LEADING EDGE VENDORS TO THE SMALL ESTABILSHMENT MARKETPLACE

INPUT

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THE COMPANY

INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions. Continuing services are provided to users and vendors of computers, communications, and office products and services.

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1 INTRODUCTION

I INTRODUCTION

A. PURPOSE

- This study is an analysis of smaller companies with an "edge" on their larger competitors in selling information handling equipment and services to the small establishment marketplace. Its purpose is to determine how these vendors developed the edge which they now have and to evaluate the significance of that edge for the larger competitors, for the small establishment marketplace, and for the leading edge vendors themselves.

B. CHOICE OF FIRMS TO ANALYZE

- INPUT screened the available data on 50 possible companies which met the basic criteria of:

  - Not being one of the top four or five companies in its field.

  - Having an established and successful business performance of a few years standing. Of the 50 possible companies, INPUT selected 13 which appeared to be the most interesting and also for which data, particularly financial performance data, was available.

- A highlight report was prepared on each of those 13 leading edge vendors, including INPUT's evaluation of the nature and magnitude of each vendor's edge. These highlights comprise Chapter III of this report.

- An analysis was made of the various impacts of these leading edges, both at present and for the future.

II EXECUTIVE SUMMARY

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A. KEY CONCLUSIONS

- Many smaller companies in the information handling industry have developed an "edge" on their competitors which has resulted in business success for the company and a powerful, positive impact on the marketplace.

- Many of these "leading edge vendors" have concentrated on the small establishment marketplace, applying their expertise to specific market niches which have been unrecognized or ignored by their larger and stronger competitors.

- The edges which these vendors have developed take many forms, but the most powerful are those which incorporate a combination of factors including technology, price, and marketing strategy.

- The most dramatic edges come about when these vendors offer products or services or customer support for those products and services which are more market responsive than their larger competitors.

- The impact which these leading edge vendors often have on their larger competitors is to pressure them to offer similar capabilities to the market, either earlier than planned or sometimes even contrary to the larger companies' basic strategy.

- The impact which these leading edge vendors have had on the small establishment marketplace is to allow small establishments to utilize new information handling technologies, the availability of which would, in many cases, be restricted to large establishments.

B. THE LEADING EDGE VENDORS STUDIED

- The 13 companies analyzed are listed in Exhibit II-1 along with their current revenue, the product or service which they offer, and the industries to which they sell.

- The companies are classified into types of markets which they address; that is:

  - Industry/Application Oriented Vendors - companies who sell primarily to one industry and/or application.

  - End User System Suppliers - companies which sell systems or functional solutions to end users, but do not limit their activities to any particular industry.

  - OEM Suppliers - companies which produce equipment intended to be incorporated into the system or service of another vendor who in turn sells to the ultimate end user.

- Each of the companies selected for analysis has been basically successful, some of them spectacularly so, against larger competitors in their field. INPUT analyzed the reasons for this success and attempted to attribute it to a particularly kind of "edge" which these companies had developed. The edge attributed to each company is shown in Exhibit II-2. While this is an over simplification of the complete set of reasons for any one company's success, in the aggregate it presents a very interesting pattern.

EXHIBIT II-1

THE LEADING EDGE VENDORS

INDUSTRY/APPLICATIONS ORIENTED VENDORS			
VENDOR	CURRENT ANNUAL REVENUE* ($ MILLION)	PRODUCT OR SERVICE	INDUSTRIES SERVED
BOWNE INFORMATION SYSTEMS	80	WORD PROCESSING SERVICES	HIGH DOCUMENT CONTENT (E.G. LEGAL)
COMPUGRAPHICS	250	PHOTOCOMPOSITION EQUIP.	PRINTING & PUBLISHING
MANUFACTURING DATA SYSTEMS INC.	41	PROGRAMMING SERVICES FOR N/C TOOLS	MANUFACTURING
REYNOLDS & REYNOLDS	140	DP FORMS & SERVICES	AUTO DEALERS

END USER SYSTEM SUPPLIERS			
VENDOR	CURRENT ANNUAL REVENUE* ($ MILLION)	PRODUCT OR SERVICE	INDUSTRIES SERVED
DATAPOINT	232	DISTRIBUTED DP EQUIP.	ALL
PRIME COMPUTER	94	MINICOMPUTERS	SOPHISTICATED USERS
ROLM	115	COMPUTERIZED PBX SYSTEMS	SMALL TO MEDIUM SIZED BUSINESSES
TANDY (RADIO SHACK)	1,065	RETAIL ELECTRONICS	VERY SMALL BUSINESSES
TELENET	9	DATA COMM. SERVICES	DISTRIBUTED NETWORK USERS
WANG LABORATORIES	322	MINICOMPUTER & WP SYSTEMS	SMALL DP USERS & LARGE WP USERS

OEM SUPPLIERS			
VENDOR	CURRENT ANNUAL REVENUE* ($ MILLION)	PRODUCT	OEM CUSTOMERS
CENTRONICS	110	DATAPRINTERS	MINICOMPUTER MFRS. & OTHERS
DATAPRODUCTS	164	DATAPRINTERS	MINICOMPUTER MFRS. & OTHERS
PLANTRONICS	87	TELEPHONE ACCESSORIES & OTHER COMM. EQUIP.	COMMUNICATION CARRIERS

* LATEST FISCAL YEAR

EXHIBIT II-2

THE "EDGE"

INDUSTRY/APPLICATIONS ORIENTED VENDORS	
BOWNE INFORMATION SYSTEMS	MARKET AND OPERATIONS EXPERIENCE IN WORD PROCESSING SERVICES
COMPUGRAPHICS	PRODUCTS WITH PRICE/PERFORMANCE TO MATCH SMALL PRINTERS AND PUBLISHERS
MANUFACTURING DATA SYSTEMS INC	CLOSE CUSTOMER RELATIONSHIPS
REYNOLDS AND REYNOLDS	CLOSE CUSTOMER RELATIONSHIPS

END USER SYSTEM SUPPLIERS	
DATAPOINT	A DISTRIBUTED DP SYSTEMS ARCHITECTURE
PRIME COMPUTER	COMBINATION OF A GOOD PRODUCT WITH GOOD MARKETING
ROLM	A MARKET RESPONSIVE PRODUCT LINE
TANDY (RADIO SHACK)	1—AN IN PLACE LARGE DISTRIBUTION NETWORK 2—AN ADVANCED POSITION ON THE SMALL COMPUTER LEARNING CURVE
TELENET	A MARKET RESPONSIVE PRODUCT LINE
WANG LABORATORIES	AN INTEGRATED SYSTEM ORIENTED PRODUCT LINE

OEM SUPPLIERS	
CENTRONICS	RELATIONSHIPS WITH A BROAD SET OF LARGE CUSTOMERS
DATAPRODUCTS	RELATIONSHIPS WITH A BROAD SET OF LARGE CUSTOMERS
PLANTRONICS	SUPPLIER RELATIONSHIPS WITH COMMUNICATION CARRIERS

C. CLASSES OF COMPETITIVE "EDGES"

- A competitive edge for purposes of this study is any unique advantage which a small company has over its competition, particularly its larger competitors. This edge can take a variety of forms including technology, price, marketing strategy, etc., but it always has a perceptible, and often an enormous, effect on the marketplace, the competitors, and on the leading edge vendor itself.

1. TECHNOLOGICAL EDGES

- As participants in the very dynamic electronic information handling business, all of these leading edge vendors are heavily involved in advanced technologies, particularly computer technology. While many of the companies have built their edge by exploiting some unique technology, none of them can base their business success or their competitive edge solely on this technology. In fact, in very few cases is a unique technology the most important element of a company's edge.

- Only in the following companies is a unique advanced technology currently an important component of their edge.

  - Datapoint - a unique distributed DP systems architecture.

  - Telenet - a working knowledge of packet switched communications technology.

  - Centronics - a depth of experience in the production of matrix printers.

  - Dataproducts - a depth of experience in the production of line printers.

- In most of the other leading edge vendors studied, the application of current, but not unique, technology to a market requirement is a very important element of each company's edge.

- Two companies were among the pioneers in their application of advanced computer technology:

  . Rolm - the use of computers in PBX equipment.

  . Manufacturing Data Systems, Inc. - the use of computers to prepare N/C tool control tapes.

- The other companies simply used existing technology very well in addressing their products to the solution of customer problems.

2. PRICE

- In only one case, the TRS-80 small computer from Radio Shack, is price the primary basis for a competitive edge on the market.

- While the exploitation of advanced technology usually results in some price advantages, most of the leading edge vendors in this study used technology as a means of providing customer features rather than lowering the price of alternative solutions. The companies (in addition to Tandy) which did use technology as a price lowering tool are as follows:

  - Compugraphics - eliminated the features that were not required by their selected marketplace, the small printers and publishers.

  - Centronics - Used matrix printing technology originally and then aggressive learning curve pricing to bring data printers into the price range of minicomputer based DP systems.

  - Dataproducts - Used a unique line printer technology originally and then aggressive learning curve pricing to provide a line printer which was a price competitive alternative to those manufactured by the major computer manufacturers.

- Plantronics - Used an ingenious design for an operator headset and volume production economics to keep their price lower than the point at which their primary customer, the Bell System, would manufacture the equipment itself.

