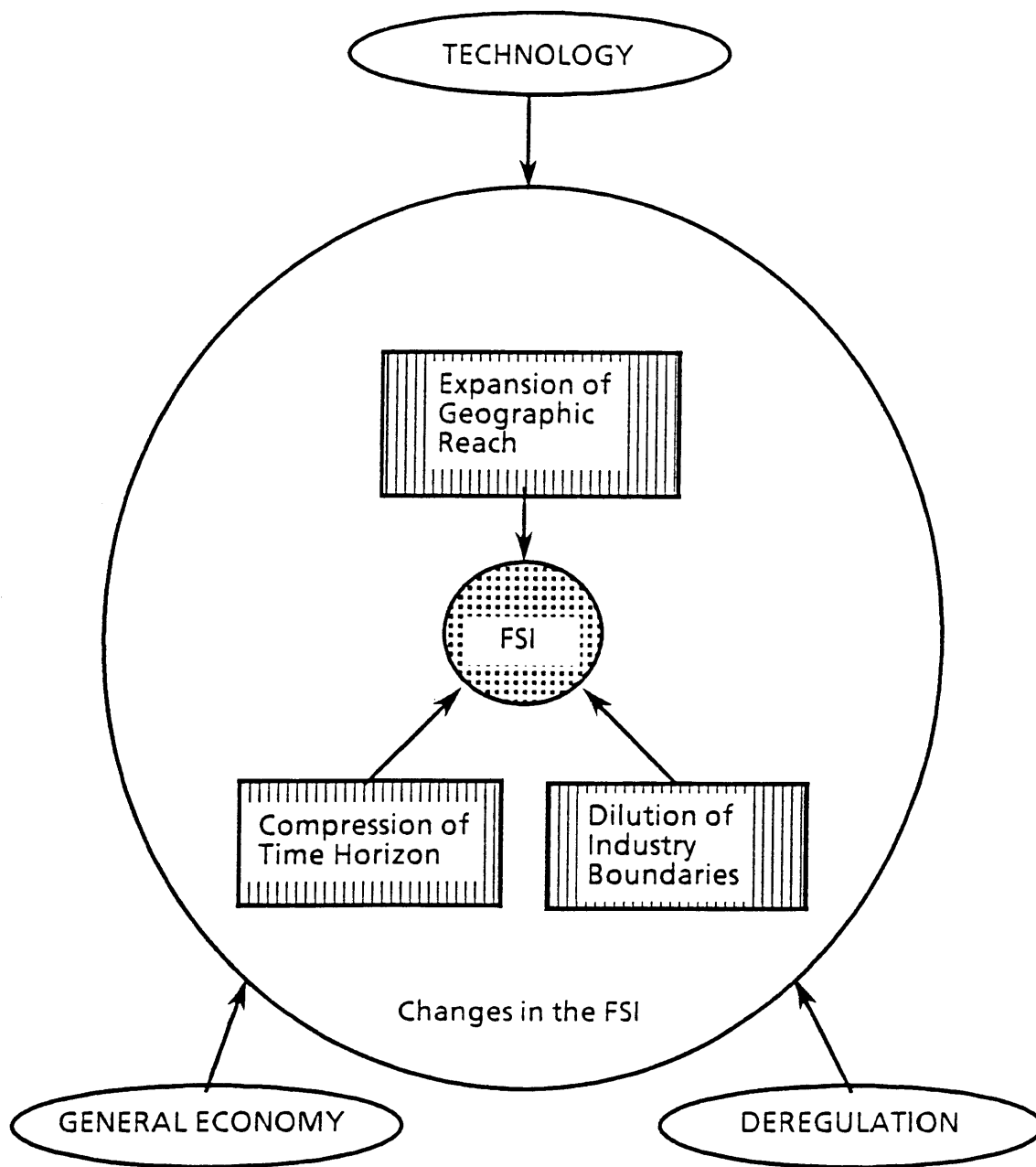


Figure 2.1: Sources of Changes in FSI

2.3 Sources of the Changes

What are the sources of these changes? As shown in Figure 2.1, they are:

1. movement towards deregulation,
2. role of technology, and
3. general economic conditions.

2.3.1 (De)Regulatory Environment

During the past decade, not only U.S., but also major European countries have experienced a wave of deregulation in the FSI. Whereas the primary goal of regulatory intervention is to protect the consumers by assuring the soundness of the product and service providers, there is an increasing support of free market economy that promotes deregulation. The deregulation fever is fueled by economic and political philosophies and increasing inter-dependency of all countries for global trade.

In the case of the FSI, the regulatory control fell into four main categories [2]:

1. range of products and services,
2. pricing of inputs and products,
3. entry into the industry, and
4. geographical location of business.

While these regulatory controls protected the consumers, they also protected the financial institutions by reducing competition. Until 1983, a firm was forced to decide between the securities business and traditional commercial banking activities such as loans and deposits. No cross-selling was allowed. In addition, securities firms were (and still are) governed by regulatory agencies such as, U.S. Congress, Security Exchange Commission (SEC), Federal Reserve Board, NYSE, etc. In the past few

years, these controls have been made lax. For example, the demarcation line between products and services offered by a securities firm and those offered by a commercial bank has almost vanished based on Rule 415 passed by U.S. Congress in 1983 [3]. As a result, commercial banks like Citicorp can now trade securities. Similarly, a bank that was allowed only to sell a few items like mortgage, a savings account and a personal loan, is now allowed to offer money market accounts, insurance policies, municipal bonds, line of credit, etc. Regulations on acquisitions and mergers are also becoming loose. For example, BankAmerica Corporation was allowed to acquire Charles Schwab discount investment brokerage business to diversify into a new funds business. Because of deregulation on the international front, almost all of the major financial institutions have opened branches in Europe and Far East. Most of the major security traders are trading securities overseas. In short, restrictions on product and service offerings, on entry into the industry and on geographical locations are gradually disappearing.

2.3.2 Role of Technology

Role of technology has changed significantly in the last decade. Technology, especially communication technology, has become of strategic importance. It is used not only to gain operational efficiencies, but also as a strategic tool to compete in this industry.

The technology itself has advanced rapidly. Digital communication is gradually replacing analog transmission making the information exchange much faster, cheaper and more reliable. Packet switched technology provides a cost-effective alternative to circuit switched networks by reducing the costs of connecting nodes with moderate traffic requirements. Optical fiber is replacing copper wires, providing much higher bandwidth at a comparable cost. Integration of voice, data and video on the same network makes it possible to offer innovative products and services at an affordable price.

Computers were used for transaction-processing and record-keeping in a back-room environment. The movement has been from the centralized back-room operations to the decentralized branch office operations to distributed processing. Most of the major financial institutions have several computer centers, all connected to each other through communication networks. The spread of Automatic Teller Machines (ATM) and the Point-of-Sale (POS) terminals probably characterize the revolutionary use of the communication technology in the FSI. Almost every urban bank has either its own ATM system, or is connected to a multi-user ATM network. An urban bank can not even think of doing business without an ATM. Similarly, almost all security traders subscribe to financial information services provided by companies like Reuters or Dow Jones. A security trader can not survive without having links to communication networks of these providers. NASDAQ provides an extreme example of how the role of the communication technology in FSI has changed. NASDAQ is a completely electronic trading floor without any human intervention where traders trade stocks using their terminals directly connected to the NASDAQ communications network.

The roles of the MIS managers and Telecommunication managers are also changing. Recently, there is an increasing amount of overlap seen in these two functions. This is in line with the advances in technology. Computer and communication technologies are becoming much more inter-dependent. Advances in computer networks are based in part on the advances in the telecommunication technology. More companies now lease T1 lines from local telephone companies to connect their computers in remote sites than ever before. The merger of the two technologies have also changed the structure and management of certain functions in this industry. The term "Chief Information Officer" (CIO) was non-existent a decade ago. Now, CIO refers to the executive responsible for managing information resources that include data processing, computing, telecommunications and networking. Yesterday's "MIS Managers" have been replaced by "Information Executives."

This thesis is not about a technical topic, however, it is important to note that

the advances in computers and communication technologies have created certain applications that financial services companies can benefit from. Reduction in costs of electronics and communication systems, and significant benefits offered by this technology has changed the basis of competition in the financial services industry.

2.3.3 General Economic Condition

In the last decade, U.S., Japan and major European countries have seen a lot of rapid changes in the economic conditions as measured by interest rates, GNP, exchange rates, etc. Even though stock markets do not always reflect the health of the industry, their performance do have a long term implication on the economy because a lot of investment decisions are based on such criteria. The increase in the volatility of markets has severely affected the competition in the financial services industry. "Markets" include security markets, currency markets and money markets.

The ups and downs in the stock markets in New York, London and Tokyo in last few years warrants extreme readiness of financial institutions to respond quickly to changes. Dow Jones Industrial Average climbed and dropped almost 850 points (about 44%) during 1987. Dollar dropped against Yen from about 159 yens per dollar to about 121 yens per dollar (24%) in one year with a mid-year rally. West German mark gained 18% against the dollar during 1987. From 1985 heights, when the dollar was strongest, the dollar has fallen 54% against yen and 55% against mark by end of 1987 [4]. Similarly, the prime rate dropped from 1982 high of 17% to 1987 low of 7.5%. During 1987, the prime rate oscillated between 7.5% and 9.25% even though regulated by the Fed. The implication is that financial markets have seen high volatility in past few years. Financial services companies have to deal with this volatility effectively in order to be successful.

How do these changes affect the strategic objectives of a financial services company, and how do communication networks help a company achieve its objectives? The next chapter addresses these questions.

Chapter 3

Managing Critical Success Factors

Certain factors become critical in order to be successful in the changing environment. It becomes essential for strategic planners to manage these factors and view them as the basis for defining company goals. While networks do not create new strategies, they do open up new possibilities for strategies. They also create new risks for the users as we will see later in the thesis.

This chapter addresses the following two questions:

1. What are the critical factors of success for financial services companies?
2. How can communication networks technology help to manage these critical factors more effectively?

3.1 Ability to Compete Globally

For a security trader, it is absolutely essential to be able to trade globally. A fiasco in Japan creates a fiasco in London, which in turn creates a fiasco in New York. The opening of New York Stock Exchange is greatly dependent on the level at which Tokyo Stock Exchange closed a few hours ago and how London Stock Market performed during the day. In addition, the transactions are executed in multiple currencies. Customers in U.S. expects its investment advisor to keep track of global

activities. Trading is not done only between 9 a.m. and 4 p.m., but it is done around the clock, around the world.

Communication networks have no geographical limitations. Of course, there are technical issues that one has to manage, but in theory, it is possible to have a world-wide network. Such a network can be based on a proprietary technology, or it can use public packet switched networks such as X.25 and satellite technology. Regardless of the implementation, the “haves” of the networks have a direct advantage over the “have-nots” by getting quicker access to information around the world. In addition, the networks give the users access to potential customers in foreign countries.

Citicorp’s Global Telecommunications Network (GTN) extends to 75 of the 94 countries in which the bank does business [5]. Citicorp claims this to be the largest network of its kind for any financial services company. The network includes a packet switched network and regional multiplexer based subnetworks. This network helps Citicorp push into its relatively new investment banking business by connecting its Global Trader securities trading network. It also opens up new markets for Citicorp, such as international securities brokerage [7].

Reuters provides another good example of how communication networks help to compete in the global markets. Reuters’ Monitor service covers 114 countries around the world. Reuters also uses a combination of several technologies to build its communication network including satellite, telecommunication and computer networks. Reuters is the only company that has a global network and can provide financial information globally.

3.2 Cost Efficiency

The financial services industry has become more concentrated. There are a small number of companies that control a large portion of total revenues in this industry. These large companies have financial leverage to provide full range of services to their clients. In order to compete in that environment, the smaller players have to

have high degree of cost efficiencies and offer services at a lower price to attract customers away from the full range of service providers. As Jim Stoddard, a vice president at Fidelity mentioned, in order to compete with full-service brokers like Merrill Lynch that has a lot of “glass and steel” and heavy commission structure, Fidelity has to have cost-efficient solutions and lower brokerage fee [1].

How do communication networks provide cost efficiencies? Even though the capital investment needed to build a network is very high, electronic-based communication is always less expensive than paper-based communication. One reason is that the marginal cost of serving an additional customer is very little. Once the investment in computers and networks is made, the additional cost of using the available bandwidth to include one more user is very little.

For example, Fidelity uses toll-free numbers and Automatic Call Distributor machines that direct customer calls to one of the four telemarketing centers in U.S. These centers are connected through private telecommunications lines. By using this technology, Fidelity has to staff only four centers in the country, thus saving a lot on the “glass and mortar” and also human service representatives around the nation.

Communication networks offer cost savings for the investors as well. Many security firms still record the deals by moving paper notes around the back office, where clerks punch in each deal’s details into batch processing systems. Telex messages are sent out to buyers, sellers and custodians of various securities to complete the transaction. This takes a very long time and billions of dollars get stuck in never-never land during this time. Citicorp is planning a computerized transaction processing network that will eliminate manual processing of security transactions and thus lower costs for both itself and its investors [6].

Another reason for cost savings is the displacement of cost from the service provider to the service user. For example, a security trader using the transaction processing network of a stock exchange pays the exchange to use the network for entering and validating a transaction. In a manual processing system, the exchange would have had to employ people to do this job. By displacing this job to the trader,

the exchange displaces the cost of doing that job as well, and saves money.

3.3 Differentiation

Having cost efficiencies alone is not enough to be successful in the financial services industry. It is necessary to be able to differentiate the products from those of competitors. There has to be two or three points that make the products different from the rest.

Communication network technology is one tool which can be used to achieve differentiation. Fidelity uses computer and communication technology to price its SELECT funds once every hour unlike its competitors who price their funds once every day. Hourly pricing of funds makes SELECT funds more attractive because they give the portfolio managers and the investors more accurate information, thus increasing their chances of making higher returns on their investments. NASDAQ uses communication technology with its electronic trading room to differentiate itself from other over-the-counter stock exchanges. A member of NASDAQ can use the terminal in her office to enter a trade with another member of NASDAQ without leaving her office or having to go to noisy and crowded exchange floors. The brokerage houses that subscribe to electronic information services from companies like Reuters and Dow Jones differentiate themselves from competitors by giving their customers real-time information. Communication technology helps its user differentiate its products and services by improving their performance.

3.4 Customer Satisfaction

This is by far the most critical factor of all. It is not applicable only to the FSI, nevertheless this is the single most factor that all of the interviewees mentioned. Customer satisfaction comes in several different ways. One is the performance of the financial product. If it is a fund, how much did the fund gain over a particular

period? What type of services does a company provide? Are the customer representatives quick to answer an inquiry or service a request? The accuracy of information provided to the customer is also very important. As one of the interviewees said, reputation of the company is what gets the customer in the door, but services is what keeps the customer in there.

Communication networks help a company enhance its services. Through its automated call answering and service system, called FAST, Fidelity serviced as many as 500,000 calls on October 19, 1987, the day the stock market crashed! This number is phenomenal considering that on an average day, Fidelity services only about half as many calls. The networks, along with the service representatives, helped Fidelity serve about double the number of customers on one single day.

Chemical Bank is planning to use the network technology to enhance its services in an effort to position itself better against its competitors [8]. Chemical Bank is experimenting with a hybrid networking scheme for retail branches in the New York metropolitan area encompassing a variety of functional groups. This new scheme will make it easy to create new branch applications which will draw on the data stored on the mainframes in its central computing facilities. These might include information on new types of accounts, product information, customer profiles, etc., that could be accessed directly from a desktop PC in the branch office to determine what new products would suit a customer.

3.5 Being First and Remaining First

It is important to be the first in this game to attract customers. Since the markets are changing rapidly, a financial services company has to respond with new product introductions very quickly. The life cycle of investment tools is shortening. Financial service providers have to keep pace with this change and shorten their new product development cycle. New accounts, new funds, new portfolios are being developed every day to attract investors. Since everyone is competing for the first place, one

have to move very quickly to get ahead of the competition.

However, it is more important to retain the first position by creating barriers to entry. The advantage of being first is that the client will have to have a good reason to take their business somewhere else. If the client does not have a reason to quit, he won't.

Reuters is a good example of this scenario. Reuters is the first company to have a truly global network serving 114 countries world-wide with its Monitor service. No other company has attempted to grow so vast geographically. One of the reasons for that is the high capital investment which acts as a large barrier to entry. Another reason is the uncertainty of the return on that high investment because it would not be easy to take away customers from a reputable firm like Reuters.

3.6 Speedy Movement and Delivery of Information

The increase in volatility of the markets and the global nature of competition warrant the need for moving the information quickly. Not only that one needs the information to make decisions, but the information has to be global in nature, and it has to be delivered fast. Yesterday's information is not good enough today. A major investor can no longer depend on reading Wall Street Journal in the morning to make major investment decisions. Since the national and international money markets are changing every second, the information has to be "real-time", and it has to be accurate.

The advantage of a communication network in this case is probably the most obvious. Transferring information from London to Boston through an electronic network takes seconds, whereas the same information will take at least a day if sent by paper mail.

Reuters entered the real-time information delivery market in early 1970s right after the Bretton Woods agreement between industrialized nations to switch from fixed exchange rates to floating exchange rates. Prior to the Bretton Woods agree-

ments, the exchange rates were fixed by central banks of various countries. The changes were predictable and hence there was no need to deliver the information on the exchange rates in a hurry. Since the Bretton Woods agreement, the exchange rates are set based on the market demand and the market supply of the currency and hence are changing just like price of any other security that is traded in the market. Reuters saw the opportunity of delivering the information on exchange rates, and established a communication network that a subscriber could use to get information on currency values and also to trade currencies.

Communication networks create another advantage by moving information around. Since each transaction creates a new piece of information, the networks not only help complete a transaction quickly and save time, but also help moving that new piece of information just created quickly as well. For example, a transaction to buy and sell stock affects the future price of that same stock. While helping to complete the buy and sell transaction of that stock, the communication network will also carry the information of pricing resulting from that transaction across to other traders. This will help the other traders make a better judgment on whether to trade that stock or not.