- It is interesting to note that all three of the leading edge vendors which have been classified as OEM suppliers are among the five companies with an important price component to their edge.

3. MARKETING STRATEGY

- The most dramatic common feature of the edge held by all of these companies is the clarity of their marketing strategy. In fact, it is by the most basic element of their marketing strategy - their selection of customers - that this study has classified the leading edge vendors into industry/application oriented vendors, end user system suppliers, and OEM suppliers.

- Within each of these classes, each company makes a further distinction of the types of customers which constitute its market. This is shown in Exhibit II-1.

- Of greater significance is the level of customer support provided by these leading edge vendors. Without exception, the level of customer support provided is higher than that of their competitors. This, perhaps more than any other single attribute, distinguishes these companies and provides them with their competitive edge.

- This customer support takes many different forms.

  - In the case of the industry/application oriented vendors, it is a close, on-site, consulting type relationship with their users. Bowne, for example, goes so far as to provide an employment agency function, actually finding temporary or permanent employees so its customers can use the Bowne service.

- The customer support provided by the end user system suppliers is less clear but nonetheless distinctly present, particularly when compared with competition. It takes the form of support integration; that is, the integration of the support services from a variety of suppliers, such as software houses. It always includes some level of equipment maintenance support.

- The OEM suppliers provide a difficult type of customer support. The end users support is provided by the systems house, so these OEM suppliers provide support in terms of reliable equipment availability and special product adaptation such as special colors and labels.

- Another important element of marketing strategy among these leading edge vendors is the concept of account control. This concept essentially treats each customer as a revenue producing resource and, therefore, something to be protected and grown. This concept is displayed most clearly in the product lines of the leading edge vendors.

  - End user product lines are complete so that a customer would not have to look elsewhere for any necessary component. Sometimes the necessary accessory products are obtained from an OEM supplier, but they are always included.

  - Product lines are expandable so that a customer would never outgrow the vendor. In the case of the service vendors, Bowne, MDSI, and R & R, this growth concept includes the provision of on-site computer capabilities for large customers. These service firms quietly introduced this dedicated system growth path for their users well before the much more publicized efforts of National CSS and Automatic Data Processing.

  - Product development programs and other forms of product line expansion, such as acquisitions, are an important part of this customer control strategy. This product line expansion strategy is particularly

important to the OEM suppliers (Centronics, Dataproducts, and Plantronics) and is shown very clearly in their actions.

- The channels of distribution receive a lot of attention from most of these companies. Most of the end user companies sell through their own field sales organization, but even here there is much tailoring of the sales organization to fit the marketplace.

  - For example, Compugraphics, in attempting to expand its marketplace to include in-company print shops, did not disturb its successful sales organization in the printing and publishing field, but set up a new field sales organization to develop the in-company print shop market.

  - Prime, in extending its product line downward from sophisticated computer users to first time users, elected to establish a dealer network to reach this new market rather than dilute its existing sales organization.

- The leading edge vendors who sell through other organizations (Rolm plus the three OEM suppliers) keep very close tabs on the needs and problems of these distribution channels.

  - Plantronics, whose primary distribution channel is the Bell System, has three ex-Bell vice presidents on its board of directors.

  - Rolm has been ready and willing to provide financial and other business assistance to some of the interconnect distributors among its dealer network.

- The ultimate example in the exploitation of distribution channels is Tandy which has been moving over 100,000 TRS-80s per year through its own network of 7,000 retail electronics stores.

4. BUSINESS STRATEGY

- The strongest competitive edges of all come not from any one of these factors of technology, price, or marketing strategy, but from combinations of two or more such factors. All of the companies in this group of leading edge vendors exhibit this combination strategy to a significant degree, but two of these companies illustrate it very dramatically.

  - Prime started in business with a very good technical product using the most advanced hardware, software, and systems technology which were practical at the time. They have maintained their technological edge in this rapidly moving computer field.

  - Some few years into their corporate life, while the company was performed adequately but not spectacularly, a marketing strategy of selling the product directly to a selected type of user was introduced. The introduction of this marketing strategy, and the marketing capability to make it happen moved Prime into its present spectacular growth path.

  - Another good illustration of combination strategy is Tandy's success with the TRS-80. The strategy here included three elements: a product that was priced low enough to penetrate a broad new market, a distribution channel that was massive enough to reach that broad market, and a production capability that was large enough and flexible enough to deliver the product when demand greatly exceeded expectations.

D. THE IMPACT ON THE SMALL ESTABLISHMENT MARKET

- Small establishments represent a market which has historically suffered as new tools of production have been introduced to their various industries.

Usually, these new tools, whether they be machine tools, or airplanes, or printing presses, or computers, are so expensive when first introduced that only the bigger companies can afford to buy them and, thereby, further increase their economic advantage over the small establishments.

- The real impact of the leading edge vendors of the type examined in this study is that they bring these new tools to small establishments much sooner than would be the case without their existence.

  - These leading edge vendors, which are small themselves, must look for market niches that their bigger competitors have not found or in which they are not yet interested. This not yet interested situation is usually found in the small establishment market. Therefore, many of the markets which these leading edge vendors pursue are segments of the small establishment market.

  - The net result of these two types of small establishments "finding each other" is spectacular growth for the leading edge vendor and an ability to continue to be competitive for the small establishment user.

E. THE FUTURE IMPLICATIONS

1. FOR THE LEADING EDGE VENDORS IN GENERAL

- The electronics industry has a tendency to generate many new entrepreneurs because the cost of entry is low and getting even lower. Since most of the advances in information handling are fueled by electronics technology, an increasing number of new vendors will be entering the market every year. These new vendors, like the leading edge vendors discussed in this report, will be searching for new market niches. Those who succeed in finding and serving such market niches will become the business successes of the 1980s, as well as providing better solutions for an increasing number of information handling problems.

2. FOR THE LEADING EDGE VENDORS OF TODAY

- Some of these companies will continue to grow and become the large companies of the future. Some, which are prime acquisition targets, will become parts of larger companies. Many, however, will stick with their original edge for too long a time and will be overtaken by others.

3. FOR THE LARGER COMPETITORS

- One of the very interesting possibilities is that large companies will themselves spawn these new potential leading edge vendors. Such a situation exists now in Exxon Enterprises, which has been the source for companies, such as Qwip, Vydec, Qyx, Zilog, etc.

4. FOR THE SMALL ESTABLISHMENT MARKETPLACE

- With this increasing number of vendors, large and small, looking for unfilled market niches, many of which are to be found in small establishments, and with some of the vendors backing up successful searches with marketing support, the future for information handling in small establishments looks very promising.

III LEADING EDGE VENDOR HIGHLIGHTS

III LEADING EDGE VENDOR HIGHLIGHTS

A. BOWNE INFORMATION SYSTEMS, INC. (BIS)

1. BASIC DATA

BOWNE INFORMATION SYSTEMS, INC. (BIS)
Subsidiary of Bowne and Company, Inc.
160 Water Street
New York, NY 10038

Dale Ries, President
Bill Mahoney, Vice President of Marketing
Ted Helweg, General Manager - Cyberway Division

Public Corporation (Bowne and Company)	
Fiscal Year End:	December 31
Total Employees (Bowne and Company):	1,780
Stock Listing:	ASE (BNE)
Company Founded:	
Bowne and Company:	1775
BIS:	1969
Products:	Financial Printing, Word Processing, Services, and Systems
Major Location:	New York, NY

	1979 (est.) ($ Million)	1978 ($ Million)	1977 ($ Million)
Total Revenues			
- Bowne	$80.0	$70.7	$58.9
- BIS	13.0	10.2	8.2
Net Income			
- Bowne	11.1	8.4	--
- BIS	1.3	0.6	--

2. THE "EDGE"

- Bowne Information Systems, Inc. (BIS), developed its original edge on the marketplace by being one of the pioneers in the offering of word processing as an on-line, remote computer service and by staying with this service while some of its major competitors, notably IBM and VIP Systems, folded up their operations.

- This longevity in the word processing marketplace, which is comparable to IBM-OPD's earliest word processing efforts (the MT/ST) has given BIS important experience in two crucial areas of the business.

  - Word processing service operations: This experience has enabled BIS to become a very cost effective operator with the flexibility to meet the peak load demands of its customers.

  - Word processing market experience. The knowledge of the marketplace gained over this ten year period of participation has enabled BIS to recognize and respond to the technological changes in the marketplace, such as in-house equipment, and also to develop a broad spectrum of newer and more functionally powerful services for particular customer and industry segments.

- The significance of this experience edge is that BIS has the knowledge of where and how to apply its marketing, sales, and new product development efforts and at the same time have the capabilities, including current profitability, to take advantage of this knowledge.

- The significance of this edge for the small establishment marketplace is that for those small establishments which have an extensive amount of word processing requirements, such as law offices, architects and engineering firms etc., BIS represents a spectrum of solutions addressing most, if not all, aspects of those users word processing problems.

- The significance of this edge to the larger companies who compete with BIS with on-premises equipment, such as word processors and word processing computers, is that they will be expected by their prospective customers, at least those familiar with BIS, to provide a similiarly broad spectrum of service. While some such large companies will respond to these user expectations, many will have great difficulty in responding to such requirements, for example, being able to provide temporary WP personnel as currently offered by BIS.

3. COMPANY HISTORY

- In 1969 Bowne and Company, an old line financial printing organization, formed Bowne Time Sharing, Inc., in conjunction with the Computer Task Group, a computer service bureau. The product to be offered was Word/One, an on-line, remote computer, text editing service similar to Datatext, a service being offered by Service Bureau Corporation, then a subsidiary of IBM.

- In the fall of 1969 SBC withdrew its Datatext offering and Bowne hastened its product to the marketplace.

- Originally the service was offered only in New York City. Boston and Philadelphia were added as access cities in 1971. Revenue growth was relatively slow.

- In 1972, Bowne's major text editing competitor, VIP Systems in Washington D.C., discontinued operations and Bowne acquired much of their business. Washington and Chicago were quickly added as access cities with Atlanta, San Francisco, and Houston being added later. This geographic expansion was accompanied by a revenue expansion which has averaged 25% annually for the past five years.

- Recently Bowne, in addition to changing the name of the subsidiary to Bowne Information Systems, Inc., has expanded the scope of its operations well beyond the original on-line, remote computing service. These recent additions

included access to a wide range of word processing devices, the sale of Word/One software as a program product to be used on customer's computers and the initiation of Cyberway services, which operate local WP service centers and offer a full spectrum of word processing solutions, ranging from the provision of temporary help to facilities management services and turnkey systems.

- BIS has little marketing or operating relationships with the parent company whose financial printing operations also continue to prosper, having expanded from a heavy dependence on securities documents to a wider market base of regulatory compliance documentation of many types.

4. PRODUCTS

- BIS' original product, the Word/One on-line service is still the cornerstone of the company's operations.

- New types of communicating devices can now be connected from customer premises to the BIS computer systems in New York City through the newly announced "Bowne Connection" compatibility program.

  - Word processors, such as IBM, Vydec, Xerox, Lexitron, CPT, Lanier, etc., can now be connected directly and Bowne plans on making the BIS system accessible to all major word processing devices.

- New types of software packages are being introduced which will allow BIS to penetrate deeper into vertical markets with extensive word processing operations.

  - One example of this is KeySearch, a system which enables attorneys to organize and retrieve documents in conjunction with major litigation.

  - Another example is COMSPEC, a computer assisted specification preparation service used by architects and engineering firms and

government agencies to prepare and edit complex construction specifications. Several proprietary data bases of construction text are accessible through COMSPEC.

- As BIS customers grow it may be economical for them to perform these word processing services on their own computers. BIS has packaged Word/One and KeySearch as program products and installed them on customers computers.

- High volume output from the BIS services are available on high speed laser printers such as the Xerox 9700 and the IBM 6670 Information Distribution. Photo composition output was one of the early features of the Word/One service.

- Many customers find the availability of trained word processor operators to be a problem. To address this problem and eliminate it as a market constraint, BIS established its Cyberway Division in 1978. This division can provide temporary as well as permanent personnel. They also have established a number of word processing centers in cities around the country from which they can perform word processing assignments for clients.

5. MARKETS

- The potential market for word processing services is the 10 billion pages of original typing produced by over 5 million secretaries and typists in the United States. While most of this volume is prepared on standard office typewriters, a growing percentage, perhaps 10% today, is being prepared using specialized word processing equipment and services.

- Some industry sectors produce a higher percentage of this volume than their total employment would indicate. These sectors include: legal, government, insurance, and banking.

- BIS marketing efforts and specialized software packages have been moving the services steadily into these high volume industry areas. Examples are the

KeySearch for lawyers, the Correspondence Management Service for government consumer agencies, and COMSPEC for architects, engineers and government construction oriented agencies such as the Army Corps of Engineers.

- Competition for the functions performed by BIS come largely from customer premises equipment. This equipment takes two forms.

  - One is the specialized word processing devices such as Vydec, Lexitron, IBM, Xerox, etc. BIS' strategy toward this competition is to join them, providing connections between the BIS system and these devices to perform additional word processing functions which is beyond the capability of the customer premises equipment.

  - The other form of equipment is the customers' use of their own computers to perform word processing. Again the BIS strategy is to join them, providing Word/one as a program product to its larger customers.

- BIS' customer base is estimated at about 5,000 Word/One users.

- The industry distribution of BIS customers is as follows:

  - Legal: 20%

  - Federal Government: 20%

  - Banking and Finance: 20%

  - Insurance: 15%

  - Other Industries: 25%

6. ORGANIZATION

- BIS is operated as an independent subsidiary of Bowne and Company. Dale Ries, the President of BIS, has been with BIS since its founding in 1969. He was originally in charge of operations, moving up to the presidency in 1974.

- BIS employs approximately 250 people of whom over 100 are sales or sales support people.

- BIS operates in downtown Manhattan out of a single computer center which is currently equipped with a dual IBM/370 Model 155, three high speed laser printers, and other peripheral devices such as photocomposition equipment.

- There are eight major access cities in addition to the NY area, where BIS operates sales and services centers. Users outside of these cities can access BIS through the Telenet packet switching network.

- Bowne and Company was one of the major stockholders of Telenet Corporation, owning about 10% of Telenet's stock. The recent acquisition of Telenet by GTE will net Bowne over $2 million.

- Recently the Cyberway Division expanded its center in NYC and opened word processing centers in Atlanta, Chicago, Los Angeles, and Washington, D.C.

B. CENTRONICS DATA COMPUTER CORPORATION

1. BASIC DATA

CENTRONICS DATA COMPUTER CORPORATION
Route 111
Hudson, NH 03051
(603) 883-0111

Robert Howard, Chairman and President
Max Hugel, Executive Vice President

Public Corporation	
Fiscal Year End:	December 31
Total Employees:	1,780
Stock Listing:	NYSE (CEN)
Company Founded:	1968
Products:	Data Printers
Major Locations:	Hudson, NH Puerto Rico Ireland

	1979 (est.) ($ Million)	1978 ($ Million)	1977 ($ Million)
Total Revenues	$110.0	$75.0	$58.0
Net Profit		13.7	12.5

2. THE "EDGE"

- Centronics' original edge, and one with which it is still dominating its portion of the data printer marketplace, was the use of matrix printing technology to produce a low cost computer printer.

- From the introduction of it's first product in 1971 until about 1975, Centronics was the only company supplying computer printers using this technology.

- In 1971 the choice of matrix printing technology was a risky venture. While the technology itself was not new, there were many who questioned the reliability of the print head at high output volumes and the user acceptability of matrix print quality. Quite obviously Centronics won this bet.

- While many new printing technologies (high speed bands, non-impact, daisy wheel, ink jet, etc., are moving into segments of the data printer marketplace, there is still a great deal of room for matrix printers for at least the next few years and Centronics' position on the matrix learning curve will continue to provide them with an edge on competition.

- Centronics is also moving into these new printer technologies, but whether they can devleop an edge through them is an open question at this time.

- Of perhaps more long range consequence is the other edge which Centronics has developed over its four years of existence and that is its relationship with the 1,000 system houses, minicomputer manufacturers, terminal system vendors and other OEM accounts. This relationship, the most important aspect of which is that it enables Centronics to understand its customers' problems and respond to them, is an even more fundamental edge than technology if properly utilized.

- The significance of this edge to Centronics is that it will be able to move around within its marketplace regardless of what happens to its matrix printer technology.

- The significance of this edge to the small establishment marketplace is that Centronics now represents a company which can tap into the marketing experience of 1,000 different companies, the vast majority of which are supplying solutions to small establishments. Centronics then, with this market knowledge and its own printer expertise, can aid its customers in bringing better information systems solutions to their customers, the end users.

- The significance of this edge to the larger companies who compete with Centronics, particularly the large mainframe computer manufacturers who also produce printers, is that this team of equipment suppliers, such as Centronics and the small system vendors through whom they sell, is more likely to be right in their assessment of market trends and requirements by reason of the numbers of assessors.

3. COMPANY HISTORY

- In 1968, Robert Howard, then an independent entrepreneur, was approached by people from the government of Nevada, expressing a need for a specialized computer system for the management and control of gambling casinos. In the course of developing such a system, some of which are still installed in Las Vegas casinos, Howard observed the lack of a suitable printer for such a computer system, and started developing this as well.

- The first Centronics printer, a dot matrix unit, was produced in 1971.

- Since that time Centronics has gotten completely out of the casino computer systems, with the last vestige of its origins, Gamex Industries, a manufacturer of slot machines, being distributed back to stock holders in June of 1979.

- The company operates out of its major manufacturing facility in Hudson, New Hampshire and two subsidiary plants in Puerto Rico and Ireland.

- Centronics has produced and sold almost 150,000 printers since 1971. The vast majority of these have been dot matrix impact printers sold through OEM's and, more recently, distributors in the U.S. and overseas.

- A significant portion (approximately 1/3) of the printer manufacturing, particularly the mechanical assemble work, was subcontracted to Japanese firms. While this subcontracting to Japanese firms has continued, the level of such effort has been cut approximately in half with the completion of an assembly building in Hudson, NH.

4. PRODUCTS

- Centronics' original printer was built around the technology of serial dot matrix impact printing. This technology, in which Centronics was one of the pioneers, is still the basis for most of the company's present product line.