3.7 Expanding Volume

As the total volume of revenues generated by the financial services industry grows, it is essential to strengthen the position of a company by growing the volume of the business. The trends of consolidation through mergers and acquisitions in this industry make this critical.

Communication networks can help a company grow its volume of both the customers and products.

The over-the-counter stock exchange NASDAQ (National Association of Securities Dealers Automated Quotes) built its automated system of computers and networks in 1971 [11]. It started with a 20,000 miles of leased lines network driven by

a computer complex in Trumbull, Connecticut. Since its introduction of automated trading system, its annual share volume grew 1,389% - from 1,390 million shares traded in 1975 to 20,699 million shares traded in 1985. The number of companies listed on NASDAQ grew 67.7% - from 2,467 in 1975 to 4,136 in 1985.

Similarly, the Midwest Stock Exchange grew by 500% between 1980 and 1985, largely due to the automation of its trading floors consisting of sophisticated computer networks [10].

The main reason for such a tremendous increase in volume of business is the difference in the capacity and speed of transactions between electronic networks and human intermediaries. Another reason for higher volume is the availability of service. As one of the interviewees at Fidelity explained, the calls made by the customer to the automated transaction system are much more defined and short because a typical customer knows exactly what transaction is to be done and what keys are to be punched before the call is made. As a result, even a machine with the same processing speed as that of a human representative can handle more calls in a given time than a human representative can. Increased volume means increased revenues, which in turn means better competitive position.

3.8 Command of Technology

As the high-tech revolution progresses, and as the role of technology changes, it is necessary to master the technology if a financial services company wants to be successful. Communication networks technology is only one of the technologies that a firm needs to command, but it is an essential piece considering the global nature of competition in this industry. The ability to talk with the customer electronically is critical. Fidelity's Fidelity Investor Exchange (FIX) lets its customers use their PCs at home to get quotes from the Dow Jones database electronically. Fidelity has been able to expand its customer base and earn revenues by commanding such technology. Technology is no more a "nice-to-have" luxury; it is essential for survival.

Strategic management of technology becomes very critical in this environment. As we will see later in this thesis, the top management at Fidelity and Reuters place a lot emphasis on managing technology. The key here is the commitment at the top of the company for investing in technology. Fidelity and Reuters both have advance technology divisions at the corporate level. These divisions continuously exploit new technology and develop applications products. It is important not only to buy the technology from outside, but also to develop technology resources within the company. The investment in and experimentation with new technology helps successful companies achieve better position in the future. For example, based on the experience of building the Global Telecommunications Network (GTN), Citicorp can more or less predict the future costs of expansion and use its own technical resources to maintain service in countries where data communication services are far more reliable. In the other countries, it can find other more effective solutions. The point is that it is crucial to manage and use the technology to be successful in the financial services industry today.

Chapter 4

Fidelity Management and Research Company

4.1 Fidelity: Background

Fidelity was founded in Boston in 1946 by Edward C. Johnson 2nd as an investment advisor to a single mutual fund with \$3 million in net assets. The company was then known as Fidelity Fund, Inc. The company grew rapidly through 1950s and 1960s, and by 1972, it managed funds with total assets of \$3.9 billion [16]. Fidelity Management and Research Company (FMR) was created in 1972 with Edward C. Johnson 3rd (Ned) as President, and Ed Johnson 2nd as the CEO and the Chairman. In 1977, Ned became the CEO and the Chairman of the company. In 1978, Fidelity diversified into brokerage business by acquiring brokerage companies. It is now one of the country's largest discount brokerage firms. In last ten years, Fidelity's assets under management have grown from about \$6 billion in 1977 to about \$75 billion in 1987 as shown in Appendix A [19]. In 1985, Fidelity reported revenues of \$470 million and profits of \$39 million [12].

FMR is made up of several subsidiaries. Fidelity Systems Company was created to maintain and develop corporation's computer and communication operations. Its annual budget is in excess of \$100 million. Its primary objective is to provide technology solutions for FMR's goals of increasing overall productivity, reducing costs, integrating into FMR's decision process for developing new products based on

technology, and creating and sustaining competitive edge over FMR's competitors.

NADCO (National Advanced Development Company) is another subsidiary of FMR that is responsible for identifying advanced technology that can help FMR to be more competitive. Both Fidelity Systems Company and NADCO report directly to the President and the CEO of FMR. Appendix A provides a part of FMR's organization chart [18].

4.2 Fidelity's Strategy - Linkage with Technology

The core of Fidelity's strategy seems to revolve around the following concepts:

1. effective use of technology,
2. customer satisfaction,
3. growth through acquisitions, and
4. remaining privately owned.

All the four parts of Fidelity's technology are inter-related. We will look at mainly the first part of Fidelity's strategy here, however, we will examine the relationship of technology to the other parts as well.

Considering that Fidelity operates two subsidiaries - Fidelity Systems Company and NADCO - to develop and use technology, it is obvious that technology is indeed at the heart of Fidelity's strategy. As Frank Diasparra, Vice President of Technology Services at Fidelity stated, "Communication networks are essential for Fidelity's survival. They are like what arteries are to the heart, except that in Fidelity's case, networks are both arteries and the heart. They not only pump the blood, but are the life of the company as well. Fidelity's whole business is based on movement of information which is made possible by the network technology [1]."

The commitment to technology is at the top. When Michael Simmons became President of Fidelity Investment Systems - a subsidiary of FMR - the information

services department had turnover rate of 40% [17]. Today, it is very small, thanks to the incentives and the motivating environment created for the technology professionals.

Customer service is another key element of Fidelity's strategy. Fidelity is expanding its network of street-level Investor Centers where customers can buy funds, trade stocks, or get money from their asset management accounts. By 1990, 100 centers should be open within an hour's drive of 92% of the affluent population in the U.S. [1]. These centers will all be linked to its computer centers and databases through a communication network across the nation.

In order to serve its customers more efficiently, Fidelity has implemented a marketing prospectus system that uses telecommunications. Instead of calling a customer services representative to request the prospectus of funds and services, a customer can call this automated system using a toll free number and request for literature using the keys of a touch-tone phone. The system generates an electronic order necessary for servicing the request and sends it to Fidelity's literature warehouse in Dallas from where the literature is shipped to the customer. The use of networks saves time and increases efficiency of the whole system.

At Fidelity, the communication networks link a portfolio manager's desk to all the decision support system (DSS) tools needed to make a buy-sell decision. Through these DSS tools, a portfolio manager or a security analyst can access outside databases on security prices. A manager's desk is also connected to Fidelity's trading system through a communication network that replaces the traditional way of trading through telephones. The trading system keeps continuous track of trading through the networked computers that are also connected to the accounting systems that generate reports of trade for the investors and managers. Through such an integrated system, Fidelity improves its customer service dramatically.

One of the strategies at Fidelity is to grow through acquisitions. Fidelity acquired a brokerage firm in 1978 to diversify into the brokerage business. Since then, it has added more brokerage business to its portfolio and has grown that business.

Does Fidelity worry about mismatch and incompatibility of technologies used by the business it is acquiring with its own? Not a whole lot. Fidelity's strategy has been to deal with the incompatibility issue afterwards. As two of the interviewees stated, "We've got to think about those issues, but we do not want to miss the opportunity to acquire a business just because the systems and the networks are incompatible. We will fix those problems later [1]." Unfortunately, fixing such a problem takes too much time and money. On the other hand, it is better to spend resources in fixing such problems rather than missing the entire opportunity to diversify.

As the largest privately owned independent investment management company in the world, Fidelity is in a unique position to use its resources on developing and applying information technology to gain competitive advantage. Unlike a publicly held company, Fidelity does not have to answer to the shareholders how much it spends on computers and communications. This situation has given Fidelity a lot of freedom for experimentation with technology and has allowed it to gain a foothold on the technology that only a few can.

Along with being privately held, Fidelity also benefits from its relatively small size. As Ned Johnson stated, "Because we are relatively small, we can and should be quicker and more nimble than our large competitors." [16] Being small, just like being privately owned, gives Fidelity freedom and flexibility to innovate.

Fidelity is a product-driven company. Its products are driven both by technology and market. Fidelity views new funds the way Kellogg views new cereals: as another opportunity to further segment a market and lure new customers. At the same time, its thrust on technology allows it to allocate resources in finding technological applications to innovate new products.

4.3 Communication Networks at Fidelity

With the development of computer and communication technology, the markets have become increasingly smaller as information is more easily and instantly accessible.

Fidelity uses this technology creatively and strategically. Fidelity's goal behind building a network is to allow its customers buy, sell, or switch mutual funds 24 hours a day, seven days a week.

As shown in Figure 4.1, Fidelity has two computer centers - one in Boston, and the other in Dallas - and four telemarketing centers - in Boston, Dallas, Salt Lake City and Cincinnati. The computer centers contain databases of customer accounts, databases of market information, decision support systems, pricing systems for funds, and also administrative support systems. By January 1987, Fidelity's Boston computer center supported a network that included more than 1,000 data circuits, 6,000 data terminals, 6,500 voice stations, and 4,500 voice circuits [14]. Fidelity realized that it was just about to outgrow the capacity of the Boston computer center, and hence, built a computer center in Dallas. This center is linked with Boston computer center through T-1 leased lines. (T-1 lines offer a bandwidth of 1.544 Mbps for digital data and voice transmission, and can be leased from most of the local and long-distance telephone companies.) Use of T-1 lines gives Fidelity the benefits of much higher capacity and higher reliability of digital transmission compared to conventional 56 Kbps analog telephone lines.

The telemarketing centers handle customer requests and inquiries. These centers are also linked through T-1 leased lines and are connected to Rockwell Collins' Automatic Call Distributor (ACD) system that distributes customer calls dynamically to the next available representative in any of the four locations. All the branch offices and investor centers are tied into the network of T-1 lines through tie lines to form a wide area network. The telemarketing centers are connected to the computer centers through separate T-1 lines in Boston and Dallas, thus forming one integrated network for both data and voice applications. This way, a telemarketing representative can access the data in computers at Boston or Dallas through one terminal.

The New York branch office is directly connected to the telemarketing centers of Boston and Dallas, as well as the computer centers of Boston and Dallas - all through T-1 leased lines. Through these dedicated T-1 lines, New York office can

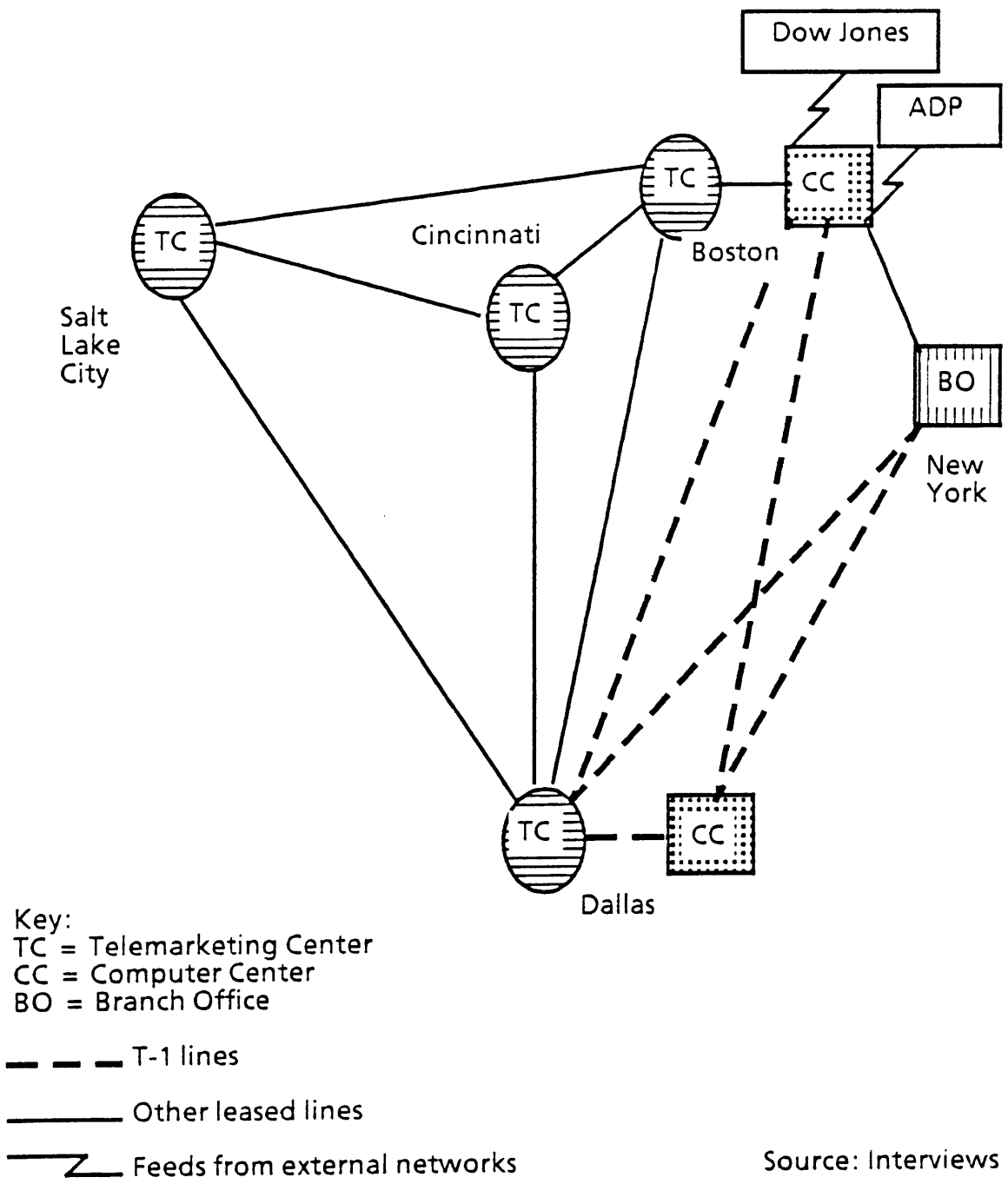


Figure 4.1: Fidelity's Communication Network

get much faster access to the computer data in Boston and Dallas compared to other branch offices.

Few points are worth noting about this network at Fidelity. First, Fidelity built the network between Boston, New York and Dallas in three months - a remarkably short time by any measure. This is a reflection of Fidelity's ability to effectively manage technology-intense projects. Second, Fidelity built in some redundancy in the network by providing multiple paths from one location to another. For example, connection between Boston computer center and Dallas computer center can be established through five different paths. The advantage of this redundancy is that it protects Fidelity against unstable facilities and unpredictable disruption of lines. Third, Fidelity's mission was to apply advanced technology without compromising production service levels. For example, its goal was to have the network available 99.5 percent of the times for end-to-end service. AT&T's Accunet T-1 service guaranteed only 98% availability, and hence Fidelity did not buy the equipment from AT&T [14]!

Fidelity is now planning to expanding the T-1 network to include more sites in U.S. Ultimately, it plans to go for T-3 technology (about 45 Mbps bandwidth) with optical fiber to connect its computer centers. Fidelity sees a great advantage in bypassing all local carriers to save on tariffs and is thinking in the direction of employing bypass technology in all major sites [1].

In the next section, we look at a few of Fidelity's products that use the networks described in this chapter.

4.4 Using Networks into Products

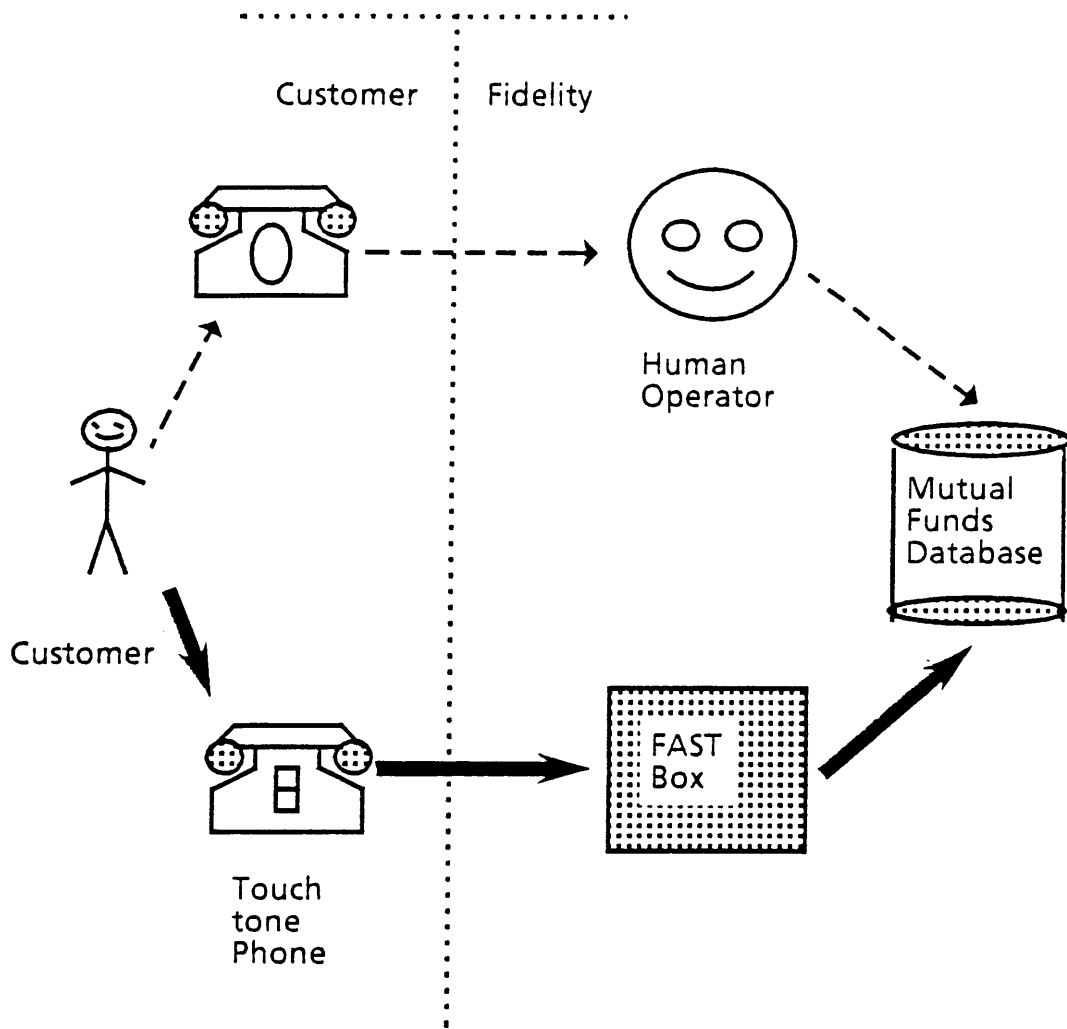
4.4.1 FAST: Fidelity's Automated Service Telephone

FAST is a good example of integration of telephony and databases. As the name suggests, FAST lets the customers perform a variety of transactions - buy, sell, transfer

funds, get quotes, get history of the accounts, etc. - through a touch tone telephone. The FAST system lets the customer enter the transaction in the database through the network described in the last chapter. User "talks" directly to the computer system instead of the human operator. The product idea was conceived seven years ago when Fidelity noticed that a large percentage of customer-calls were inquiries about price of a fund or yield of an account, etc. Fidelity started with replacing the human operator with a recorded message containing answers to most of the commonly asked questions. It soon realized that continually updating the quotes on a recorded message system was very cumbersome. After careful study of alternatives that took about three years, Fidelity implemented a system from Periphonics (a New York based company) that would search databases in different locations and return the information through a voice response [1]. The FAST boxes are connected to the computer centers in Boston and Dallas through Fidelity's network as shown in Figure 4.2.