- With a number of different models of dot matrix printers, which operate at speeds of 10 to 180 characters per second, Centronics is now producing these units at a rate approaching 100,000 units per year.

- Within the last two years Centronics has significantly broadened its product line in terms of price, capability and types of technology employed.

  - The printers range in price from under $1,000 to over $7,000.

  - The capability ranges from 10 characters per second to 600 lines per minute.

  - The technology includes not only dot matrix, but also band printing and non-impact electrical discharge printing.

5. MARKETS

- The market for printers can be classified into three application related categories as follows:

  - Computer printers. Output devices operating as a peripheral component of a computer system. The speed range of these printers can be 10 characters per second up to 20,000 lines per minute, but most computer printers fall in the range of 100 to 1,000 lines per minute.

  - Communications printers. Output devices connected remotely to a computer system or to another communication terminal. Usually a communications printer either has a keyboard attached or is attached

to another device, such as a CRT, with a keyboard. Printer speed is usually related to communication line speed, that is 10 to 300 characters per second.

- Word processing printers. High print quality output devices intended to replace office typewriter functions. The printer, usually lower speed (15 to 80 characters per second), will either have its own keyboard or will be connected to another device with a keyboard.

- Centronics operates in that market which is made up of the lower speed portion of the computer printer market and the higher speed portion of the communications printer market.

- The primary customers in this market are the minicomputer manufacturers, the small system manufacturers, and the communications terminal system vendors.

- It is from these manufacturers and vendors that Centronics claims an OEM customer base of approximately 1,000.

- Centronics' recent new product introductions will expand its market coverage of the computer printer market. The 6000 series band printers will put it into the 100 to 750 line per minute speed range.

  - The non-impact microprinter will put it into the very low price end of the computer system market typified by the Radio Shack TRS-80, where Centronics has already made some marketing inroads.

- In order to pursue these broader markets, Centronics has added new distribution channels to its tradition OEM routes. It has added a number of distributors in the U.S. and abroad. It has also signed up Hamilton/Avnet, the largest U.S. electronics distributor.

- While there has been a trend among the computer manufacturers, particularly the large minicomputer manufacturers, to develop and produce their own printers, the proliferation of technologies and user demand for application features has made this a very difficult path for the manufactures to follow or at least to expand.

- The independent printer manufacturers, on the other hand, are expanding their product scope, just as Centronics is doing. The net effect is that some major competitors, particularly Dataproducts, are coming into Centronics dot matrix marketplace just as Centronics is expanding into the line printer marketplace.

6. ORGANIZATION

- Centronics is still controlled and managed by its founder, Robert Howard.

- Max Hugel, who came to the company in 1975 from Brother Industries, its primarily Japanese subcontractor, is Executive Vice President.

- Over the past two years, as the company has expanded its product line and integrated its manufacturing operations, new management personnel have been brought in, primarily in Manufacturing, Engineering, and Finance.

- The company had 1,780 employees as of June 1978.

  - Approximately 10% of these employees are engaged in research and development.

  - Approximately 20% of these employees are engaged in marketing and customer support, including service.

  - The company employs approximately 75 salesmen.

C. COMPUGRAPHIC CORPORATION

1. BASIC DATA

COMPUGRAPHIC CORPORATION
80 Industrial Way
Wilmington, MA 01887
(617) 944-6555

Carl E. Dantas, President

Public Corporation	
Fiscal Year End:	September 30
Total Employees:	3,700
Stock Listing:	NYSE
Company Founded:	1960
Products:	Photocomposition Equipment
Major Locations:	Wilmington, MA Haverhill, MA

	1979 (est.) ($ Million)	1978 ($ Million)	1977 ($ Million)
Total Revenues	$250.0	$181.1	$129.9
Net Income		13.6	9.6

2. THE "EDGE"

- Compugraphic's edge on the photocomposition equipment business is a family of products with a price/performance capability uniquely tailored to the needs of small to medium sized customers, primarily commercial printers and newspapers.

- There are many companies in the photocomposition business, most of them older and larger than Compugraphic. These companies have, however, concentrated their products and marketing efforts on the larger customers, leaving the small user market largely to Compugraphic.

- The net result of this is to leave Compugraphic with a strong position of product and market leadership in the small establishment segment of the marketplace. Compugraphic estimates a market penetration of about two-thirds of the small to medium sized newspapers and about 10% of the commercial printers, far ahead of its competition.

- The signficance of this edge for Compugraphic is that it has achieved a 35% average annual growth rate in total revenues and in net income over the past eight years, and is in a strong market position to continue this expansion for quite some time.

- Compugraphic's edge has a particular significance to the printing and publishing sector of the small establishment marketplace. ITT has allowed such establishments to employ the same kind of technology as their bigger competitors have employed and thereby retain their relative competitive position.

- The significance of this edge to Compugraphic's larger competitors is that they have lost control of a segment of their market. This segment may or may not have been economically attractive to these larger companies but it represents a sizeable amount of revenue, and even more importantly, it demonstrates an approach tailored to a user's specific needs which may prove attractive to larger users of photocomposition equipment, the primary market for Compugraphic's larger competitors.

3. COMPANY HISTORY

- Compugraphic was founded in 1960 by Ellis Hansen and Bill Garth. Its original plan and product line was the production of specialized computer control systems which prepared input data for typesetters, such as Yellow Pages.

- From its founding until the late 1960s, the company was primarily a specialty engineering and manufacturing firm with little marketing orientation.

- In 1968 Compugraphic developed a low cost phototypesetter, the first such low cost unit in the industry.

- The Compugraphic phototypesetter was designed specifically to meet the actual needs of the small to medium size newspaper market. Unneeded features were eliminated and the prevailing price of competitive equipment at $25,000 and up was lowered to under $10,000.

- Compugraphic's strategy of specifically targeted price/performance products oriented to the small establishment in the printing and publishing industry remains today.

- In 1971 Compugraphic extended its market from newspapers to commercial printers. One of the strategies which Compugraphic employs to serve this market is the development and maintenance of a very large set of typefaces for use in the varied material produced by these printers.

- Recently Compugraphic has extended its marketing into in-plant print shops, a less sophisticated market, but one which is growing very rapidly.

- Compugraphic has now a fairly complete line of low to medium cost phototypesetting systems. They are now expanding the input interfaces to include word processors and other kinds of input terminals.

4. PRODUCTS

- Compugraphic's primary product is a line of phototypesetting machines which range in price from $4,000 to $35,000.

- This equipment is designed to take various kinds of text input (keyboard, paper and magnetic tape, OCR pages, etc.), and with special editing and typesetting commands which select the typeface and make graphical rearrangements of the text, produce a photographic print of the final copy as it is to be printed. These phototypesetting systems replace mechanically driven hot lead typesetters (Linotypes) and other, even more manual, typesetting operations.

- In addition to the basic phototypesetter product line, Compugraphic produces a line of peripheral equipment to work in conjunction with the basic unit. This peripheral line includes input devices of various kinds, editing stations, storage devices, and communications interfaces. This line of peripheral equipment is designed to enhance the interface between the origination of text and the phototypesetter which produces the final output form for printing.

- This peripheral equipment can put Compugraphic's word management system, built around the basic phototypesetter, up into the $100,000 price range.

- Compugraphic also produces accessories and supplies to use with their products and systems.

  - One important accessory is the filmstrip which contains the actual typefaces. Compugraphic maintains a library of over 800 different typefaces and a staff of 200 people devoted to the design and production of type.

  - Compugraphic also sells accessories such as film processors and light tables, and supplies such as photographic paper and processing chemicals.

- Compugraphic's latest product is the AdVantage, a large screen display terminal which automates the make-up process of combining advertising copy and artwork.

5. MARKETS

- Compugraphic has operated in two primary markets: commercial printers and small to medium sized newspapers. Recently they have been expanding their markets into other areas such as in-house printing.

- Over 40% of their sales go to the commercial printing market. Compugraphic estimates that there are 56,000 potential customers in this market, including small print shops, ad agencies, publishers, and specialty printers. Compugraphic has about 5,000 customers at present in this market.

- Somewhat less than 40% of Compugraphic's sales are obtained from small to medium size newspapers, the company's original market. Of the estimated 12,000 such newspapers, Compugraphic has a market penetration of 79% of the dailies and 58% of the weeklies. Over half of their new sales to this market are to existing customers.

- In this newspaper market, the systems are increasingly multi-terminal systems operating to an editing processor and, after editing, directly to a photo-typesetter.

- Magazine publishers, a segment of the commercial printing market, use similar terminal to computer to typesetter systems.

- The largest developing market for photocomposition equipment is the in-plant market. Compugraphic estimates that there are 55,000 establishments operating their own internal printing facilities. The applications include sales brochures, catalogs, newsletters, procedures manuals, etc.

- The in-plant market is a less sophisticated market than newspapers and printers and requires extensive education, for which Compugraphic has established a separate sales force.

- Compugraphic obtains almost 40% of its revenue from international sales.

- There are ten other manufacturers of photocomposition equipment, such as Mergenthaler, AM Varityper, Harris, and Dymo. Compugraphic specializes in the low priced end on the marketplace and has the largest market share in their price range.

6. ORGANIZATION

- Compugraphic employs about 4,000 people. Approximately 40% of these are production people employed in Wilmington, MA and other plants in the immediate area.

- All of the domestic sales are handled directly by a field sales force of some 400 people. Maintenance is covered by more than 300 field service people.

- The sales force is organized into three groups selling to newspapers, commercial printers, and in-plant print shops.

- International sales are handled by a network of foreign subsidiaries and dealers.

- Compugraphic recently acquired Quadex, a $3 million per year manufacturer of typesetting "front end" devices which enable and enhance the interface between typesetters and text input equipment.

- The company spends about 3% of its annual revenue on R&D.

D. DATAPOINT CORPORATION

1. BASIC DATA

DATAPOINT CORPORATION
7900 Callaghan Road
San Antonio, TX 78284
(512) 699-7123

Harold E. O'Kelley, Chairman, President and CEO
Richard V. Palermo, Executive Vice President, DP Group

Public Corporation	
Fiscal Year End:	July 31
Total Employees:	5,000
Stock Listing:	NYSE (DPT)
Company Founded:	1968
Products:	Distributed Data Processing Equipment And Systems
Major Locations:	San Antonio, TX Waco, TX Dallas, TX Sunnyvale, CA Berkeley, CA Singapore

	1979 ($ Million)	1978 ($ Million)	1977 ($ Million)
Total Revenues	$232.1	$162.3	$103.0
Net Income	25.2	15.3	8.4

2. THE "EDGE"

- The primary edge which Datapoint has in the data processing equipment marketplace is its system architecture. This is a systems approach which integrates computers, terminals, other peripheral equipment and software into systems which are uniquely effective in distributed data processing applications. This system architecture is both adaptable to many different user requirements and upwardly compatible to allow users to change and grow.

- These dispersed data processing systems are applicable both to geographically dispersed operations, such as remote plants and sales offices, and also to functionally dispersed operations within a single building, for example, order entry operations and accounting operations.

- This edge, a technological edge basically, is becoming more valuable as more users recognize the dispersed nature of the data processing operations which their organizations are actually performing.

- This edge also becomes more valuable as user companies distribute or decentralize the operating authority within their companies out to remote locations which then have a need to see and manage the information pertinent to their local needs.

- In other words, Datapoint's edge is in having a data processing system architecture which is uniquely in tune with the perceptions and needs of today's business managers.

- The significance of this edge for Datapoint itself is both a successful financial growth pattern and a growing level of recognition in the minds of potential users.

- The significance of this edge for the small establishment marketplace is primarily on the branch segment rather than the independent segment. While Datapoint has made numerous sales to small independent businesses, such sales are usually heavily dependent on application software which is not offered by Datapoint.

- Within small branches, the dispersed data processing concepts developed by Datapoint are an ideal solution. These concepts give the local manager complete control over his own information and the ways of handling it, while at the same time giving him access to the corporate DP system.

- The significance of Datapoint's edge to its larger competitors is a further demonstration of the increasing desire of users to obtain local or distributed data processing solutions to their DP applications whenever and wherever such solutions are available.

- Some further moves by Datapoint into user solutions are likely to have even more effect on the marketplace. The stated intentions of Datapoint to develop "office of the future" kinds of applications is a move in this direction.

3. COMPANY HISTORY

- Datapoint was founded in 1968, under the name Computer Terminal Corporation, by Phil Ray and Gus Roche.

- The original product was a Teletype compatible CRT, a novel idea at the time. This was the first product of Computer Terminal Corporation and was called the Datapoint 3300.

- In the early 1970s, Victor Poor, now Datapoint's Senior VP-R&D, came up with the idea of a "computer-on-a-chip" which was to be built into the terminal.

  - The computer-on-a-chip became the Intel 8008 micro processor, the first practical manifestation of the now ubiquitous microprocessor.

  - The terminal, designated the Datapoint 2200, became the first truly programmable terminal. It could not wait for the chip and was built, using other technology.

- This new computer/terminal put the company ,now called Datapoint Corporation, into a different kind of business with a different growth curve and a need for a new top executive. Harold O'Kelley came to Datapoint in 1973 as President and CEO.

- The original terminal now became more of a computer with a built in input/output capability. The applications for it became "dispersed data processing," Datapoint revenues grew from $19 million in fiscal 1973, to $72 million in 1976, to $232 million in 1979, for an 50% AAGR.

- Datapoint has also expanded, very successfully, into the voice communications management market and is now starting to apply its broad range of hardware and software to the "office of the future" market.

4. PRODUCTS

- Since the original Datapoint 2200 intelligent terminal, the company has spawned a family of "dispersed data processors" which now include, in order of introduction:

Datapoint Model No.	Year of First Delivery	Price of Basic Unit
2200	1971	$ 8,000
1100	1974	$ 6,000
5500	1974	$26,000
1130	1975	$13,000
1150	1976	$15,000
1170	1977	$16,000
6600	1977	$34,000
1500	1978	$ 6,000
6000	1978	$12,000
1800	1978	$11,000
3800	1978	$ 7,000

- This array of processors, which differ primarily in terms of processor speed and memory size, are closely related in terms of system architechture and interchangeablity.

- Since the advent of the 2200, Datapoint has emphasized and developed software to match this advanced hardware. User languages, such as DATAFORM for data entry, DATAPOLL for multistation communications, DATASHARE for multiple users, and others, have always been an integral part of Datapoint's product offerings.

- Increasingly sophisticated distributed system architectures, specifically the ARC System or Attached Resources Computer, are major steps toward efficient use of multiple processors, either in a single location or in multiple locations.

- Datapoint has also emphasized attachments of their DDP systems to large mainframe computers, particularly IBM, by providing extensive support of standard data communication protocols, as well as direct channel interfaces to these mainframes.

- In 1976, Datapoint extended its market coverage with the INFOSWITCH line of communication management products. The INFOSWITCH line is itself based on processors in the Datapoint standard product line.

- Datapoint also offers a broad line of peripheral devices such as printers and magnetic storage devices. These units have generally been purchased on an OEM basis from equipment manufacturers, but Datapoint is integrating more of them into its own manufacturing plants.

5. MARKETS

- Datapoint's basic market thrust is toward companies which have data processing requirements in more than one location. This multiple location requirement may be multiple locations within the same building or even the same office, but more commonly involves larger geographic spreads and is often a nationwide requirement.

- The applications are highly variable, ranging from heavy computational, to data entry, to remote data base access. The Datapoint architecture becomes most effective in the middle of this application range, where some number of elements of the total data processing function must be performed at each of the locations.

- Over 90% of Datapoint's domestic sales are directly to end users, either through their own extensive field sales organization or through a network of some 200 dealers. Less than 10% of sales are through OEM contracts.

- Datapoint's customers range in size from small companies to the very largest of companies.

- The INFOSWITCH line, in particular, is aimed today at companies with very large telephone bills, such as insurance firms. This product line is used by companies with as few as 6 long distance trunks.

- Datapoint gets about one-fourth of their revenue from overseas customers. The company is represented overseas by TRW. In addition, CII Honeywell-Bull has an OEM contract with Datapoint.

- While there are a number of companies selling to the distributed data processing market, such as mainframe computer manufacturers, specialized data communication terminal and equipment manufacturers, and others, Datapoint's major competition comes from IBM.

6. ORGANIZATION

- Datapoint reorganized in 1977 into functional divisions with a corporate support staff.

  - A newly designated group called the Data Processing Group is headed by Richard Palermo. This group is further subdivided into three divisions: Small Systems, Large Systems, and Data Processing.

- The Peripheral Operations Division, headed by John Walker, has the facilities of Amcomp, acquired in 1977, as the nucleus.

- The Communications Management Products Division is headed by Dan Hosage.

- The Customer Service Division is headed by Vince Balhorn.

- The International Operations Division is headed by Herb Hensley.

- Development work, which accounts for about 7% of annual sales, is carried out at each of the divisions. A software development group is located in Berkeley, California. Vic Poor, Chief technical officer, has a small R&D staff to provide overall guidance to product development.

- The company has over 5,000 employees, of whom about 20% are in field sales and service.

E. DATAPRODUCTS CORPORATION

1. BASIC DATA

DATAPRODUCTS CORPORATION
6200 Canoga Avenue
Woodland Hills, CA 91365
(213) 887-8000

Erwin Tomash, Chairman
Graham Tyson, President/CEO
Robert Bartizal, Executive Vice President
Charles Dickinson, Senior Vice President, Operations

Public Corporation	
Fiscal Year End:	March 31
Total Employees:	3,950
Stock Listing:	ASE
Company Founded:	1962
Products:	Data Printers, Core Memories, and Communications Test Equipment
Major Locations:	Woodland Hills, CA Santa Clara, CA Wallingford, CT Hong Kong Puerto Rico Ireland

	1979 ($ Million)	1978 ($ Million)	1977 ($ Million)
Total Revenue	$163.6	$139.6	$115.3
Net Income	14.2	15.5	12.2

2. THE "EDGE"

- Dataproducts' edge, for most of its existence, has been one of technology and specialized manufacturing expertise. This edge, uniquely applied to the business of line printers, has enabled the company to establish a position of market leadership among the independent manufacturers of line printers.

- As the market for computer printers broadens, particularly down and toward lower speed/lower cost units, Dataproducts has been faced with the need to broaden their product line in accordance with the marketplace. Dataproducts

has, for the past few years, been doing exactly that and the early results of their efforts are now appearing as revenue.