4.4.2 Hourly Pricing of SELECT Funds

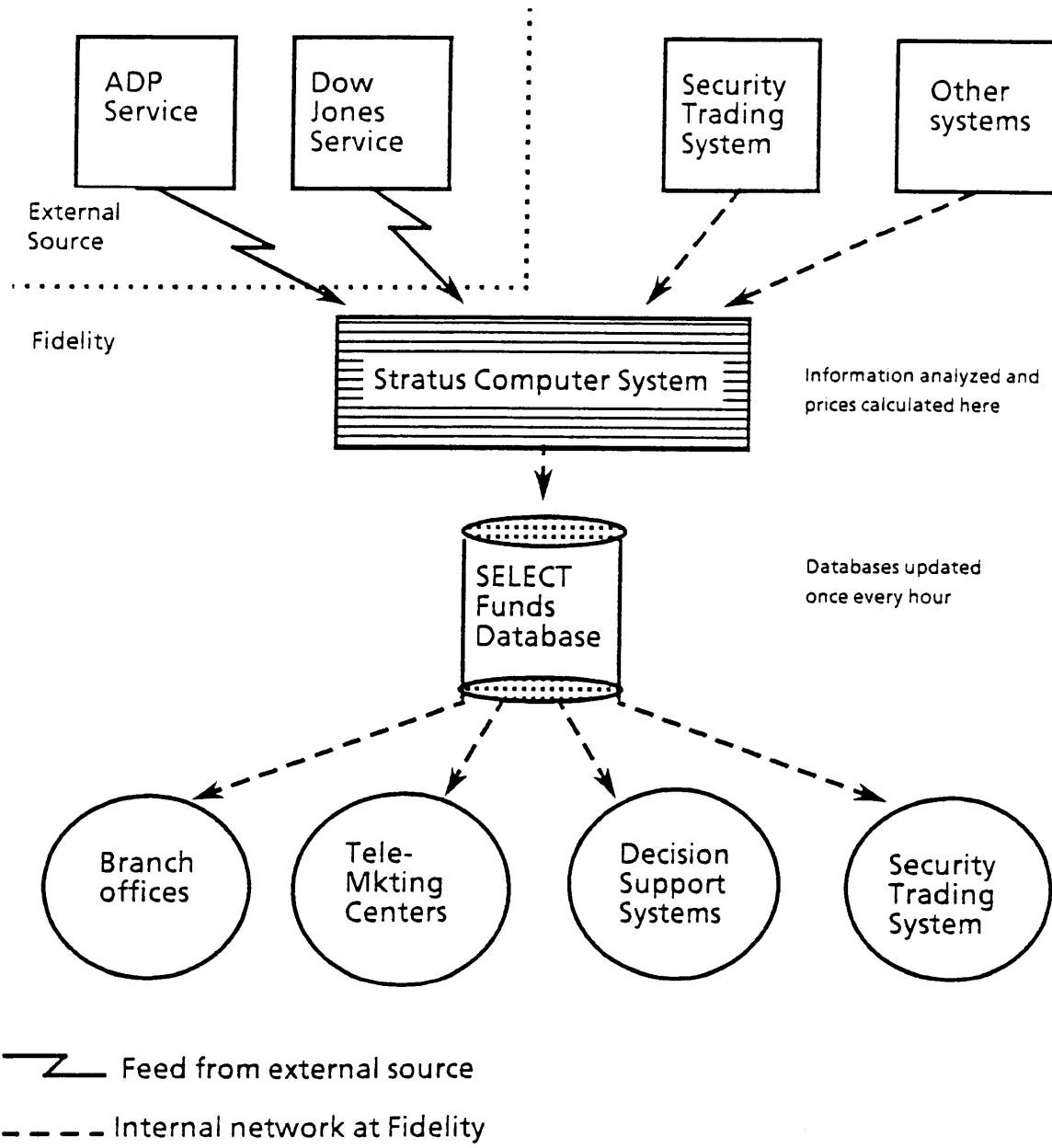
Fidelity's differential advantage is in its ability to price the SELECT mutual funds on hourly basis as opposed to conventional daily pricing. Fidelity achieves this by intense use of the bandwidth of its networks. Pricing information on the funds is fed from five or six different outside sources including Dow Jones financial information services, and Fidelity's trading system to Stratus computers through the feeds from external networks on hourly basis. Stratus fault-tolerant computers are used because of their high availability. The pricing is determined by the programs running on Stratus and then distributed to all branches and telemarketing centers, to the decision support systems of portfolio managers, and the the security traders every hour [1]. It is also distributed to the On-line Reference System or the bulletin boards in investment centers electronically through the internal network as shown in Figure 4.3.



Key:
 - - - - -> Old way of doing transactions
 —————> New way of doing transactions

Source: Interviews

Figure 4.2: Fidelity's FAST Product



Source: Interviews

Figure 4.3: Hourly Pricing of SELECT Funds

4.4.3 FIX: Fidelity Investor Express

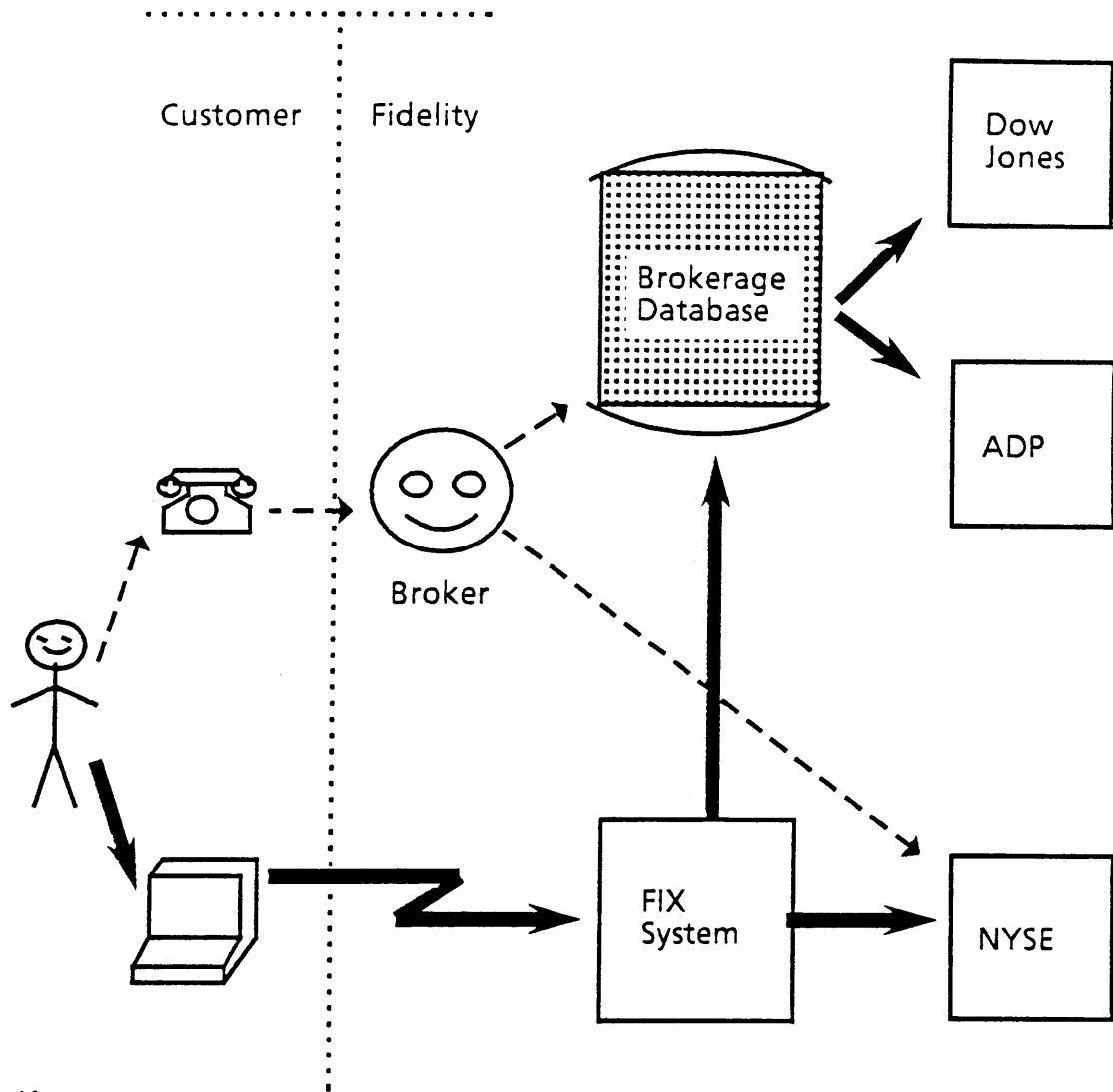
FIX is an attempt at promoting end-to-end electronic transactions in Fidelity's brokerage business. Using a personal computer at home, a customer can log into the FIX system at Fidelity and perform a transaction for buying or selling stocks. The customer can also access the Dow Jones or Reuters financial information services through the same connection to FIX as shown in Figure 4.4. This product is still on a trial basis because the initial feedback from customers is not very encouraging. Customers are still skeptical about the reliability of the system since the customer loses control of the transaction instantaneously after the order is entered [1]. However, the service is available for the customers that may want to use it.

4.4.4 Fidelity First: An Integrated Solution

Probably, Fidelity First is the most interesting example of all for its use of communication networks and connectivity between disparate databases. Also referred to as Fidelity One, this five year project (started in 1985) will result into a product that will connect the mutual funds databases with the brokerage services databases - two databases with very different applications and implementations. The purpose is simple - to be able to give a customer a unified access to all the accounts he or she might hold with Fidelity [1].

Since the brokerage systems were acquired with the brokerage business, these systems are technically incompatible with the mutual funds systems that were developed in-house. These two systems can not "talk" to each other. Since the acquisitions, both computer systems have grown separately meeting the needs of the individual businesses, but creating an inconvenience for the customer that has accounts on both systems, and for the representative as well. As the number of clients using both services is growing, it becomes critical to unify the two databases.

Currently, most of the customers have separate accounts for separate funds at Fidelity. For example, a customer might have a Megallan Funds account, an Overseas



Key:

- > Old way of doing transactions
- > New way of doing transactions

Source: Interviews

Figure 4.4: FIX - Electronic Connection from Home

Funds account, a Puritan Funds account, and a couple of accounts for discount brokerage services. To further complicate the matter, the accounts may be registered under different versions of the same name - e.g. Anand Parikh and A.S.Parikh. If the customer wants to get the current status of all accounts, first of all he has to call different representatives for the mutual funds accounts and brokerage accounts. Second, the mutual funds account representative has to switch between different screens for Megallan, Overseas and Puritan funds, especially if they are registered under different versions of the same name.

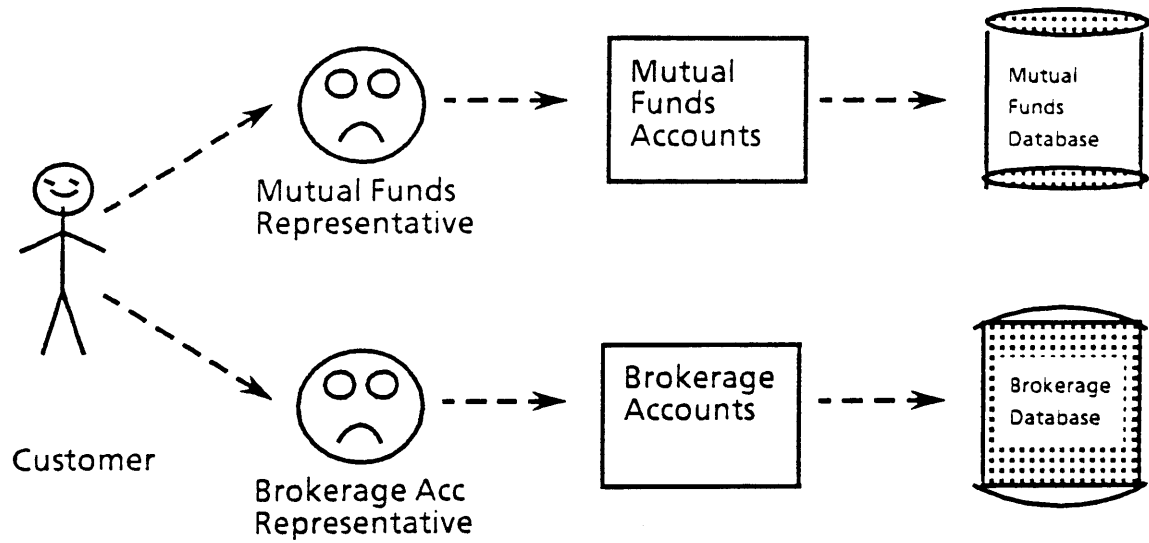
Currently, the brokerage services use information from ADP (Automated Data Processing, Inc.) network hooked into the New York Stock Exchange. It operates in a bisynchronous real-time processing environment. On the other hand, the mutual funds databases operate on the SNA (IBM's Systems Network Architecture) network in synchronous batch processing environment. Mutual funds systems are also hooked into the Dow Jones Services feed through Stratus computers. These are only a few of the differences between the two systems.

With Fidelity First, a single representative will be able to access all accounts under one single access number as shown in Figure 4.5. This new system is being installed in phases. Currently, some of the retail clients have been converted to the Fidelity First system. Ultimately, all retail and institutional clients will be put on the this system. This system provides differential advantage to Fidelity by making it possible for it to cross-sell two separate services using one single representative, thus getting it one step closer to offering convenient one-stop shopping.

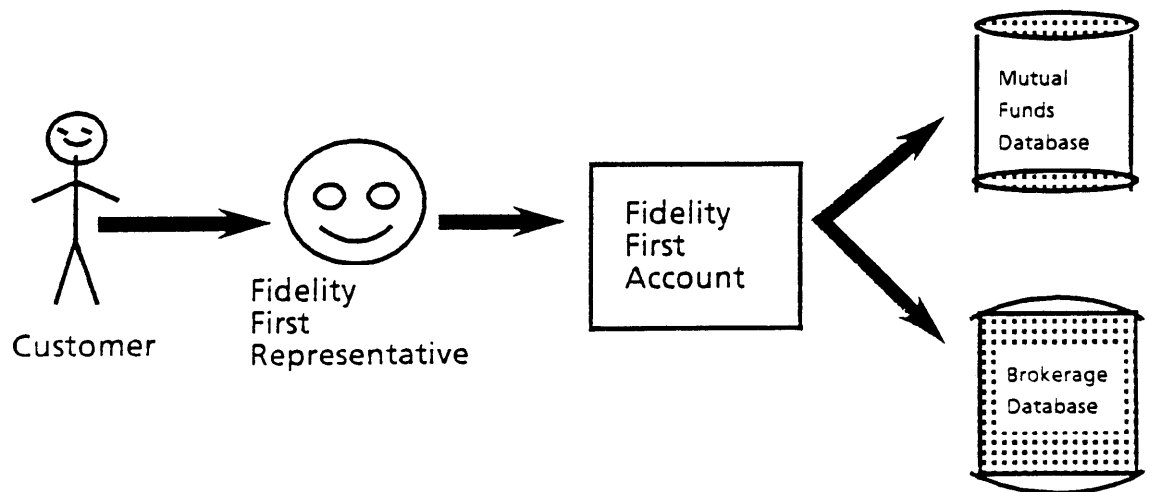
4.5 Fidelity's Competitive Advantage

What are the advantages of such an extensive use of computer and communication technology? There are several:

1. First of all, through the products like FAST and FIX, Fidelity reduces its per unit transaction cost. As mentioned earlier, the marginal cost of servicing



(a) Old System : Separate Access for Separate Accounts



(b) New System : Unified Access for All Accounts

Source: Interviews

Figure 4.5: Fidelity First: Unified Access

an additional customer is very little until the capacity of the system is fully utilized. It saves money on human labor. The savings in the cost are passed on to the customers as savings in the commission. Fidelity's discounted brokerage service charges 70% less commission as compared to a full-service brokerage house.