- The significance of the early edge which Dataproducts developed with their high speed line printers has been to allow the company to build a strong business foundation with major customers, a manufacturing capability, and the people and financial resources to implement an ambitious new product devleopment program which is now underway. Whether that new product program will succeed to the level of giving Dataproducts another edge remains to be seen, but the point is that the original edge gave the company the capability to keep pace with a rapidly changing product technology and market requirements.

- The significance of Dataproducts' edge for the small establishment marketplace is that the availability of low cost, high speed printers from Dataproducts is one of the factors which allowed minicomputers to be applied in full scale business data processing applications.

- The significance of Dataproducts' edge for their larger competitors has been, until recently, to discourage them from entering the line printer manufacturing business and to look elsewhere for business opportunities. Dataproducts' position on the learning curve was such that only the very biggest companies, such as IBM and Control Data, could manufacture these line printers with the same economics. Recently, new printer technology, primarily band printers, have changed this equation considerably, but Dataproducts is still in the position of manufacturing increasing quantities of drum printers every year (12,000 units in 1978).

3. COMPANY HISTORY

- Dataproducts was founded in 1962 by Erwin Tomash and a number of its present officers.

- The basic concept around which the company was formed was a new kind of printer hammer for high speed printers. Using this print hammer, developed by Cliff Helms, now Senior Vice President - Technical Programs, Dataproducts built a business and a market position in the high speed computer printer market.

- While most of this kind of business is the captive territory of the large computer manufacturers, particularly IBM, Dataproducts found enough room as an OEM supplier to some of these companies to build a business.

- As the minicomputers became a factor in the data processing market in the early 1970s they became an even more important customer for Dataproducts printers. Today the sale of printers to minicomputer manufacturers on an OEM basis represents almost 40% of Dataproducts annual revenue.

- OEM customers of all kinds, the computer makers, the system and terminal assemblers, have constituted practically all of Dataproducts business until recently. The company counts over 400 such companies as its customers.

- In 1969, Dataproducts acquired Stelma, a Connecticut manufacturer of communication test equipment for common carriers and military systems. Stelma, now operating as Data Products New England, now also produces militarized versions of Dataproducts' printers.

- In 1978, Dataproducts embarked on a massive program of new product development and introduction. It concentrated its efforts in the lower speed end of the printer market but placed sizable efforts on a number of new technologies. The primary effect of these efforts, so far, has been to impact net income and the program is behind schedule, at least with respect to revenue budgets.

- Dataproducts' financial results have had ups and downs through the 1970s, but the downs have been periods of no-growth which look bad only in comparison to the 20% growth rate in the up years.

4. PRODUCTS

- Dataproducts is primarily in the business of manufacturing data printers. For most of its existence those printers were drum based line printers. In the past few years, as drum printer technology was impacted by band technology line printers on the lowside and by Xerographic printing technology on the high side, Dataproducts has been diversifying its product line into other kinds of technologies.

- Dataproducts' broad line of drum printers ranges from 300 lines per minute at $4,500, up to 1800 lines per minute at $16,000.

- The company has recently introduced new printer products built around four different technologies.

  - Band Printers. Medium speed units (300 and 600 lines per minute) and competitive with the lower end of the company's existing drum printer line.

  - Matrix Printers. Matrix printers operate a character at a time. Their speed is usually measured in characters per second. Dataproducts' first matrix printer operates at 340 characters per second, which is very high speed by comparison to the currently available matrix printers. Three hundred and forty characters per second is approximately equivalent to 200 lines per minute.

  - Thermal Printers. Dataproducts introduced an 80 character per second thermal printer. Again this is very fast for its class. Eighty characters per second approximates 50 lines per minute.

  - Daisy Wheel Printers. Dataproducts acquired the printer division of Plessey Peripheral Systems in March 1979. This product operates at 45 characters per second, but with a solid character suitable for word processor applications.

- Dataproducts recently entered into an agreement with A.B. Dick for cooperative research in ink-jet printing. This makes the fifth new printer technology in which Dataproducts has visible participation.

- Dataproducts also claims to have research work underway on electrophotographic non-impact printing technology, the technology which could have considerable impact on the high speed end of their product line.

- Dataproducts is also in the magnetic core memory business. The production of their products is starting to decline as solid state technology takes over. All core memory manufacturing has been transferred to the Hong Kong plant and Dataproducts has been planning the phase out of this line for some years. It represented about 4% of total revenue in fiscal 1979.

- The company is also in the business of producing communications test equipment in the Connecticut plant. This is specialized equipment sold to common carriers and to the military. It represented about 13% of revenue in fiscal 1979.

5. MARKETS

- Dataproducts' primary market is the minicomputer manufacturers. These companies buy Dataproducts' line printers and resell them with their own labels attached as components of their minicomputer systems. About 40% of Dataproducts business comes from these limited number of firms.

- Mainframe computer manufacturers and manfacturers or assemblers of distributed processing systems and terminal systems are also OEM customers of Data products.

- As Dataproducts broadens its product line down from the high speed printers area where it was the acknowledged leader of the independents, it opens up new markets and new areas of competition.

- The lower speed units are much more likely to be communications oriented than the high speed units. While many of these lower speed units will be used on lower cost mini and microcomputer systems, more of them are likely to be used in remote locations. This environment and Dataproducts' customers will be somewhat different than in the past.

- Dataproducts' competition is also changing, both by reason of Dataproducts' modes and by reason of technologies. Centronics, in particular, is moving from its traditional dot matrix printer market up into the band printer market that has been a piece of Dataproducts territory. They both sell to the minicomputer manufacturers and to other OEMs.

6. ORGANIZATION

- Dataproducts operates a number of manufacturing plants in the United States and abroad. As the product line broadens, the responsibilities of these plants are being oriented toward more specialized pieces of their printer product line operations. For example, the Santa Clara plant, where much of the core memory work was done, has been relieved of that work in order to produce the thermal and matrix printer lines.

- In order to move these new printers to other markets, in addition to their traditional OEM customers, the company is establishing a network of distributors in the United States and in Europe. These distributors will be oriented primarily to the matrix, thermal, and daisy wheel printers.

- Dataproducts spends about 8% of its revenue for R&D.

F. GTE TELENET COMMUNICATIONS CORPORATION

1. BASIC DATA

GTE TELENET CORPORATION
8330 Old Courthouse Road
Vienna, VA 22180
(703) 827-9200

Lawrence G. Roberts, President and Chairman

Subsidiary Corporation: Company was acquired by GTE Corporation in June 1979.

Fiscal Year End: December 31

Company Founded: 1972

Products: Packet Switched Data Communications Services

	1979 (est.) ($ Million)	1978 ($ Million)	1977 ($ Million)
Total Revenues	$15.0	$ 8.9	$ 4.1
Net Income (Loss)		5.0	4.1

2. THE "EDGE"

- GTE Telenet's apparent edge on the telecommunications market is almost purely technological. The mystique of technology in the communications markets, especially technology deriving from defense research, has great attractions as a marketing, and particularly as a PR tool.

- But GTE Telenet's real edge is in the characteristics of the services offered, particularly in two aspects.

  - The costs to a user are totally unrelated to the distance between locations, and the variation with usage is generally much less than with other exchange services. In effect, a user is operating in a cost controlled environment, a very attractive feature for users, such as remote computing service vendors.

- Computers and terminals can communicate with each other, even though they are operating at different speeds, codes, or communication protocols. The conversion from one protocol or speed or code to another is accomplished within the network. This is another very useful feature for the users with huge populations of different types of terminals and computers.

- While packet switching is the vehicle used by GTE Telenet to provide such features (and it is of some advantage), these features could be very effectively offered by networks with technologies other than packet switching. GTE Telenet has, however, offered these features and in so doing has broken new and valuable ground for users long accustomed to accepting the offerings of the established carriers as the way to do things.

- In short, the GTE Telenet edge is a fresh approach to providing data communication services which are of greater utility to the ultimate customer.

- The significance of this edge to GTE Telenet is that now, with adequate financial backing, reputation, and practical communications experience from GTE, GTE Telenet can exploit their fresh approach as a useful, rather than a questionable, service to users.

- The significance of this edge to the small establishment marketplace is that it is the communications users in this marketplace who are most at the mercy of the available communications services. The large user can use many unique system approaches, as well as scale factor, to obtain many of the communications services he needs at reasonable cost. The small user has no such options. These new service features from GTE Telenet, and other new communications features coming from other suppliers as a result of GTE Telenet's example, will be particularyly useful for small establishments.

- The significance of this edge to the large competitors of GTE Telenet, such as AT&T, Western Union, Continental Telephone, etc., is that users' needs for new communication service features are thoroughly showcased with GTE

Telenet. Even with GTE Telenet as a somewhat questionable survivor, many users were prepared to, and in fact did, commit huge resources to the GTE Telenet approach.

- GTE Telenets' bigger competitors have already started to implement many of the new features demonstrated by GTE Telenet. Probably the most dramatic such implementation is the Bell System's ACS.

3. COMPANY HISTORY

- GTE Telenet's origins go back to the Arpanet project funded by the U.S. Department of Defense, Advanced Research Projects Agency in the mid 1960s. Arpanet was a communications network built to allow the computers of large defense research contractors, mostly Universities, to communicate with each other.