2. It increases the overall capacity of the system by employing electronic solutions that are inherently more efficient than human operators. For example, through FAST, Fidelity was able to answer about 500,000 calls in one single day on October 19, 1987 - the day the Dow Jones Industrial Average plunged more than 500 points.
3. Fidelity creates a barrier to entry for its competitors by employing a system that has high capital costs. Even for competitors with deep pockets, there is a lead time advantage to Fidelity. For example, since the development of hourly pricing system about a year ago, no competitor has been able to provide hourly pricing of mutual funds yet. Competitor has to first make an investment in developing such a system which can take at least six to nine months. Within this time, Fidelity can solidify and expand its customer base.
4. Through the systems like FAST and FIX, Fidelity makes its service available around the clock. Customers would naturally prefer a service without any restriction on time that in can be used. We all have experienced the value of the service provided by the ATMs.
5. Fidelity displaces the responsibility of entering transaction error-free to the customer. Instead of a human representative entering customer request on paper, now the customer enters the request through the key pad of phone or through a personal computer.
6. By providing hourly pricing of SELECT funds, Fidelity differentiates its funds from those of competitors. It also provides more accurate information to the

investors and increases the chances of a better investment decision giving a higher return on the investment.

7. Fidelity First not only provides a lot more convenience to both the customers and representatives to service customer requests, but also increases productivity. Higher productivity translates directly into cost-savings.

Overall, the use of this technology saves Fidelity money, satisfies its customers, and gives Fidelity a competitive advantage by letting it differentiate its products from those of its competitors.

In the next chapter, we examine another fascinating example of communication networks technology user - Reuters Limited.

Chapter 5

Reuters

5.1 Background: From Pigeon Wings to Computerized Networks

Reuters was founded in London in 1851 by Baron Paul Julius von Reuter, a German emigre to Britain, as a supplier of stock market information. In 1851, Reuters used pigeons as a mean to transport the financial information. From there, it emerged to be a leading global news service, and is now the world's largest disseminator of financial information. According to Information Week [9], Reuters operates the world's largest private communications network and earns 91% of its revenues from sales of its computerized financial services!

Reuters obtains its information from over 113 securities and commodities exchanges and over-the-counter markets, and from more than 2,721 subscribers to Reuters who contribute information about the markets in which they deal [20]. The information flows through several networks into Reuters where it is consolidated and packaged into various services for the financial and business world.

In 1964, Reuters made a commitment to the computerized communication technology and started building a world-wide network. Reuter Monitor was launched in 1973, giving its subscribers access to the largest real-time database that is commercially available [23]. According to one of the interviewees, some of these databases

handle up to 200 changes every second! Reuters went public in 1984. Reuters operates in 158 countries today. Appendix B shows a summary of financial highlights and markets served by Reuters at the end of 1986 [20].

5.2 Reuters' Strategy

“Being global” and “being technological” are the focal points of Reuters’s strategy. It revolves around five key elements [20]:

1. to expand the Reuter database of real-time and historical news and data through internal development and acquisition,
2. to maintain an efficient and worldwide communications network through research and development and investment in network infrastructure,
3. to increase the communications, dealing and automated trading facilities offered to subscribers both geographically and by markets,
4. to maintain the flow of new products and product enhancements, particularly for the purpose of data manipulation, and
5. to provide attractive packages of information and communication products and services.

Reuters’s strategy of acquiring companies to acquire technology is evident in many examples. In 1984, Reuters bought Rich & Company to acquire the computerized trading room technology. In 1987, it acquired Instinet Corporation that makes global stock trading networks for stock exchanges. In 1986-87, it also acquired Finsbury Data Services based in London, a financial information database provider; Networks Utilities based in Chicago, a vendor of a decision support system for the brokerage industry; I.P. Sharp based in Toronto, a specialized software company; and LHW Wyatt Brothers based in UK, supplier of voice communication systems for trading rooms.

Reuters's goal is to make itself indispensable by equipping traders and interconnecting them. These acquisitions have helped Reuters get a strong foothold on the technology needed to achieve this goal.

Technology development is not entirely through acquisitions, however. Reuters's Corporate Technology division in London and its Strategic Technology Group in Long Island, New York, are chartered to search and bring new technology in the company and develop applications based on the available technology.

Figure 5.1 shows the top eight players in the electronic information market, including Reuters [22]. As the chart suggests, Reuters is competing against powerful players like Quotron/Citicorp and Dow Jones/Telerate which have a strong technological inclination themselves. As mentioned before, Citicorp is planning to integrate Quotron's computerized quotation network into its own Global Telecommunications Network to strengthen its position as a financial information provider.

The main reason Reuters has been able to compete successfully is its global presence that none of the competitors have for all the products they offer. It is the only company that operates in so many countries with both financial information services and news services, and that has such a large communication network covering so many countries across the world. Plus, it is probably the only company that knows how to successfully package the communication technology with its products.

5.3 Networks at Reuters

Reuters has about 15 different networks used for different services. It is not possible to describe the networks in detail in this thesis; however, the Reuter Integrated Data Network (IDN) provides a good example of communication network technology at Reuters. The IDN project started about five years ago for the equities markets. The project addressed integration at the global level. It will eventually provide the communications architecture for all information services at Reuters [23].

IDN has three principal features in its design:

THE TOP PLAYERS IN ELECTRONIC INFORMATION

Company	1985 Information revenues Millions of Dollars	Percent of total revenues	Type of information sold
• Reuters	\$505	80%	Commodities and Security quotes, news
• Dun & Bradstreet	325	12	Credit and miscellaneous business information
• Quotron	187	91	Securities Quotes
• TRW	160	3	Credit Check
• Mead	154	6	Legal and general business information
• Telerate	149	100	Commodities and securities quotes
• McGraw Hill	120	8	Financial Information
• Dow Jones	100	10	Securities and general business information

Source: Business Week, August 25, 1986

Figure 5.1: Top Players in Electronic Information Delivery

1. high speed distribution of data,
2. ability to expand the database quickly to match the growth of markets, and
3. full duplication and backup of the network.

At the heart of the network are two databases at Reuter technical centers in new York and London. Information from exchanges in North America, Europe and the Far East is collected to form quotations databases. Dedicated circuits, some via satellites, speed the information delivery from these remote locations to database systems in New York and London. Reuters then packages this information with numbers for price/earnings ratios, yields, etc. Final product is then distributed for terminal access around the world. All systems and inter-center communications are fully backed-up; all data centers are fully protected against power or plant failures; all equipment is maintained by Reuters's own dedicated staff, to ensure the highest possible level of service availability. Figure 5.2 is a depiction of Reuter IDN.

The first product to run on the IDN was Equities 2000, which was formally launched in May 1987. Reuters is also planning to establish a separate Far East center to meet the needs of this expanded market.

Another network at Reuters is the Reuter Monitor Network which provides the infrastructure for most of Reuters's services including Reuter Monitor Dealing Service, Reuter Monitor Bonds Database Service, etc. This network employs multiple technologies that include satellite communication, land-based T-1 carriers, Digital's DECnet computer communication network, etc. Reuter Monitor Network supports about 130,000 terminals worldwide [1].

Next, we look at some of the products that use these networks.

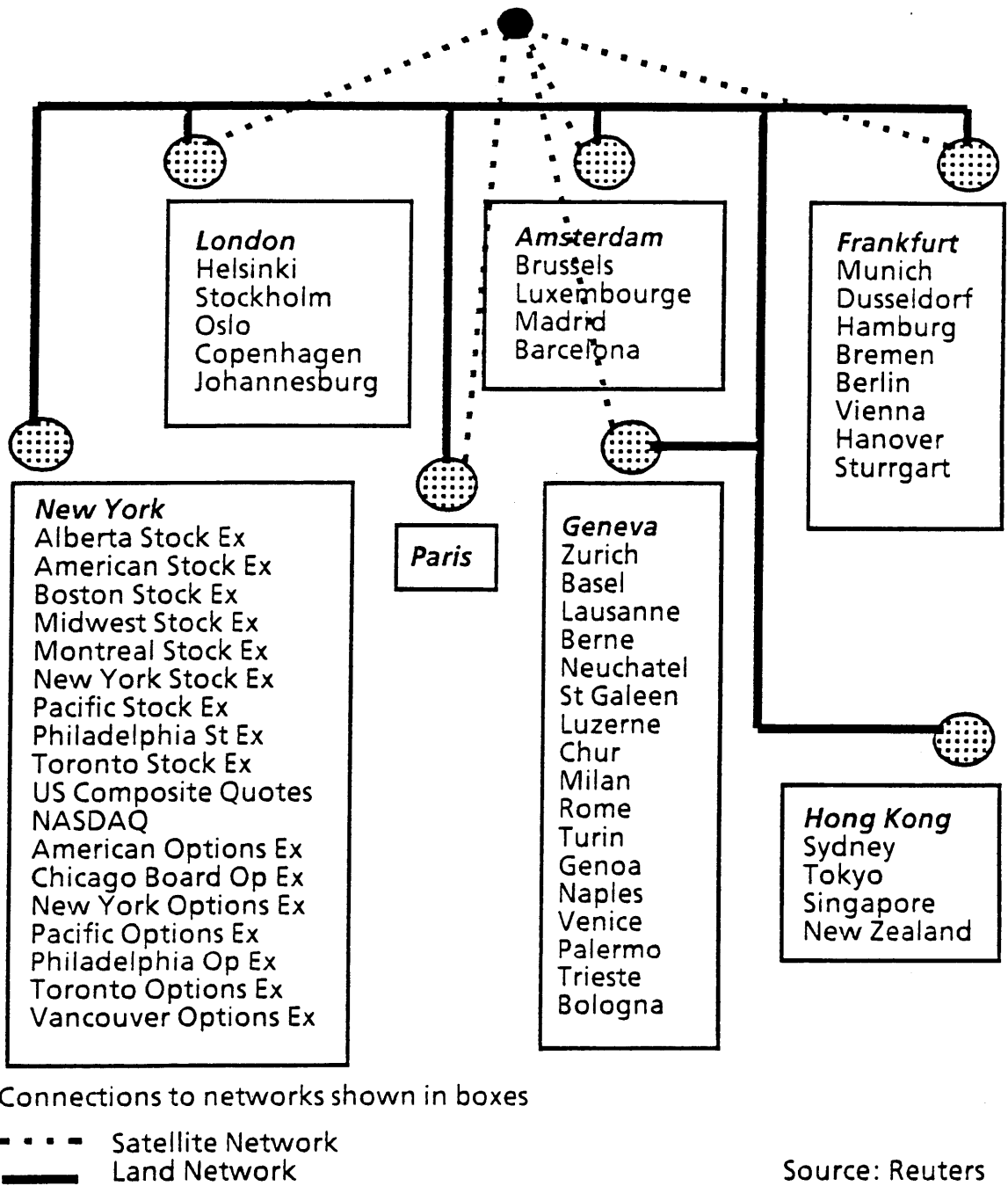


Figure 5.2: Reuter Integrated Data Network

5.4 Network-based Products

5.4.1 Equities 2000

As mentioned earlier, this was the first product to run on the Integrated Data Network. The product is targeted at the rapidly expanding international securities market, aiming to provide quotations for every instrument traded on every stock, commodity, options and futures exchanges around the world. When the product was launched in May 1987, it carried over 55,000 real-time quotations of stocks, bonds and related options from 75 stock exchanges. The Commodities 2000 product - a sister product of Equities 2000 - carried about 18,000 quotations on commodities, financial and energy futures and options from over 30 exchanges.

Clearly, this would not have been possible without the use of communication network technology. This technology made two things possible: (a) to provide real-time information, and (b) to cover so many exchanges around the world.

Using this product, a user can view market quotations, financial and political news, and foreign exchange rates - all at the same time. This product also allows access to the entire Reuter Monitor database of news and market prices of currencies, bonds, commodities, etc., provided by 2,721 banks and brokerage houses. Subscribers also get an access to Reuter historical database covering news and background information on over 2000 companies worldwide - at times, an essential tool for making an investment decision.

5.4.2 Reuter Monitor Dealing Service

Quotations and real-time data are very useful for making an investment decision, however, that is only a step in the right direction. The next step is real-time transaction processing through the network around the world. This is what the Reuter Monitor Dealing Service attempts to deliver.

This service facilitates direct trading on a personal dealer to dealer basis. Reuter

Monitor Network is designed such that any terminal can connect to any other terminal across the world within seconds and complete a transaction within minutes. It is a fast computerized network system that enables dealers to trade with each other on video terminals. The dealer has three key elements he or she needs at the fingertips:

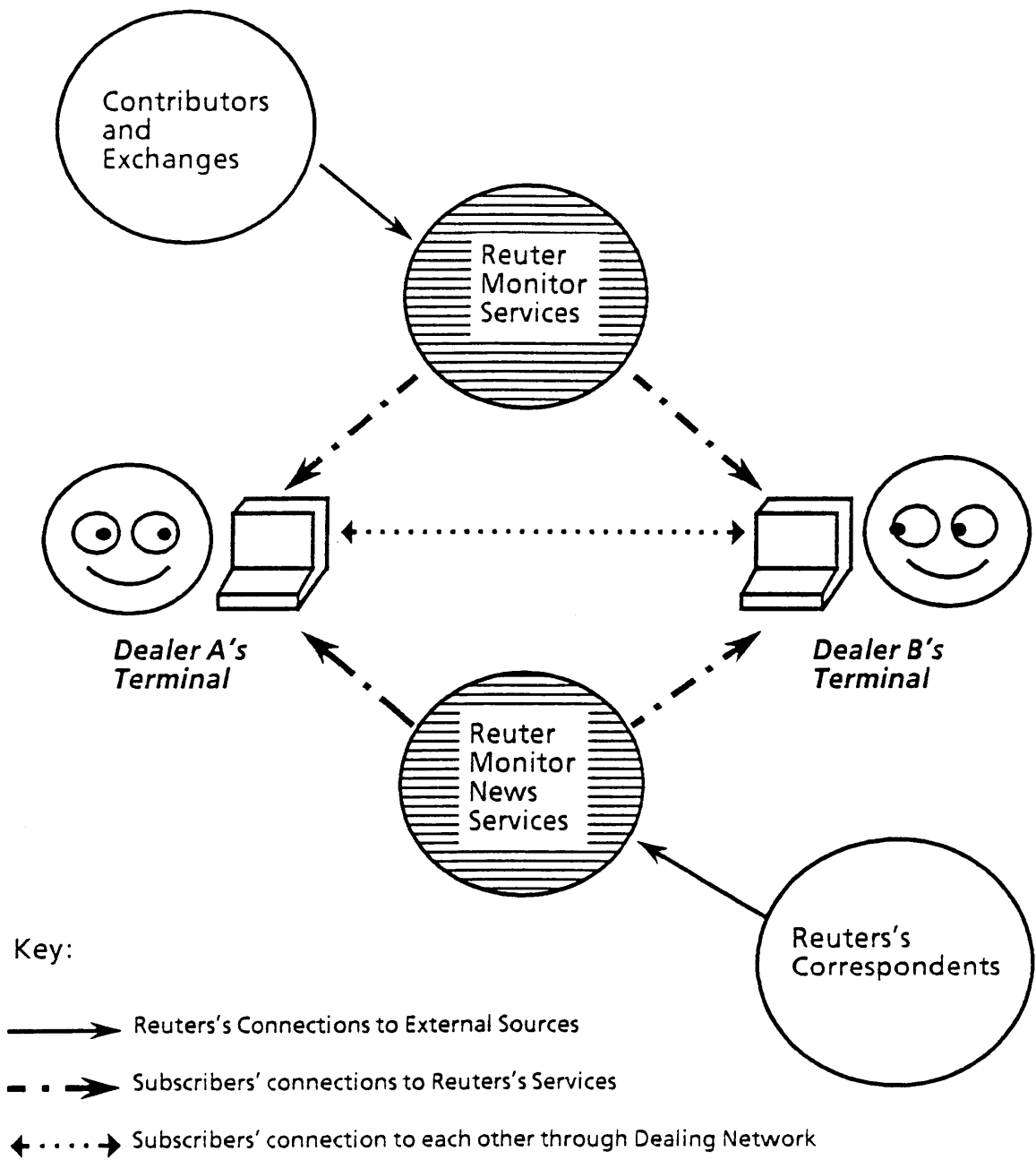
1. access to rates,
2. access to news, and
3. access to a fast communication facility for direct dealing.

These three elements are brought together by the Dealing Service on a single screen. Figure 5.3 is a depiction of how this service works.

5.5 Competitive Advantages

What are the competitive advantages that accrue to Reuters from the use of the communication network technology?

1. In the case of Reuters, it is clear that “no networks” equals “no products”! Most of Reuters’s products are based on the several networks that it operates. Reuters’s whole business depends upon this technology. It is essential for survival, not only for a competitive edge.
2. Reuters’s products are essential to its customers. If Reuters would not provide these services someone else would. Reuters keeps its products differentiated by the use of the communication technology at the global level. Most of its competitors use the same technology, but no one uses it in so many countries as Reuters does. The advantage of being global is not only the expansion of market, share, but also better service to its customers. For example, if I am dealing in oil futures in the U.S., I need to know the oil prices in the middle east in real time before I can make a decision on my bid. If the terminal I am



Source: Reuters

Figure 5.3: Reuter Monitor Dealing Service

using to get the information does not provide me that information, it is of no use.

3. Global network acts as a barrier to entry from competitors. For a competitor to create a similar network, it has to make a lot of capital investment either in technology or in acquisition. Citicorp did both by building GTN and acquiring Quotron. However, very few of Reuters's competitors have as deep pockets as Citicorp does.
4. Network-based services also give Reuters a lot of potential for diversification. For example, a controversial issue is whether Reuters is beginning to replace the exchanges by its network-based dealing system. As a London stock broker told the Wall Street Journal [21], "Reuters has actually become the market. There isn't any exchange, just Reuters." Reuters defends itself by saying that it wants only to be a link between established methods of exchange and is not developing into a competitor for exchanges. Whatever the strategy, the network technology is certainly providing Reuters an opportunity to expand into an electronic exchange for all types of securities, futures and currency. In fact, Reuters already has an agreement with the Chicago Mercantile Exchange to install a networked trading system designed for futures and money markets [9].

Chapter 6

Strategic Management of Networking Technology

6.1 Technology's Place in the Corporate Strategy

It should be evident from the discussion thus far that in order to compete successfully in today's financial services industry, the communication networks technology needs a place at the center of the corporate strategy. As Peter Keen mentions in his book 'Competing in Time' [33], "Technology is not a peripheral issue. The planning process has to begin with business strategy, but it has to end with boxes and cables" to form a communication network.

Following strategic issues have a direct relationship with how key decision-makers view the role of communication technology:

1. Get a competitive edge within the existing marketplace and product base by using communication technology to achieve higher customer satisfaction by differentiation and cost leadership,
2. Improve the performance of the business using communication technology when coordination, communication and timeliness of key information are constrained by time and geography, and
3. Improve positioning of the company to expand market and product boundaries by exploiting communication technology that provides large-scale delivery ca-

pability and advantage of lead time to change the products.

In each case, the top decision-maker must realize the strategic advantages offered by the communication technology, and consider them while formulating the corporate strategy. The top brass has to make a commitment to invest in this capital-intensive technology. As we have seen earlier, this technology is an integrated part of the corporate strategies at both Fidelity and Reuters.

Strategists do not need to understand the nuts and bolts of the communication technology, but they have to know enough to be able to judge its impact on competitive positioning. Some of the issues that the senior executives - including presidents and CEOs of companies - need to know while formulating business strategies are described in the following sections.

6.2 Sustaining the Competitive Edge with Networking

It is important not only to gain competitive edge, but to sustain it as well. To sustain the competitive edge, one must be cautious for not letting the technology become a commodity. Technology has to be properly packaged with other products and services of the company such that the customer keeps getting more value from these products and services. The question that the strategists have to answer is how to lock the customers in and competitors out.

Use of communication networks help answer this question in several ways [28]. Figure 6.1 shows how communication technology can defend its user against competitive threat and help sustain the competitive edge [34], [35].

As Figure 6.1 shows, communication technology can introduce switching costs, making it more costly for a buyer to change suppliers. For example, Fidelity introduces switching costs by giving its customers more timely information that can help the customers to manage their investments better. Better management of funds results in higher return on investment. If a buyer switched to another mutual funds company that does not use this technology, the chances are that the performance

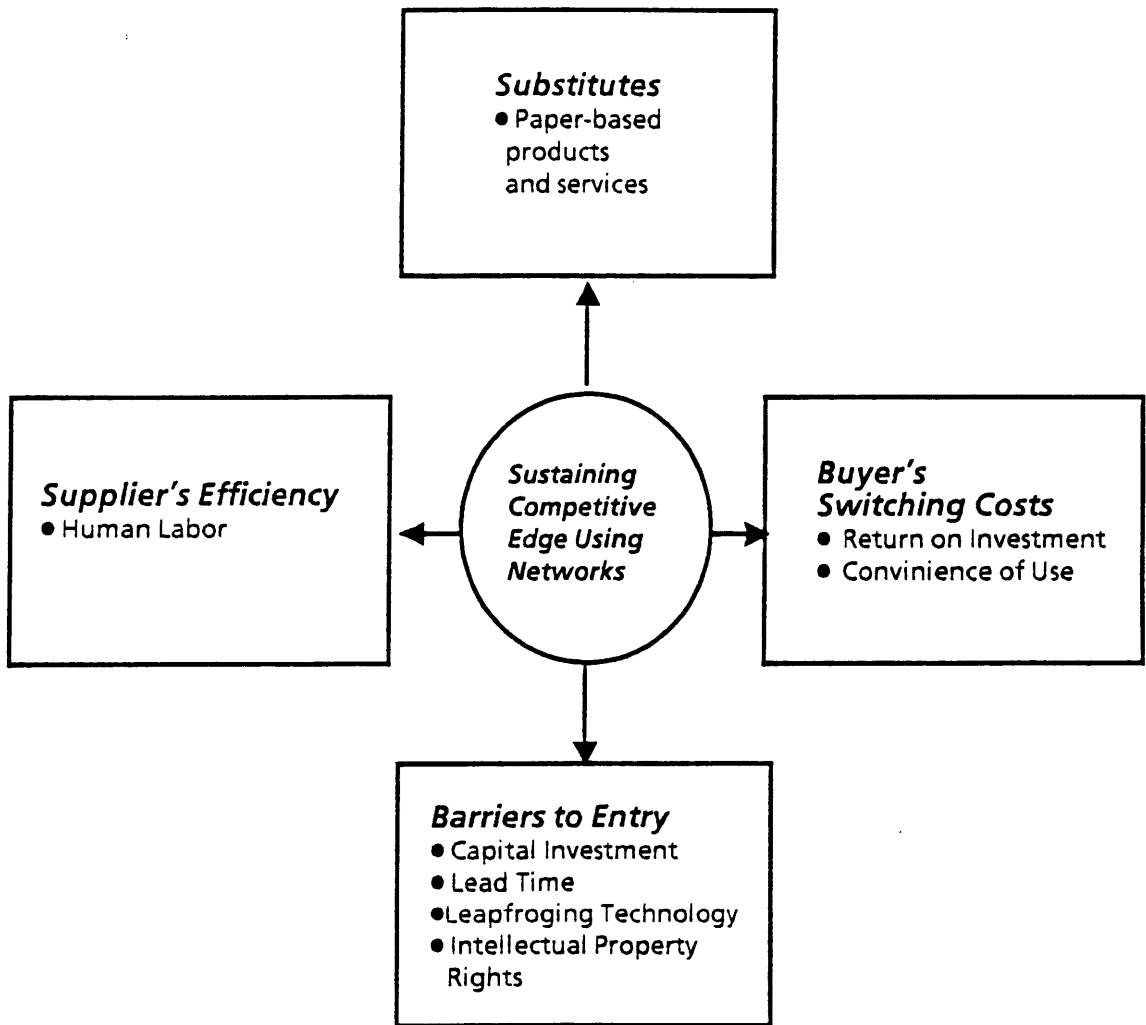


Figure 6.1: Sustaining Competitive Edge with Networking

of those funds would be worse because of lack of timely information. The switch to another company will cost the buyer in terms of lower return on investment. The switching costs need not be in terms of money. They can be also in terms of convenience. For example, if a customer is used to the convenience of Fidelity's FAST or FIX products, and to trading funds using the automated telephone or a personal computer, and if the performance of funds at two companies are same, he will not switch to another mutual funds company that does not use this technology because he will lose that convenience offered by FAST and FIX. Thus, these switching costs reduce the threat of substitution.

Communication technology gives its user bargaining power against suppliers. For example, as we have seen, it is cheaper for Fidelity to use the FAST boxes to answer the routine requests of customer than to use human operators. Fidelity can use this advantage of technology as a bargaining power to one of the suppliers - human operators. This does not mean that all human labor can be or should be replaced by technology. However, it is a viable option to displace the labor force and use it for some other functions where it can be more productive, for example, in advising clients on better investments.

This technology also protects the user against threat from substitutions. It is clear that an electronic information service is more efficient than a paper-based information service as we saw in the case of Reuters. Communication based on electronic networks takes much less time and money to complete compared to communication based on paper mail. Therefore, paper-based communication is clearly an inferior substitute to electronic communication.

Communication networks also provide several barriers to entry that help sustain the competitive edge. They are:

1. Cost: As we seen earlier, the capital cost of networks is quite high. In addition, companies have to hire skilled professionals to operate the network and develop applications. Only competitors with deep pockets can afford this technology.

2. **Lead Time:** Use of this technology provides lead time to its user. Companies such as Fidelity gain at least six months of lead time by packaging this technology in its products. Typically, it takes the competitor two to three months to copy a mutual fund. This time gets much longer if technology is built into the fund. For example, the hourly pricing of SELECT funds have been around for about a year now, but no competitor has been able to copy it because it uses complex technology [1].
3. **Leap-froging Technology:** The competitive advantage also comes from leapfrogging in technology rather than incremental improvements. For example, Reuters created the dealing network and brought together buyers and sellers directly on the electronic tubes connected to the network. The ability to trade equities directly through the network without going through an exchange was a leapfrog in technology.
4. **Protection of Intellectual Property:** Technology can be protected by patents, copyrights, trademarks and proprietary rights. For example, Reuters protected its innovation of trading systems by a patent. By doing so, Reuters created a huge gap between itself and its competition.

Thus, communication network technology helps its user sustain the competitive edge by providing switching costs, barriers to entry, cost efficiencies and differentiation of products and services. A better set of products and services, delivered more efficiently by electronic means, helps the user of this technology defend against threat from competitors.

6.3 Benefits and Issues of Integrating Value-added Chains

A company does a variety of activities to meet its business goal. Each of these activities adds value to the company's overall performance. These activities are linked to each other and are dependent on each other. The linkage of these activities

is referred to as a value-added chain. The activities in this chain are connected to each other such that the performance of one activity affects the efficiency and effectiveness of another activity.

“Integrated Value-added Chain” is an extension of Michael Porter’s framework [24] that extends the interdependence of activities outside a company to other companies. Thus, an integrated value-added chain is an integration of the value-added chain of a company with those of its suppliers and buyers [29].

Communication networks technology has a profound effect on both the linkages of internal activities of a company, and on the linkages to activities of a company with its suppliers and buyers. Communication technology greatly enhances the value added to the performance of a company by linking its internal and external activities more effectively and efficiently. Figure 6.2 shows a part of integrated value-added chain that is relevant to this discussion.

As shown in Figure 6.2, inbound logistics for a financial services company refer to gathering information from various sources. This information includes stock quotes, market prices, interest rates, currency rates, etc. Operations refer to packaging the information in various products and services. Outbound logistics refer to the delivery of products and services containing the information gathered. Marketing and Sales refer to understanding, creating and expanding markets, and to selling products and services. Service means performing transactions of clients and responding to customer requests.

This example shows Fidelity as a financial services company, Reuters as one of its suppliers, NYSE as a supplier to both Fidelity and Reuters, and an individual investor as Fidelity’s customer. The linkages between NYSE, Reuters, Fidelity and the Investor are shown in this figure. NYSE gathers information from multiple sources, Fidelity’s brokerage services being one of them. Reuters gathers information from NYSE among others. This information is packaged in services such as Reuter Monitor and is made available to subscribers such as Fidelity. Fidelity also gets certain information directly from NYSE. The information is ultimately passed on

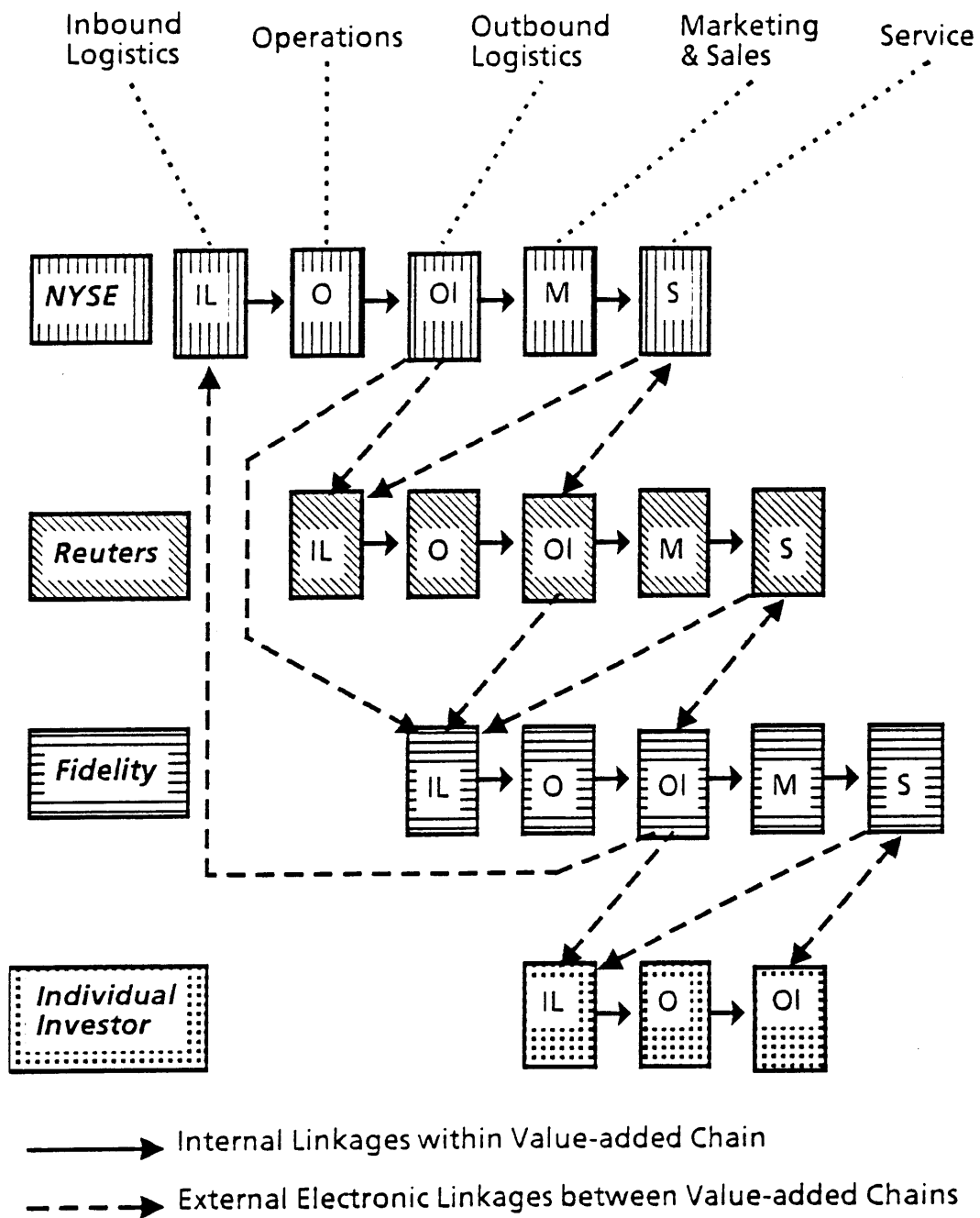


Figure 6.2: Integrated Value-added Chain

to the investor in various forms. It can be packaged as a part of a mutual fund's price; it can also be passed on directly as stock prices. The linkages between NYSE, Reuters, Fidelity and the Investor can all be electronic as we have seen in last two chapters.

These electronic linkages between the various components of an integrated value-added chain can also be used for other activities. For example, an investor wanting to buy stocks can place a transaction order to Fidelity through the FIX service that uses electronic communication network. Fidelity's computers perform the transaction as a service to the investor and send the information of the stock transaction electronically to NYSE. This information generates new information about stock prices and is passed on back to Fidelity and Reuters from where it ultimately reaches the investor. In this way, communication linkages provide a closed loop feedback on transactions and prices to all components of the chain.

6.3.1 Benefits of Integration

Integration by communication technology is permeating the value-added chain at every point, transforming the way value-added activities are performed and the nature of the linkages among them. Integrating value chains by communication network technology provides following benefits:

1. **Cross-selling:** Integration of suppliers and buyers on either sides of a value-added chain makes it easier for a firm to cross-sell. By integrating the mutual funds business with brokerage business, Fidelity can cross-sell its brokerage services to its mutual funds customers at no additional expense.
2. **Flow of New Information:** It lets different components in the integrated chain generate more data as a component performs its activities, and collects and transfers the information quickly that was not available before. This technology greatly enhances a company's ability to exploit the linkages between activities, both inside and outside the company.

3. **Responsiveness:** The networking technology provides a glue between activities of a company with those of its suppliers and buyers, thus coupling the components of a value-added chain more tightly. This integration of infrastructures does increase the inter-dependencies of the components in the chain, however, it also allows a firm react more quickly to the changes in supplier's strategies and buyer's needs. If London Stock Exchange decides to list 500 new stocks, Reuters can almost instantaneously expand its services to include those 500 listings.
4. **Generic Strategies:** Communication networks help a company achieve cost leadership and differentiation for all of its activities [25]. As we saw earlier, Fidelity saves money by consolidating its telemarketing operations in four centers and linking them to one single warehouse of advertising literature in Dallas. At the same time, its ability to fill in a customer's request for a prospectus in less than a day - made possible by its use of toll-free numbers and communication networks - differentiates its marketing activity from its competitors'.
5. **New Possibilities:** Use of networks to integrate value-added chains opens up new possibilities for the players involved. For example, Reuters signed an agreement with London Stock Exchange in summer of 1986, to expand its Reuter Monitor service to display bid and offer prices quoted by the member firms of the London Stock Exchange in addition to the prices of the stocks themselves. Thus, the subscribers of the Reuter Monitor service could see the additional information on stock pricing that they previously could not see in one package. This agreement allowed Reuters to use its networks as a conduit for information about the member firms of the exchange as well as for the exchange itself.

6.3.2 Issues of Integration

Extending the concept of integrated value-added chain, it can be seen that it is possible for the supplier to go directly to the buyer by short-circuiting the chain. In the above example, the London Stock Exchange also wanted to use Reuters's network as a conduit to get information of the transactions performed by Reuters's subscribers. Reuters did not feel comfortable passing the information on its subscribers which it considered confidential, and refused to use the networks for this purpose [21]. According to an interviewee, the issue was not yet settled.

This possibility of forward integration by information providers and backward integration by brokers is especially threatening if the integration is done through electronic networks. For example, using Fidelity's FIX service, a customer can directly access the Dow Jones database from a PC at home. The customer, however, has to pay Fidelity for the service today, but it is possible that Dow Jones can offer the same service to investor with an access to a PC at home. To protect against such a scenario, therefore, Fidelity has to package some other services to the Dow Jones database and provide the customer with more than just the price quotes. Fidelity does so by providing transaction capabilities in its products.

It is true that a chain is as strong as its weakest link. If one of the links breaks, the chain will break as well. In the case of the integrated value-added chain, all components of that link has to operate smoothly for the whole chain to operate smoothly. For example, if the internal networks at Fidelity are broken, the information gathered from the stock exchanges and Dow Jones or Reuters does not reach the customer. In that case, the integration from the stock exchanges to Reuters or Dow Jones to Fidelity is of little value.

Similarly, if the customer does not feel comfortable using a personal computer or the keypad of a touch tone telephone to perform a transaction with Fidelity, the gains of integrated networks in efficiency and cost-savings are only myths. Only if the customer uses the electronic facility provided by the vendor, would the benefits

be realized.

Financial services companies will have to manage these issues in order to benefit from the integration of value-added chains.