  - Arpanet used an advanced data switching technology called packet switching. This new packet switching technology was essentially a way of fluiding or homogenizing large and small messages into a standard size, such that they could move without clogging through standard communications channels.

  - The project sponsor for ARPA was Dr. Larry Roberts, now the president of GTE Telenet.

  - The prime contractor for the Arpanet was Bolt, Beranek and Newman, the Boston consulting firm, which was the original source of funds and the largest stockholder in GTE Telenet.

- In the late 1960s, a flood of newly organized firms petitioned the Federal Communications Commission to become specialized common carriers. They were encouraged by the FCC's new policy of regulation by competition and some favorable court rulings on the issue.

- Most of these petitions were granted after lengthy hearings.

- Many of these early entrants have since folded, some with great fanfare such as Datran, a subsidiary of University Computing Corporation.

- Most of these petitioners sought to enter the private line business along high traffic routes, such as Chicago to St. Louis and New York to Chicago.

- Some of these entrants have survived and to a certain extent prospered, notably MCI, the original petitioner, and SP Communications, a subsidiary of the Southern Pacific Railway.

- These early petitioners were all seeking to provide transmission services using basically standard technology.

- Later in this round of new carrier start ups some organizations petitioned to become, not transmission carriers, but value added carriers; that is they would use the facilities of the transmission carriers, primarily AT&T, and would offer value added services on top of these more basic offerings.

  - The first of these were GTE Telenet and Packet Communications Inc.; the latter company has since folded. The technology they were going to use was the Arpanet developed technology of packet switching. Since they were the first value added carriers on the scene, value added networks and packet switching were, somewhat improperly, considered to be the same thing.

- GTE Telenet's goal was, and still is, to offer nationwide data communications services, interconnecting various types of subscriber terminals and computers. This ambitious goal required huge investments of capital, even though GTE Telenet used transmission facilities leased from AT&T. This requirement for capital, which caused the demise of Datran, has been a continuing problem for GTE Telenet and has caused them to bring in a number of additional investors

such as Bessemer Sercurities, Bowne and Company, Time Inc., etc., in addition to making a sizable public stock offering in 1977.

- GTE Telenet's first revenues were achieved in 1975. In spite of revenue growth that reached $9 million in 1978, operating losses and the need for expansion capital led GTE Telenet to seek the support of a larger company.

- In late 1978 GTE offered to buy GTE Telenet. The acquisition was approved by stockholders in the spring of 1979 and FCC approval of the acquisition was received in June of 1979. GTE Telenet is now operating as a subsidiary of GTE.

- Of the original investors in GTE Telenet, Bolt, Beranek and Newman made $10 million on the sale, doubling their net worth. Bowne and Company made approximately $2 million on their investment.

4. PRODUCTS

- The primary product which GTE Telenet offers is a packet switched data communications service. They also offer private packet switching systems to large companies. These private systems represented $1.25 million in revenue to GTE Telenet in 1978.

- The GTE Telenet service is currently available locally in 180 cities in the U.S. Of these cities, 89 are equipped with GTE Telenet switching equipment. Customers in other cities can access the Telenet system by means of In WATS service. Access to the Telenet network is also available from 27 foreign countries.

- All of the transmission facilities are leased from AT&T. The trunks between large GTE Telenet switchers, designated class I Central Offices, are 56 KBPS Digital Dataphone Service. The other trunks and local loops are also leased lines from Bell.

- The switching centers comprise Prime minicomputers and microprocessor based systems developed jointly by GTE Telenet and Digital Communications Corporation, who manufactures the units for GTE Telenet.

- Typically the service interconnects two computers or a low speed terminal to a computer.

  - At the point where the computer connects to the GTE Telenet system there must be a special high speed interface device. This device is usually one of the interface processors provided by GTE Telenet, or it may be special software built into the customer's own computer. Many of the minicomputer companies provide this software with their equipment.

  - Remote terminals are today limited to asynchronous devices operating at speeds of under 120 characters per second. Such terminals are the typical devices used on almost all remote computing services.

  - Plans are under way to interface the network to higher speed synchronous terminals, namely the IBM 2780 and 3270 type devices.

- In order to simplify and standardize the interface between customer computers and the network, GTE Telenet has been very instrumental in promoting the development of an international data communications standard called X. 25. This standard has been recommended by the international communications standard group (CC ITT) for use worldwide.

5. MARKETS

- The market which GTE Telenet serves today is primarily the remote computer services market, both commercial and educational.

- There are today some 200 computers connected to the GTE Telenet system.

- Over 100 of these are commercial remote computing services or commercial data bases.

- There are 15 Universities connected to the network as part of a University cooperative network called Educom. A number of other Universities are also connected.

- Of much greater market potential than these service oriented computers, are the data networks of private companies. While GTE Telenet has not been as successful in selling these networks, they have a sizeable number of such companies including TRW, Bechtel, Gillette, PPG and Xerox.

- One of the major limitations to their marketing efforts in attracting these private networks is the users' estimate of GTE Telenet's long-term survivability. A user invests considerable effort in implementing a new network. User experiences with new carriers, particularly Datran, have made them very cautious about making big commitments to a questionable, even though attractive, new service. The recent acquistion of GTE Telenet by GTE should go far in alleviating such user fears.

- Since 1976, GTE Telenet has had one direct competitor. Tymnet, the value added carrier subsidiary of Tymshare, offers a data communications service very much like GTE Telenet's packet switching service, and starting with the built in usage of Tymshare's own service customers, Tymnet has been a very powerful competitor for GTE Telenet's present market.

- Of more consequence is GTE Telenet's future competition. Information industry giants IBM and Xerox have announced their plans to go after the large corporate network market and last year AT&T announced their Advanced Communications Service, a packet switching type of service very much like the existing GTE Telenet service.

- GTE Telenets future existence, even as a subsidiary of GTE, may be less dependent on their present technology and market lead on these giant

competitors than it will be dependent on the massive size and growth rate of the American data communication market.

6. ORGANIZATION

- The most striking element of the GTE Telenet organization is their management team. From Lawrewnce Roberts down, they are:

  - Young; Roberts is 41.

  - Bright; Roberts and two of his Vice Presidents have earned PhDs. Most of the others have Masters Degrees.

  - Academic; Roberts and most of his original staff came from academic/research backgrounds.

  - Limited in their telecommunications business experience--like most of the leading edge vendors, GTE Telenet's management is well versed in the technology and in the users' needs, but in the commercial telecommunications business with its requirement for managing huge sums of capital and it's inherently far flung business operations, there is a much higher premium on business experience than in most other industries. The merger with GTE should go far in eliminating this potential weakness.

G. MANUFACTURING DATA SYSTEMS INC.

1. BASIC DATA

MANUFACTURING DATA SYSTEMS INC.
4251 Plymouth Road
Ann Arbor, MI
(313) 995-6000

Kenneth R. Stephanz, President and CEO

Public Corporation	
Fiscal Year End:	August 31
Total Employees:	579
Stock Listing:	OTC (MDSY)
Company Founded:	1969
Products:	Computer Aided Manufacturers Services
Major Location:	Ann Arbor, MI

	1979 (est.) ($ Million)	1978 ($ Million)	1977 ($ Million)
Total Revenue	$41.0	$28.8	$22.2
Net Income	4.3	3.3	2.4

2. THE "EDGE"

- The basic edge which MDSI has developed is a tight relationship with a large number of key customers in their selected market. These customers include some of the largest manufacturers in the world, as well as many small establishments.

- The edge has been initiated from a good basic product in an area in which MDSI is the acknowledged expert. The edge has been expanded by organizing for and providing extensive support to their customers, both during the system installation phases and during the continuing applications phase.

- The long-term significance of this edge for MDSI is that they have become the industry leader, a position from which their customers, and the rest of the industry, follow MDSI's direction. This then could lead to an even tighter lock on MDSI's piece of the entire N/C industry and its standards and practices.

- The short term significance of this market edge is that MDSI has been achieving spectacular growth in revenues and profits.

- The significance of this edge for the small establishment marketplace is both specific and general.

  - It is specific to the small manufacturing establishments. These companies can, through the use of remote and shared access to computer assistance, reduce the extremely high cost of implementing an N/C system, and not be placed at a further economic disadvantage from their larger competitors.

  - MDSI's edge is also general as it demonstrates a very specific industry/application oriented business strategy which proved highly profitable to a company willing to implement such a strategy in depth.

- The significance of this edge by MDSI on their larger competitors is that it, to a large extent, dictates a path which these large companies must now follow if they are to compete with MDSI. This path has two dimensions, both of which are attributable by the market to MDSI, and which users will increasingly expect their other suppliers to follow.

  - An N/C programming language standard.

  - A level of user applications support.

3. COMPANY HISTORY

- MDSI was founded in 1969 by Kenneth Stephanz and Charles Hutchins.

Hutchins was at Comshare and had developed a numerical control program for use with Comshare's remote computer service. Stephanz, then with Bendix, and Hutchins, established MDSI to sell and install these programming systems still using the Comshare service.

- Further development of this software system, called COMPACT II, has made it the most widely used system for computer assisted programming of numerically controlled machine tools. The COMPACT II language has been officially adopted as an ANSI standard computer language.