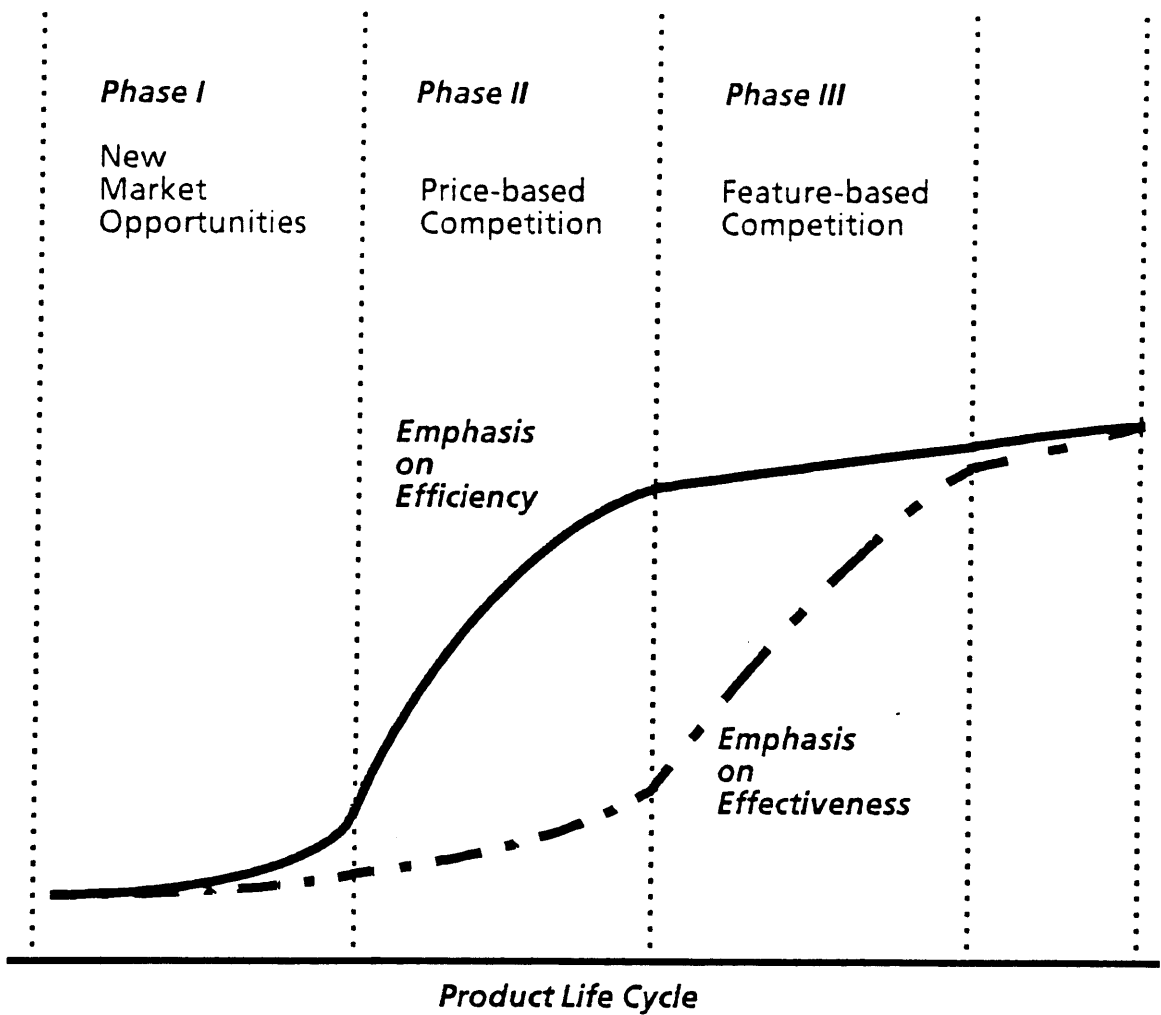
6.4 Managing Efficiency and Effectiveness

In any industry, the competition starts off by introduction of new products. These new products tend to address newly discovered needs of customers. In the beginning, there is very little competition because demand is higher than what suppliers can provide. In addition, the industry is being flooded with new ideas. During this phase, the emphasis on both efficiency and effectiveness is very little because one can compete successfully even without efficiency and effectiveness. This is shown in Figure 6.3 as Phase I.

As the industry matures, the competition sets in for price and time-to-market. ‘Who gets the products at the lowest price first’ becomes the name of the game. In a price-competitive situation, efficiency of manufacturing the product or packaging the service at the lowest cost becomes very important. During this phase, the emphasis on efficiency increases dramatically as competitors try to lower the cost of production and packaging. During this stage, there is also a large “shake-out” in the industry as many companies quit the industry because they can not survive the price-war. This is shown in Figure 6.3 as Phase II.

At the end of Phase II, cost-based competition does not give much of a competitive advantage because most of the competitors are determined to match the price. As a result, features of the products become more important than price or cost. Competitors start placing more emphasis on effectiveness of the product, and not just on the efficiency. This is shown in Figure 6.3 as Phase III.

Financial services industry is currently going from the second stage to the third stage. We have seen competition growing and a shake-out occurring with many companies going bankrupt in last few years. The competition is not only in de-



Key:

- Emphasis on Efficiency for Competitive Edge
- - - - -** Emphasis on Effectiveness for Competitive Edge

Figure 6.3: Managing Efficiency and Effectiveness

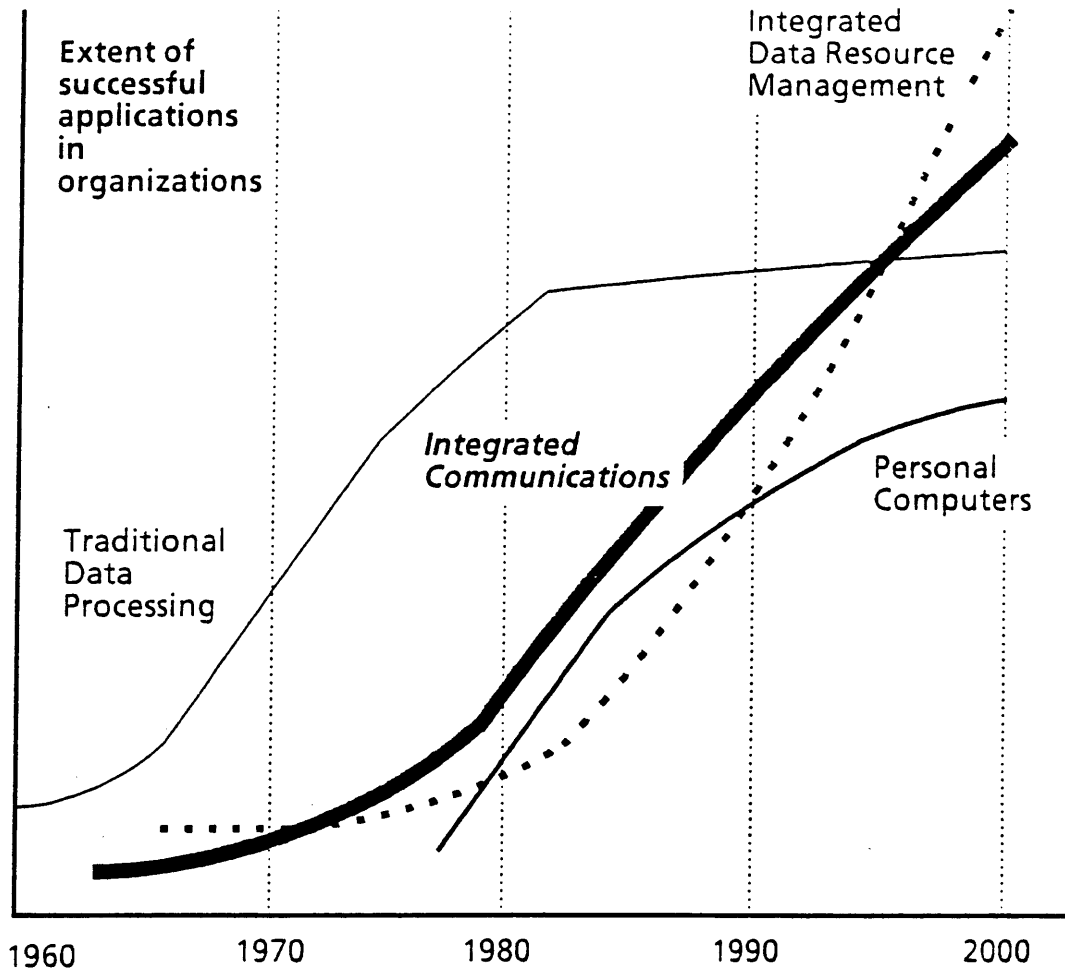
livering products with the lowest price-tags, but also in the value of that product. What features are packaged in the product, how convenient is it to use, what is the quality of the product, what functions can it perform, etc., are the questions of key importance.

Communication networks technology is capable of providing both the efficiency and the effectiveness in a product or a service. For example, Fidelity's FAST service provides convenience of doing a transaction at any time of the day from any touch-tone phone. Fidelity First product will give Fidelity's customer convenience of making transactions between several accounts, all using one access number. A subscriber of Reuter Monitor service can get quotes and make deals in stocks, bonds, precious metals and oil using the same screen that is connected to multiple information sources. The convenience of access, the accuracy and timeliness of data, and the quality of service are valued more than the cost of making those happen.

It is for this reason that this technology is finding a lot of new applications very quickly. Figure 6.4 shows learning curves for new technologies [37]. As shown in this figure, learning curve for integrated communication technology is quite steep meaning that a lot of new applications are being developed and used in organizations that are based on this technology. This is another reason why strategists in the FSI should invest in this technology. Users can find innovative applications of this technology that can suit their needs.

6.5 Creating a Suitable Environment for Innovations

One of the reasons that Fidelity is so successful in innovating new products that are based on technology is its environment. Fidelity is a privately owned company. As most of the interviewees at Fidelity mentioned, the private ownership gives it tremendous advantage over publicly owned companies for making decisions on investment in technology. If Ned Johnson wants to invest in building a network across the countries, he does not need to convince the shareholders of his idea.



Source: Peter Keen (1981)

Figure 6.4: Learning Curves for New Technologies

Of course, the leader of the privately owned company has to have the vision to invest in technology, but once he or she is convinced that the technology is strategically important for the success of the company, the flexibility of making independent decisions can be exploited. A company has to create an environment that is suitable for innovations if it wants to benefit from technological advances. This environment has to have a lot of flexibility, room for error, and a balanced control that does not retard creativity. The environment has to promote entrepreneurialism that allows people to use whatever creative juices they may have. Typically, such an environment has decentralized organizational structure rather than hierarchical.

While promoting flexibility and creativity however, the decentralized organization must not lose the control and the sight of a common goal. Communication technology allows decentralized organizations to maintain this control by providing a glue between different parts of the organization. Almost all of the successful large corporations today have some form of a computerized communication network. Applications such as electronic mail, file transfers, shared databases, are a few examples of how networks can help retain the thread of commonness between different parts of an organization.

6.6 New Product Development Strategy

If a company wants to benefit from the communication network technology, it must pay close attention to how it develops new products and how it incorporate this technology in it.

There are two reasons for it. First, the product life cycle is shrinking, and therefore, product design cycle is shrinking. It used to be that a mutual funds company spent 18 months to bring a new product out with high technology-content. Now, that design cycle has shrunk close to six months [1]. In fact, as we saw before, Fidelity spent only three months to build its T-1 network between Boston, New York and Dallas. Without the emphasis on time-to-market and continuous watching of

technological developments, this would have taken more than double the time.

Second, the technology is changing very rapidly. As Frank Diasparra, a vice president at Fidelity in charge of Technology Services, says, “The technology is changing so quickly that if you try to address future business problems or agendas with the technologies today, you can be wrong.” [13]

For this reason, Fidelity has a very interesting approach to incorporating technology into new products. It modifies the implementation of its products continuously to take advantage of new developments in technology. This process of ‘incrementalism’ results in layers of technology that coexist. The problem, of course, is the compatibility between different layers of technology. But, Fidelity prefers to manage the compatibility problem rather than waiting for the technology to mature till perfection. Fidelity’s NADCO (National Advanced Development Company) subsidiary looks at very advanced technologies for applications in its products. The hourly pricing of SELECT funds and Fidelity Investor Express (FIX) were both made possible by NADCO’s initial efforts. The Technology Services group looks at the technology of next two to three years. If something looks promising, a team of engineers pursues it, talks to the vendors, builds prototypes, and brings it to the attention of Fidelity’s President. The idea enters a formal process of approval and gets implemented or rejected at the end. During this process, both technical and marketing people get involved.

The important point here is that Fidelity has decided to spend resources on keeping track of the technology. There is also money for experimentation if there is a slight hope that it can give the company a competitive edge.

6.7 Marketing and Distribution Strategy

Communication technology has a great impact on a company’s marketing and distribution strategy as well. Using communication networks, a company can expand into more areas, and yet centralize its distribution facility to get scale economies. As we

saw in Fidelity's case, Fidelity has expanded regionally by setting up telemarketing centers in four areas - Boston, Dallas, Salt Lake City and Cincinnati. While these four centers serve four different regions of the U.S., they are connected to each other and to the computer centers in Boston and Dallas by a communication network so that they all can share the same data at the same time. In this way, these four centers operate independently, yet they tie into a common database. Moreover, if a customer in the Dallas region calls telemarketing center in Dallas, and if the center is busy, the call is automatically routed to one of the other centers. The representative at the other center has an access to the same data as the one in Dallas, and therefore the customer does not know the difference.

Similarly, the distribution of prospectus and other material is centralized. Prospectus are shipped from one center in Dallas instead of fifty separate centers for fifty branch offices. A request for prospectus is routed to Dallas on the communication network automatically when a representative enters the request on the screen. In this way, Fidelity has to staff and operate only one distribution center and saves a lot of cost of distribution.

6.8 Managing Vendor Relations

Vendor relations becomes a strategic and a technical issue. Good vendor relations can often take the shape of a strategic partnership. The bargaining power of the technology user over the technology vendor plays an important role in the vendor relationship.

In the communications networks arena, vendor relations become extremely important for one simple reason - compatibility between multi-vendor equipment. Since the regulations on the equipment designs are very loose, almost every vendor has its proprietary architecture. Only recently, international standards such as OSI (Open Systems Interconnect) and IEEE 802 series standards are emerging for the computer communication equipment. National and international standardization bodies such

as CCITT, ISO, ANSI, IEEE, etc., are working hard at standardizing protocols for networks. In the telecommunication arena, AT&T has set defacto industry standards, and equipments are certified by agencies such as Bell Core, and regulated by FCC and the PTTs.

A user of the communication networks would not want to get locked into the proprietary architecture and protocols of one vendor for ever. Since DEC's computers use a different communication protocol from IBM's computers, it is in the benefit of the user to influence its vendor to make the protocols compatible with the standards set by various international committees.

Companies like Fidelity work hard at convincing their vendors to modify the designs to suit their needs and to reduce the incompatibility problems. For example, Fidelity wants IBM to provide Ethernet support on the Personal System-2 computers [1]. IBM which has typically supported token ring implementation of local area network, and not Ethernet, may accommodate Fidelity's request if it gets convinced of two things: (1) if IBM does not provide this support, someone else would, and (2) Fidelity is not alone in making this request, but there are a host of other buyers who may switch the vendor if they do not get what they want. Fidelity can not create the standard, but it can certainly influence its vendors to design its products to meet certain standards.

It is important to work closely with the technology vendors not only to influence them, but also to know of their technological innovations before the competitors do. How to get the new technology before the competitors get it? Reuters answers this question by being a 'lead user' for certain technology. Reuters maintains close relationships with key vendors to try to learn about their latest technological developments before the products are announced. For example, it worked with Intel Corporation on development of a graphics display processor chip that some other company was going to buy from Intel and use it in a graphics display board that Reuters was going to buy. Since this chip was the heart of the product that Reuters was going to use in its terminals, it made sure that the application met its needs

and that it got that technology first [1].

6.9 Make versus Buy - A Strategic Choice

There are two ways a company can get the technology. (a) it recruits technical people and develops the technology (or the applications based on technology) in-house, and (b) it buys technology from other companies that use the technology. Another form of (b) is to buy the company itself that uses the technology. Both choices need large investment and have far-reaching implications. They both are long-term commitments for a company and can change the course of the company significantly.

Fidelity and Reuters both do some of both, but Fidelity does more of (a) and Reuters does more of (b). As we saw earlier, Fidelity's NADCO and Fidelity Systems Company were formed specifically for developing technology-based applications in-house. NADCO developed the hourly pricing for SELECT funds and Fidelity Investor Express (FIX) using communications technology. The Technology Service group, a part of Fidelity Systems Company, built the T-1 network.

Reuters also has a Corporate Technology group that evaluates and develops technology. However, most of Reuters's technology is acquired. Reuters acquired Rich Inc. that manufactures computer systems for trading rooms. It acquired Instinet that makes automatic screen-based trading networks. It also acquired IP Sharp that operates a global communication network known as IPSANET, which can link thousands of banks, multinational companies and other institutions. Reuters also acquired Wyatts that integrates telephone systems with screens. The acquisition of Finsbury Data gave Reuters historical databases of financial information. Network Utilities Inc. provided analytical data on stocks and options trading opportunities that Reuters integrated in its Reuter Monitor system.

The benefit of getting technology through acquisition is that one would know what it is buying. Reuters would have bought Rich only if Rich had the technology

that Reuters wanted. In case of internal development, however, one does not always know what the outcome is going to be. One has to wait until the end of the development cycle to see if the results meet the initial needs of the company. On the other hand, getting technology through acquisitions have the problem of compatibility and integration. First of all there is a problem of integrating two companies and their people and cultures. In addition, one company's systems and networks would very likely be different from those of the other's. Fidelity still faces this problem between its mutual funds business and the brokerage funds business that it had acquired. Reuters does not even plan to integrate all of its acquired technologies because it is a horrendous problem. Moreover, acquisitions were made more as strategic stop-gaps and integration of technologies was a secondary problem. Reuters advertises, "Acquisitions help Reuters provide complete information packages [23]."

If technology is developed in-house, one does not face the problem of incompatibility as much. There is more control over what to develop and when. Moreover, the knowledge-base created through internal development stays inside which can be used for other applications in the future. There are possible economies of scope to gain through 'making' rather than 'buying.'

Since both 'make' and 'buy' have limitations, another way to get the technology is through strategic alliances. In fact, this is not an alternative to 'make' or 'buy'; it is rather a complement. Whether a financial services company decides to spin off a group to develop technology to use in its products (like in the case of Fidelity), or to acquire technology by buying a company (like in the case of Reuters), it should also form alliances with key technology companies to gain competitive advantage in a world of high competition. By allying its technology strategy to those of its key technology partners, a company can retain both flexibility and control. The company can also exert influence on the technology partners and change their direction to its benefit. Of course, the key here is the bargaining power that lies with the company vis-a-vis the technology partners. A small company that has no impact on the performance (short-term and long-term) of a big technology vendor would have little

bargaining power to form a strategic alliance. In such a case, it is better for such a company to buy technology. On the other hand, for big companies like Reuters and Fidelity, there is a lot more scope for partnership.

6.10 Competing in Global Markets

As described in the first chapter, a financial services company has to be able to compete globally. Transfer of funds across geographical and political boundaries warrant that flow of information and connectivity of systems extend beyond the conventional geographic and political boundaries. Competing in global markets is not easy, but it is made simple by communication networks. If a company decides to expand its operations into Europe either because the market is lucrative or because its competitor is doing it, it also has to think about connecting the foreign offices and update their databases in real time. About three years ago, Fidelity changed its strategy from being a Boston-based centralized company to a regionalized company throughout North America. While doing this, it became extremely important to set up a communication networks tying computers in these facilities so that all offices could share the same data at almost the same time. That was the motivation behind the T-1 network it set up as described earlier [1].

However, while building communication networks around the world, the following issues emerge:

1. First, one has to face the regulatory agencies like FCC (Federal Communications Commission) in the U.S. and PTT (Post Telephone and Telegraph) in Europe. To add to the complications, the telecommunication standards and regulations are very different in different countries.
2. On the technical side, one has to worry about what architecture is most suitable for geographically wide-spread network - hierarchical or distributed, circuit-switched or packet-switched, etc.

3. Another issue is cost of coordination of different pieces in a global network. The network has to be modular such that the performance of one piece has only marginal effect at the most on the performance of the rest of the network.
4. One also has to find local suppliers of information on that network. If the local exchange does not supply information to the network in a country, that network is not put to the full use.
5. Most importantly, a company must have a lot of experience in dealing with local governments, cultures and infrastructures of foreign countries. For example, if the global network is designed such that it relies on the telephone lines of a country to connect computers, and if the country does not have an adequate infra-structure of telephone lines (like in some third-world countries), then the network would not work no matter how advanced the technology.

In this way, communication networks technology offers a powerful tool that can be used to gain competitive advantage. If managed strategically, it can put its user far above the competition. At the same time, there are issues about this technology that a user must be aware of. These issues are discussed in the next chapter.

Chapter 7

Limitations of Communication Networks

So far, we have seen only the good side of the communication networks. In this chapter, we examine some of the limitations of this technology. Limitations in a company's ability to gain competitive edge from the use of this technology arises from three sources [32] as shown in Figure 7.1. Limitations are a function of a mismatch between:

1. Strategic Objectives,
2. Organizational Infrastructure, and
3. Technological Capabilities.

Strategic objectives refer to the goals of the company that provide it competitive advantage over its competitors. Organizational infrastructure refers to the structure of the company and relationships between different groups within the company, plus the relationships with buyers and suppliers. Technological capabilities refer to the strengths and weaknesses of the technology itself.

The area marked by "minimum" on three axes indicates the minimum commitment at strategic level for exploiting the technology, the minimum level of organizational infrastructure needed to support the technology, and the minimum level of technological capabilities inside and outside the company. If any of three dimensions

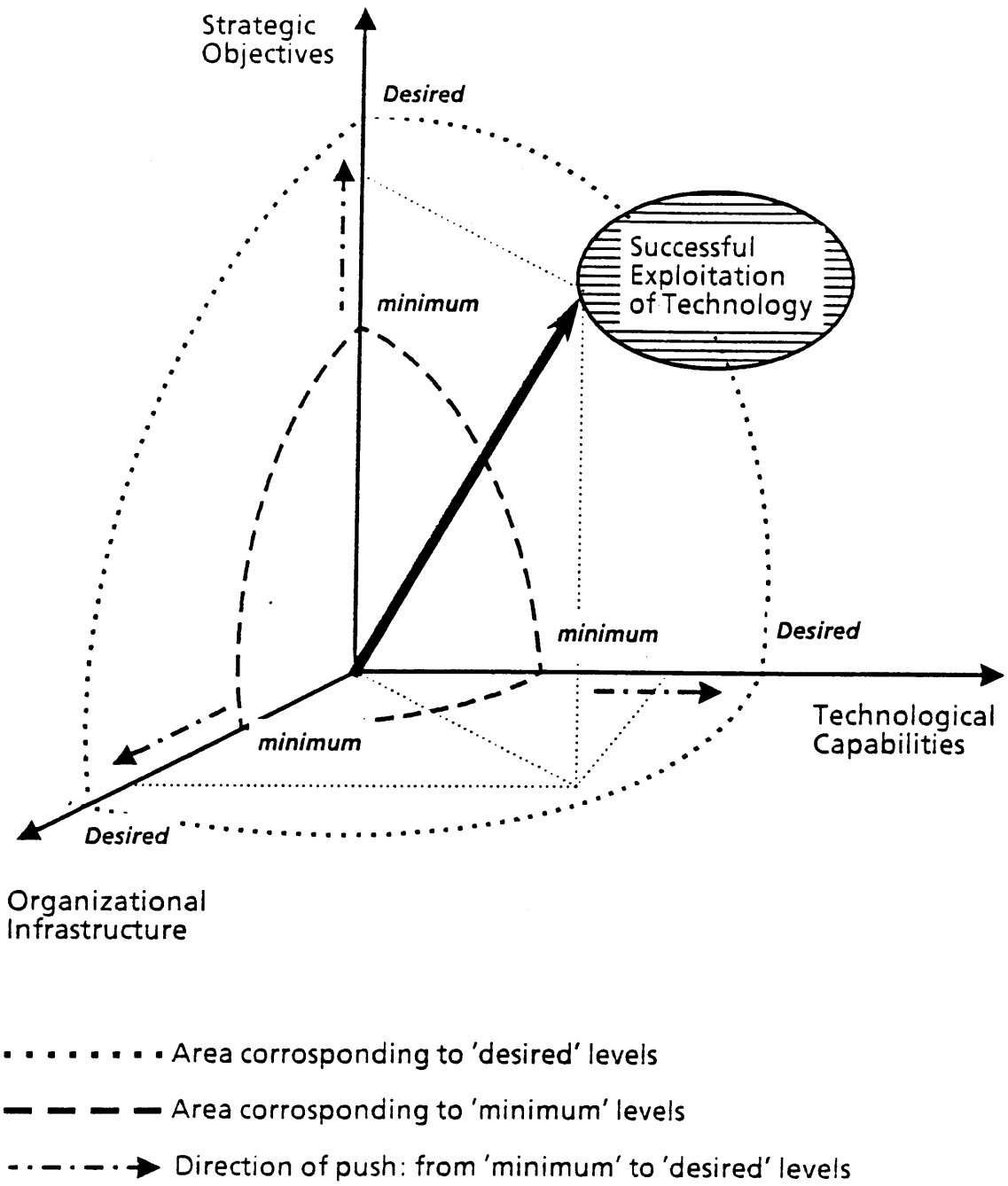


Figure 7.1: Limitations of Communication Networks

is lower than the minimum levels indicated, then the technology does not land itself to all possible advantages. The area marked by “desired” on the three axes indicates the desired level of corresponding dimensions. Successful organizations tend to push from the area marked by “minimum” to the area marked by “desired”. While pushing along the three dimensions toward “desired”, a balance must be maintained between all three dimensions to achieve optimal solution. Thus, if there is too high commitment at strategic level for the use of the technology, but not adequate technological capabilities or organizational infrastructure to support the technology, then the company would not get all benefits of the technology. Similarly, if the company is technologically capable to exploit technology, but does not have any plans to invest in equipment to use that technology or to train people, then it will not get all benefits that the technology offers. Some of the obstacles for achieving the balance between the three dimensions are described below.

7.1 Organizational Obstacles

1. Getting a Consensus: If a lot of groups are involved in building a large network, it is very difficult to get a consensus on specifications of that network, primarily due to the political conflicts within groups. For example, while building its Global Telecommunications Network, Citicorp decided to go for a packet-switched network at the corporate level [5]. But it had a hard time convincing its regional divisions to back that decision. (Note that Citicorp is a highly decentralized company.) Some of the regional divisions wanted to expand their mux-based networks because they had already made investment in that technology for local needs. These regional divisions started deploying more mux-based networks very quickly to convince the headquarters to abort its packet network idea. Ultimately, the headquarters compromised by letting the regional divisions keep the muxes for switching within the regions, and connected the regions using the packet technology.

If a network is built for multiple purposes, most likely it will be sub-optimized for at least some of the applications. Main reason for this is that one has to compromise certain benefits to achieve certain others. Especially in large networks such as Manufacturers Hanover's GEONET [31] and Citicorp's GTN [5], where a single network is built to integrate a lot of different groups of an organization, it is difficult to build a network that satisfies the needs of every group. Typically, different pieces of a network get optimized for local needs because of each group has different needs.

2. Distrust in Automation: Another flavor of organizational limitation of the network technology is in convincing the customer of the true intention of using this technology. For example, Reuters's Instinet subsidiary is having a problem convincing New York Stock Exchange for allowing it to become its member [9]. NYSE believes that Instinet is out to close the exchanges by replacing them with its computerized networked trading system.

In addition, as Instinet's Chairman and CEO, William Lupien, says that one of the biggest obstacles in selling his system to brokers is fear and distrust of any system in which deals are consummated via computer rather than face-to-face or over the phone. Just as certain people would rather withdraw cash from human tellers instead of using ATMs even though the line for human tellers may be ten times longer than that for ATMs, in the case of security trading, brokers may prefer to deal with humans rather than machines. The basic problem here is trusting the automated systems.

3. Security and Authentication: Just who is allowed to use the networked services and who is not, is another organizational problem. To be able to use the automated services, the customer now has to use an access card, or punch in a password. Previously, the broker knew the customer by face and authentication was an informal "hello". On the other hand, because of technical limitation of security of electronic systems, the network provider and user have to worry

about how to keep the unwanted hackers away from the network?

7.2 Technological Limitations

1. Incompatibility and Integration: Networks and systems from different vendors do not necessarily connect to each other. If they connect, they do not necessarily operate with each other. For example, even if one can transfer a file of data from one network environment to another, it may not be possible to change the file in the second environment. Connectivity and interoperability are two forms of incompatibility. Fidelity faces incompatibility problems between the environment of its mutual funds business and that of its brokerage business as described earlier. Fidelity First project is an attempt at resolving some of this incompatibility problem to achieve a better integration of the two businesses. In addition, incompatibility problem comes up also when a company tries to integrate various resources acquired over a period of time. Depending on the needs at the time, a company buys certain computing resources without considering the compatibility issue. When in future, it tries to integrate them into a network, it finds out that they can not be integrated. This is natural phenomenon because the rapid evolution in the technology causes obsolescence very quickly, and vendors introduce new proprietary products to differentiate them from their competitors.
2. Capacity: How much data can the network carry, how fast, and over what distance? These are technical issues that need to be addressed. With Fidelity's use of T-1 leased lines, it increased its capacity of shipping data between its computer centers from 56Kbps to 1.544Mbps. However, this may not be enough as Fidelity's data traffic grows along with its business. When, it becomes over utilized, Fidelity will have to invest in higher bandwidth technology such as T-3 (45 Mbps) on optical fiber lines. Networks should not create a bottleneck in the entire computing system of a company.

3. **Availability, Reliability and Accuracy:** In order to benefit from the high capital investment in building and operating networks, availability of the networks is extremely important. If networks are not available around the clock, the company loses its strategic advantage of having the networks. At the same time, networks should be reliable and should provide accurate information. Information with errors is worse than no information at all. Technical limitations in availability, reliability and accuracy can cause a strong technology strategy to fail.

For example, during the stock market crisis in October 1987, it was extremely essential for Fidelity to keep its networks up and running. Since more than half of the customer-calls are made through the network, without an operational network, Fidelity would have risked making half of its customers helpless, which could have resulted in a loss of business for Fidelity. As we saw earlier, Fidelity had rejected AT&T's network equipment because it did not meet Fidelity's requirement of 99% availability rate [14].

It is strategically important to have robust networks that never fail. If they do fail, they should recover from the failure easily and quickly. Almost all the interviewees stressed this point. For this purpose, both Fidelity and Reuters have backup plans for the networks. In the computer centers in New York and London, Reuters has its own backup generators to keep the computers and networks working for several days in a row in case of a power failure. All its land-based networks are backed up by satellite circuits.

4. **Security:** Security is as much of a technical limitation as it is an organizational limitation. Most of the users of financial information, including Fidelity and Reuters, use encryption techniques to secure its data flowing through the networks. Reuters uses encryption for all satellite transmission since satellite transmission is a broadcast technology that any one tap in. For the land-based transmission, Reuters provides services only on dedicated leased lines. Sub-

scribers can not use any telephone lines to receive Reuters's services; they have to use leased lines.

In conclusion, it is important to understand as a user of this technology, that communication networks do have certain limitations. If one can manage these issues and get around the limitations, the benefits are enormous as we have seen in this thesis.

Chapter 8

Conclusions

In this thesis, we have looked at how communication networks have changed the way companies compete in the financial services industry. Fidelity and Reuters provide excellent examples of how the use of this technology give them strategic advantage by improving the management of critical success factors. We have also seen how the networking technology should be managed to derive and sustain a competitive edge.

8.1 Summing up the Impact and Value of Networks

This section summarizes the analysis of the impact and value created by the communication networks.

The ‘Impact/Value’ framework of Hammer and Mangurin [36] very succinctly summarizes the main points discussed in this thesis. This framework is shown in Figure 8.1.

This framework suggests that communication technology has created three major impacts:

1. compression of time,
2. overcoming the restrictions of geography, and
3. restructuring of relationships.

		<u>VALUE</u>		
		Efficiency	Effectiveness	Innovation
<u>IMPACT</u>	Time Compression	Accelerate Business Process Ex. Reuter Dealing Service	Improve Decision-Making Ex. Hourly Pricing of Fidelity SELECT funds	Create Service Excellence Ex. Fidelity's FAST Service
	Geographic Expansion	(Re)Capture lost Economy of Scale Ex. Fidelity's Prospectus Distribution System	Ensure Global Mgmt Control Ex. Internal Networks at Fidelity & Reuters	Penetrate New Markets Ex. Reuters's Satellite Network
	Restructured Relationships	Short-circuiting Intermediaries Ex. Instinet's Trading Systems	Distributing Scarce Knowledge Ex. Agreement Between Reuters & London Stock Exchange	Establish Closer Ties to Customers Ex. Reuter Monitor Network & Terminals

Figure 8.1: Impact/Value Framework

'Compression of time' means that the time required to perform a business task is reduced by the use of this technology. 'Overcoming restrictions of geography' means that communication networks make it possible for a business to expand in remote geographical areas without having a significant physical presence there. 'Restructuring of relationships' means the structure of organizational relationships - both inside and outside a business - are changed.

It is interesting to note that these three impacts created by communication technology match exactly with the three major changes in the financial service industry as described in Chapter 2 and shown in Figure 2.1. This suggests that the changes in the financial services industry are in part due to the impact of communication technology.

The framework of Figure 8.1 also suggests that the communication technology adds value in three ways.

1. gain in efficiency, which means increase in productivity and/or decrease in cost,
2. gain in effectiveness, which means better management of business, and
3. innovation, which means improved products and services.

Nine different combinations emerge from these impacts and values of communication technology. Figure 8.1 shows examples of each combination.

Communication technology creates efficiency by accelerating the process of a business task. For example, Reuter Monitor Dealing Services reduces the time it takes for a security trade to close. The compression of time creates effectiveness by improving management decision making. The hourly pricing of SELECT funds by Fidelity is an example of this as we have seen earlier. Compression of time can give rise to innovations by creating excellent service. The use of automatic call distributors by Fidelity reduces the waiting time for the call to be answered by the next available representative.

Geographic expansion makes it difficult for a company to take advantage of economies of scale because operations are split into multiple locations. Communication technology can create efficiency by recapturing some of the lost scale-economies by connecting the multiple operation sites. Fidelity's use of networks to connect its four telemarketing centers to one warehouse in Dallas is an example of this. Geographic expansion also makes it difficult to retain management control over multiple sites. Both Fidelity's and Reuters's internal communication networks help ensure management control over remote locations. Geographic expansion creates innovations by making it possible for a company to penetrate new markets. Reuters's use of satellite networks makes it possible for it to expand its Monitor service to countries that were beyond its reach previously.

The restructuring of relationships creates efficiency by short-circuiting the intermediaries. With Reuter Equities 2000 service, traders trade with each other directly on networked terminals instead of going through an exchange. Effectiveness is created by distributing scarce knowledge to people who would not normally have that knowledge. The agreement between the London Stock Exchange and Reuters to let Reuters display the bid and offer prices of the exchange's member firms on the Reuter Monitor Service is an example. Communication networks also restructure relationships and create innovation by letting the user establish closer ties to its customers. Reuters establishes closer ties with its subscribers by tying the terminals on customer premises to its networked services. Reuters can use these links to add other services in the future that can be delivered on the same terminals.

8.2 Future Trends

Looking at the actions of the leaders in the financial services industry, following trends emerge:

1. more electronic exchanges,

2. movement toward 24-hour trading,
3. more global expansion and electronic links with remote sites,
4. increase in global alliances and partnerships,
5. more mergers and acquisitions to offer one-stop shopping,
6. more joint ventures with computer and communication companies, like AT&T's venture with Quotron, and IBM's venture with Merrill Lynch, and
7. higher investment in private networks using T-1 and fiber optics technologies, and fault-tolerant systems for higher availability, reliability and expandability.

The communication technology seems to be heading in the following direction:

1. convergence of protocols toward international standards such as Open Systems Interconnect (OSI),
2. emergence of Integrated Services Digital Network (ISDN) as an important technology offering integration of data, voice and video networks,
3. increase in speed and bandwidth of networks,
4. increasing support of transaction processing applications on networks,
5. increasing support of distributed processing applications through networks,
6. functional integration of heterogeneous systems, not only physical integration, and
7. increasing need to connect islands of high-performance local area networks to form high performance wide area networks.

As it can be seen, the direction of advances in the financial services industry seems to be merging with the direction of advances in the communication networks

technology. FSI should be able to benefit a lot by the trends that will shape tomorrow's communications technology. At the same time, the communications technology will keep shaping the future of the financial services industry as the FSI becomes more and more dependent on this technology of the future.

8.3 Actions

In the wake of this opportunity, what should the strategists in the financial services industry do?

1. First of all, they should realize the benefits as well as limitations of this technology.
2. Next, they should place this technology at the core of their overall competitive strategies and grow it with full commitment from the top.
3. They should exploit the benefits of technology to improve linkages with vendors and customers, and to make their operations more effective and efficient.
4. They should also invest in re-educating key decision makers of their companies continuously to keep pace with the changes in this technology and its applications.
5. And finally, they should use networks as a strategic variable and create an infrastructure in the company that can exploit this technology to the fullest extent.

Who wins by doing all of the above? I believe that the answer is: 'every one'. The financial services companies win by strengthening their competitive position. The suppliers of this technology win by getting revenues from the financial service companies. And the customers of these companies win by getting new products at lower price with better service!

We are already experiencing the strategic impact of the communication networks today, but we have seen just the beginning of that experience. The intersection between the value of the technology and the needs of the financial services industry will keep growing in the future.

Appendix A

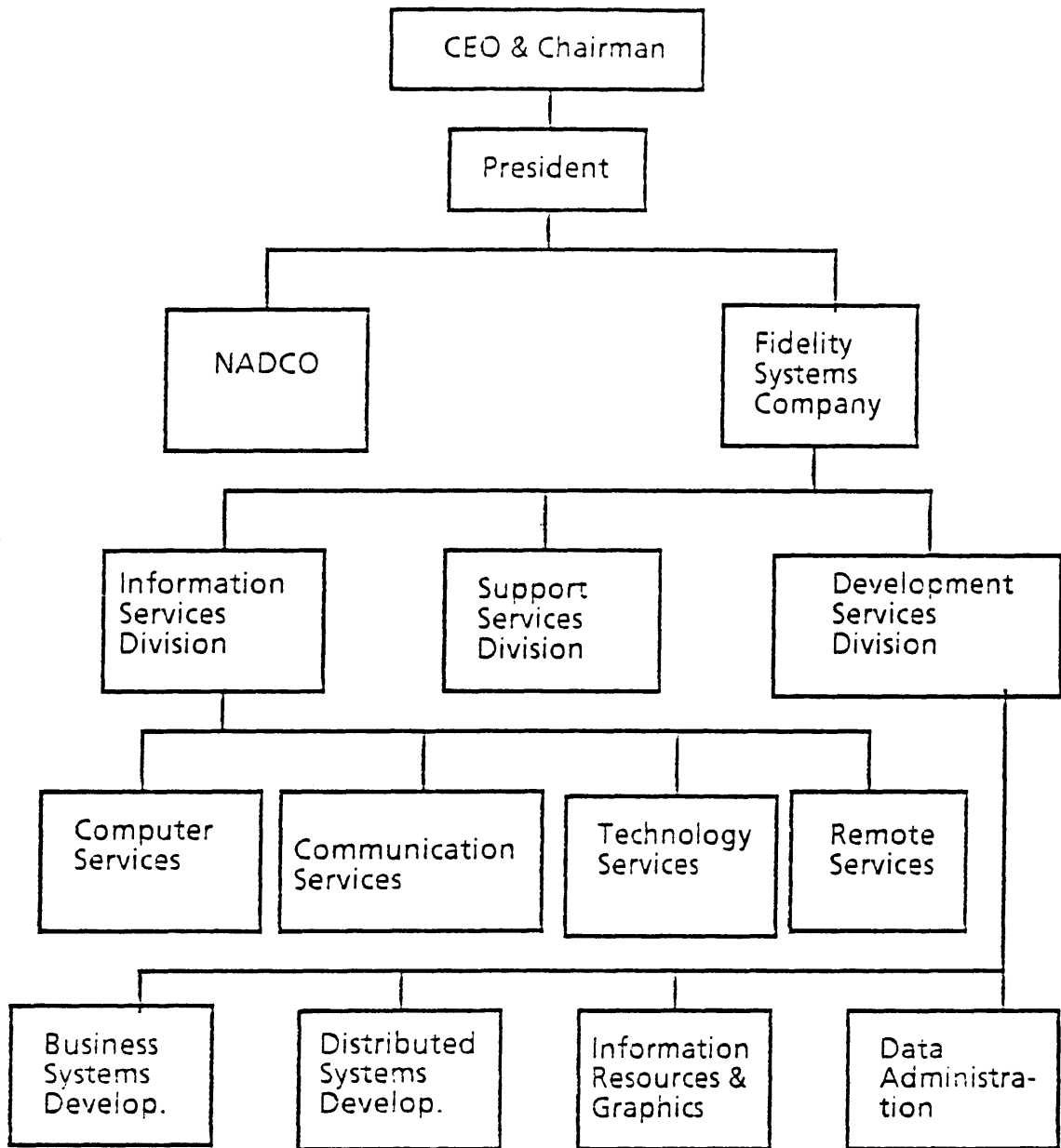
Fidelity Management and Research Company

Fidelity's Assets Under Management

<u>Year</u>	<u>Billions of Dollars</u>
1976	5.0
1977	5.5
1978	6.5
1979	9.0
1980	9.7
1981	14.9
1982	19.3
1983	23.1
1984	27.2
1985	39.6
1986	56.4
1987	75.0 (appx.)

Source: Fidelity

Figure A.1: Growth in Assets under Management



(Part of Organization Relevant to Thesis)

Figure A.2: Fidelity's Organization Chart

Appendix B

Reuters Holdings PLC

Reuters - Financial Highlights

	1986	1985	
	£ miiion	£ million	% change
Revenue	620.9	434.1	43
Profit before tax	130.1	93.6	39
Pre-tax profit margin	21.0%	21.6%	
Taxation	49.4	38.7	28
Profit after Tax	80.7	54.9	47
Post-tax Profit Margin	13.0%	12.6%	
Return on Equity	43.8%	32.8%	
Net Assets	180.9	186.0	(3)
Additions to Tangible Assets	96.0	71.3	35
Funds Provided by Operations	132.0	92.8	42
R&D Expenditures	23.3	17.0	33
Earnings per Ordinary Share	19.4p	13.2p	47
Dividend per Ordinary Share	5.5p	3.25p	69

Source: Annual Report 1986

Figure B.1: Financial Highlights - 1986

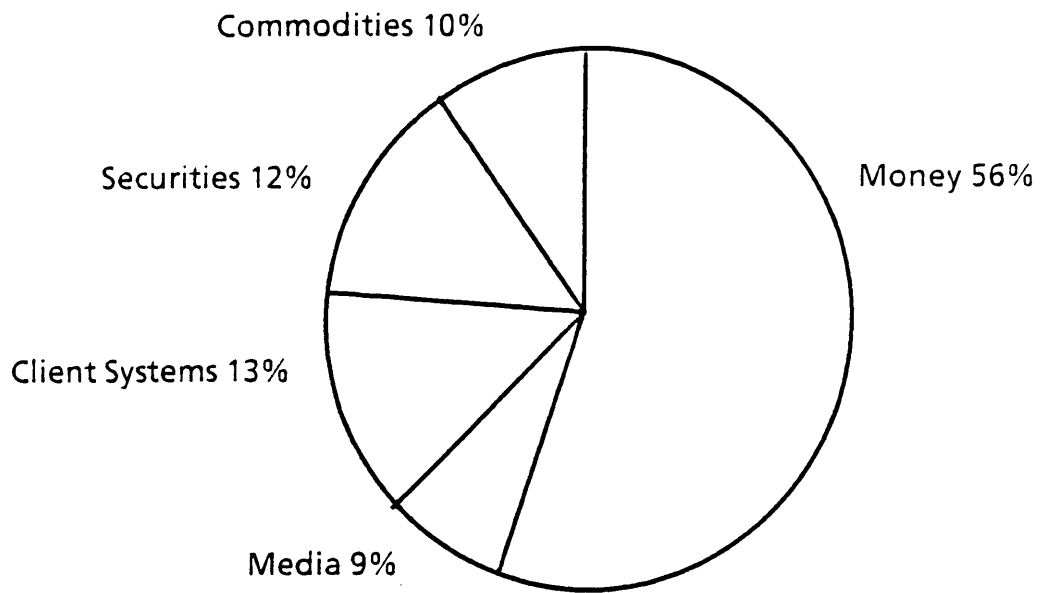
Products

	Automated Trading	Quotation Retrieval	News	Graphics	Dealing Systems	Data Processing	Contributed Data	Client Systems
Money		●	●	●	●	●	●	●
Commo- dities		●	●	●	●	●	●	●
Energy		●	●	●			●	●
Shipping		●	●				●	●
Equities	●	●	●	●		●	●	●
Bonds		●	●	●	●		●	●
Media			●			●		

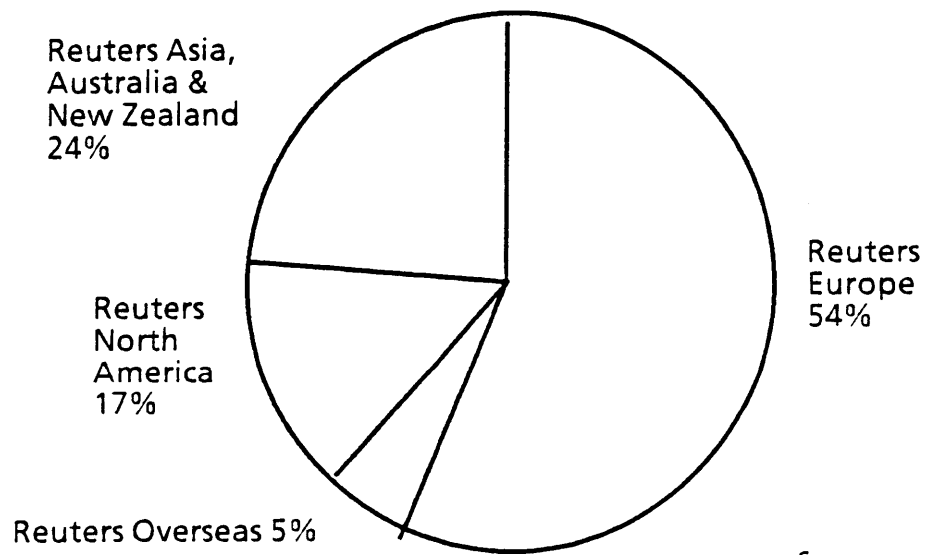
Markets

Source: Annual Report 1986

Figure B.2: Products and Markets



PERCENTAGE REVENUES BY MARKETS



PERCENTAGE REVENUES BY AREAS

Source
Annual Report 1986

Figure B.3: Percentage Revenues by Markets and Areas

Appendix C

List of Interviewees

1. Jim Alosi, Marketing Manager, *Networks and Communications Marketing, Digital Equipment Corporation*, July, 1987
2. Jeffrey Bennett, Strategic Technology Analyst, *Corporate Technology, Reuters*, December 2, 1987
3. Jack Chaffin, Vice President, *Fidelity Systems*, October 28, 1987
4. Robert Clyatt, Marketing Manager, *Reuters Information Services*, October, 1987
5. Ralph Dement, Group Manager, *Distributed Systems Strategic Planning, Digital Equipment Corporation* June 10, 1987
6. Frank Diasparra, Vice President, *Fidelity Technology Services*, November 18, 1987
7. Cindy Hatch, Assistant to Vice President, *Fidelity Retail Services*, October 30, 1987
8. Ken Larson, Vice President, *Fidelity Retail Services*, October 30, 1987
9. Alan Liggett, Vice President, *Fidelity Retail Services*, November 6, 1987

10. Suzanne Mahoney, Group Marketing Manager, *Fidelity Investments*, October 24, 1987
11. Martin Makarewicz, Manager, *Fidelity Technology Services*, November 18, 1987
12. Patrick Mannix, Vice President, *Corporate Technology, Reuters*, December 2, 1987, (also from the Presentation of "Technology at Reuters" at MIT Sloan School of Management)
13. Ellen Quackenbush, Product Manager, *Distributed Systems Strategic Planning, Digital Equipment Corporation*
14. David Rubin, Consultant, *Arthur D. Little*, July 1, 1987
15. Pam Snaith, Business Analyst, *Distributed Systems Strategic Planning, Digital Equipment Corporation* June 10, 1987
16. Jim Stoddard, Vice President, *NADCO, Fidelity*, November 11, 1987
17. Robert Ware, Sales Executive, *Reuters Information Services*, November 23, 1987
18. Joe Yanushpolsky, Group Manager, *Distributed Systems Strategic Planning, Digital Equipment Corporation* October 30, 1987

Bibliography

- [1] Interviews by author, See the List of Interviewees, Appendix C, 1987
- [2] Case Study 9-183-007, "The Evolving Financial Services Industry: Competition and Technology for the '80s", *Harvard Business School*, 1983
- [3] Pamela G Stone, "Information Technology for Competitive Advantage in the Securities Industry", *MIT Sloan School of Management Master's Thesis*, May 1986
- [4] Special Report, "Year-end Review of Markets and Finance", *The Wall Street Journal*, January 4, 1988
- [5] Gary Stix, "The High Cost of Global Reach", *Computer and Communications Decisions*, August 1987
- [6] Leon Harris, "Coming: A Clash of Titans", *Computer and Communications Decisions*, August 1987
- [7] David Locke, "Citicorp Designs Detailed Reporting System for Global Operations", *Interoffice*, May 1987
- [8] Tim Moran and Gary Stix, "Grand Net Plan", *Computer Decisions*, March 23, 1987
- [9] Barton Crockett, "Instinet: Pushbutton Stock Trading Comes of Age", *Information Week*, November 2, 1987

- [10] Advertising Brochure EA 28159-42-85, "Networking Decisions are Business Decisions", *Digital Equipment Corporation*, 1985
- [11] Hartej Pal Singh, "Key Factors for Establishing Electronic Markets", *MIT Sloan School of Management Master's Thesis*, June 1987
- [12] Alex Taylor III, "Why Fidelity is the Master of Mutual Funds", *Fortune*, September 1, 1986
- [13] Richard Layne, "Advanced Technology Groups: Can you Afford (Not) to Have One?", *Information Week*, January 19, 1987
- [14] Richard Amster and Daniel Tonelli, "T-1 in Three Months? Here's How", *Computer and Communications Decisions*, June 1987
- [15] Barry Riley, "One-stop Shopping", *Financial Times*, June 20, 1987
- [16] Case Study 9-284-035, "Fidelity Group", *Harvard Business School*, 1983
- [17] Richard Layne, "Straight Shooter: Fidelity's Michael Simmons Knows What He Wants", *Information Week* August 31, 1987
- [18] Suk Whan Chang, "The Impact of Information Technology on Providing Strategic Advantage for Investment Management Companies: A Case Study on Fidelity Investments", *MIT Sloan School of Management Master's Thesis*, June 1987
- [19] Advertising Literature, "Fidelity International", *Fidelity Management and Research Company*, 1987
- [20] Reuters, "Annual Report 1986", *Reuters Holdings Private Limited Company*, 1986
- [21] Gary Putka, "Electronic Whiz: Long a News Agency, Reuters Now is Also Biggest Data Publisher", *The Wall Street Journal*, August 22, 1986

- [22] Anne R Field and Catherine L Harris, "The Information Business", *Business Week*, August 25, 1986
- [23] Reuters, Advertising Literature, Reuters Holdings PLC, 1986-87
- [24] Michael E Porter, "Competitive Advantage", *Free Press*, 1985
- [25] Case Note 183-121, "Strategic Information Technology", *Harvard Business School*, 1983
- [26] Barbara Donnelly, "Can Reuters Conquer the World?" *Information Technology*, 1985
- [27] R Edward Freeman, "Managing the Strategic Challenge in Telecommunications", *Columbia Journal of World Business*, Spring 1983
- [28] Eric K Clemons and F Warren McFarlan, "Telecom: hook up or lose out", *Harvard Business Review*, July-August 1986
- [29] Michael E Porter and Victor E Millar, "How Information Gives You Competitive Advantage", *Harvard Business Review*, July-August 1985
- [30] Special Report, "Analysis of Black Monday", *The Wall Street Journal*, December 16, 1987
- [31] Case Study, "Manufacturers Hanover (Geonet)", *Harvard Business School*, 1982
- [32] Stuart Madnick, "Perspectives on the Effective Use, Planning, and Impact of Information Technology", *Planning for the Strategic Use of Information Technology*, Oxford Press 1987
- [33] Peter G W Keen, "Competing in Time: Using Telecommunications for Competitive Advantage", *Ballinger Publishing Company*, 1986
- [34] Michael E Porter, "Competitive Strategy", *Free Press*, 1980

- [35] Gregory I. Parsons, "Information Technology: A New Competitive Weapon", *Sloan Management Review*, Fall 1983
- [36] Michael Hammer and Glenn E. Mangurian, "The Changing Value of Communications Technology", *Sloan Management Review*, Winter 1987
- [37] Peter G. W. Keen, "Communications in the 21st Century: Telecommunications and Business Policy", *Proceedings of Symposium on Communications in the 21st Century*, 1981