- MDSI's basic operations continue to be the sale and installation of these programming systems to manufacturing organizations which use numerical control machine tools. However, the method of performing the computation has gone beyond the use of remote computing services. COMPACT II is now also provided via computers on the users premises. These computers are either minis provided by MDSI, or the user's own large mainframe computer.

- Remote computing services still provide 62% of the total revenue and continue to provide a substantial portion of the company's annual growth.

- MDSI has recently been expanding the scope of their product developments for manufacturers. These expanded products include order entry and production control software for smaller users and parts coding systems for very large users.

- Sales have increased over the last four years at an AAGR of over 40% with net income increasing at the same rate.

4. PRODUCTS

- MDSI's basic product is a software package called COMPACT II which generates control tapes for numerical controlled machine tools.

- This software package is delivered to end user manufacturing firms in a number of ways:

  - Via remote computing services.

  - Via special minicomputer systems sold by MDSI.

  - Via COMPACT II packages installed on the manufacturer's own mainframe computer.

- The remote computing service access is the original method of delivering the product and still represents two-thirds of MDSI's annual revenue.

- To use this remote computing service, the user would enter the dimensions and other variables describing the part to be machined using a standard time sharing terminal. He will also define the machine tool he is going to use to make that part. The remote computer, using COMPACT II, would analyze the input data, ask for corrections where necessary, and would then send back to a paper tape punch, usually on that same time sharing terminal, the necessary code to allow the resultant punched paper (or Mylar) tape to be used directly on the numerical controlled machine tool.

- For high volume users, MDSI has developed two versions of a specialized minicomputer system which would replace the remote computer service and perform the same functions.

- Additional accessory products from MDSI include:

  - Digital plotters for visualizing the parts to be machined and the machine tool motions required, and intelligent terminals for preparing, editing, and duplicating the N/C tapes.

  - A parts classification system to allow similar parts to be produced more economically.

- MDSI is reported to be working on a number of new programs aimed at enhancing their position with their customers. These additional programs include:

  - Use of PASCAL, a higher level, more powerful programming language.

  - An interactive graphics design system, for use by design engineers.

  - A system for order entry and production control functions, to be used on the in-house minicomputer systems.

- The computers by which MDSI provides the remote computing service and conducts its internal developments are those of Comshare, Tymshare, and ADP Network Services. MDSI has contracted with these RCS companies to have MDSI software resident on dedicated computer systems from these companies, and to have MDSI customers use these dedicated computers and the communication networks of these RCS companies to perform the actual data manipulation.

5. MARKETS

- MDSI sells only to manufacturing firms using numerical control machine tools.

- Of some two million machine tools in the United States, approximately 50,000 today are operated by numerical control. 20,000 of these operate in either a simple or unchanging way and therefore do not require any assistance in generating N/C tapes.

  - Of the other 30,000 which could use computer assistance, approximately half do use computer assistance.

  - MDSI claims about 10,000 or two-thirds of these machines as customers.

- These machines are operated by approximately 2,500 MDSI customers. This customer base is expanding by about 500 new customers per year.

- MDSI maintains a program library with the interface routines or "links" with almost 2,000 different N/C machine tools.

- MDSI has also started to obtain a significant percentage (15%) of its revenue from overseas manufacturers. There is an overseas market for N/C machine tools comparable in size to that of the United States.

6. ORGANIZATION

- MDSI's strategy of implementing its product through the remote computing facilities of existing vendors has enabled it to avoid putting resources into such facilities and to concentrate its resources on its basic product, the COMPACT II programming system.

- As a result, the company is able to achieve almost $70,000 in revenue per employee, and at the same time achieve a 40% annual revenue growth.

- Of MDSI's current 579 employees, approximately 30% are in field sales and customer support. This does not include any hardware maintenance personnel, since all of this work is handled by hardware contractors.

- MDSI spends between 5 and 6% of its annual revenue in R&D.

H. PLANTRONICS, INC.

I. BASIC DATA

PLANTRONICS, INC.
10443 Bandley Drive
Cupertino, CA 95014
(408) 996-9606

Jack W. McKittrick, Chairman
William L. Martin, President

Public Corporation	
Subsidiaries:	Zehntel, Inc. Frederick Electronics Action Communications Systems Kentrox Industries
Fiscal Year End:	June 2
Total Employees:	1,290
Stock Listing:	NYSE
Company Founded:	1961
Products:	Voice Headsets, Data Terminals, Telephone and Message Switching Systems, Automatic Testing Equipment
Major Locations:	Cupertino, CA Santa Cruz, CA Beaverton, OR Dallas, TX Frederick, MD Montreal Tijuana

	1979 ($ Million)	1978 ($ Million)	1977 ($ Million)
Total Revenues	$86.6	$69.3	$53.7
Net Income	8.7	7.9	5.6

2. THE "EDGE"

- Plantronics original edge was based on taking an ingenious product design, a lightweight telephone headset, and moving with it into a favored supplier relationship with the key companies of a huge industry, the American telephone industry.

- Plantronics became one of the earliest companies to be an accepted supplier of subscriber location equipment for the Bell System, with their Star Set operator headset and, more recently, their Vu Set data terminal.

- The company has used these relationships to expand their knowledge of and contacts with the entire telecommunications industry and has used the cash flow from these operations to acquire a number of other small but well known suppliers to other segments of that industry.

- Their position now is that of a broad based supplier of telecommunications equipment with continuing strong supplier relationships to both domestic and foreign communications carriers. In their increasing relationships to communications end users, Plantronics is being careful to develop products and markets where there is a complementary, rather than a competitive, relationship with their major customers, the carriers.

- The significance of this broad based communications product edge is the increasing strength and flexibility of these supplier relationships with companies which are themselves growing rapidly, and at the same time the maintenance of a high level of stability. Such relationships, along with a high level of R&D, portends a long period of profitable growth for Plantronics.

- The significance of this edge for the small establishment marketplace is the demonstration of a successful pattern of outside suppliers to the Bell System and other large carriers. The end result of this pattern of outside suppliers will bring many more new, ingenious and useful products such as the Star Set, to the universe of telephone system users.

- The significance of this edge for Plantronics' major competitors is the demonstration of another channel of distribution to the end user of telecommunications; that is the path through, rather than around, the major communications carriers. This distribution channel is already being followed by other companies, such as DEC and Northern Telecom. It seems likely that, with FCC encouragement and Bell acquiescence, many more companies will follow this path successfully demonstrated by Plantronics.

3. COMPANY HISTORY

- In 1961, in Santa Cruz, California, Jack McKittrick, the present Chairman, Courtney Graham, the recently retired chairman, and Keith Larkin, all of whom were aircraft pilots, developed and started to produce radio communication headsets for pilots and other aircraft crews. The advantage of these new headsets was their light weight, as compared with those then in common use. The first sales were to the aircraft industry and to air traffic control personnel.

- Shortly thereafter, Plantronics started to sell these lightweight headsets to the telephone companies for use by telephone operators. A close working relationship was developed with various components of the Bell System. Of great aid in the establishment of this relationship was the FCC Docket #19129 which resulted in AT&T setting up a Purchased Products Department for handling such relationships with outside suppliers.

- Since that time Plantronics has sold over two million of these headsets to Bell and through Bell, to its customers. These headsets, called Star Sets, still represent almost one third of Plantronics total revenue.

- In 1968 Plantronics acquired Frederick Electronics whose principal product is computer-based Telex switching systems, primarily sold to foreign communication administrations.

- In 1973 Plantronics acquired Kentrox Industries, a manufacturer of telephone transmission equipment used in the central office of telephone companies.

- In 1976 they acquired Action Communications Systems, a producer of message switching processors and of the WATSBOX, a computer based telephone management system.

- In 1978 Plantronics acquired Zehntel, Inc. a manufacturer of automatic printed circuit board testers, and also Wilcom Products, a manufacturer of telephone test equipment.

- The combination of these acquistions plus continuing substantial growth from their original line of headsets has taken the company in the last ten years from $7 million in annual revenue to today's $87 million. Net earnings have grown at a corresponding rate.

4. PRODUCTS

- All of Plantronics products and subsidiaries are basically related to the field of telecommunications.

- The original lightweight headset is produced in over 115 variations for different customers' requirements. Specially designed headsets from Plantronics were used in all of the NASA manned space flight programs.

- A centralized telephone answering system called CentraVox has been sold to telephone companies for use in central offices.

- A computer terminal, called Vu Set, designed to operate in conjunction with touch-tone telephones, has been approved as a company-wide standard by the Bell System for sale by Bell to its customers. While an interesting concept, the Vu Set has not lived up to Plantronics marketing expectations.

- The Telex switching systems from Frederick, marketed under the name Eltex, have been successfully sold to many foreign communication administrations. The latest version, Eltex V, developed in conjunction with Cable and Wireless, the British international record carrier, has been ordered by a number of customers.

- The WATSBOX from Action Communication Systems has been supplemented by larger telephone management systems called Roadrunner/Apex, introduced in 1978. These systems are built to operate in conjunction with telephone company equipment rather than replace it. One recent enhancement to these systems has been voice recognition equipment which would enable field salesmen, for example, to call into the system speaking their authorization code and the requested telephone number.

- Test equipment and telephone transmission devices round out Plantronics broad line of telecommunications related products. The most sophisticated of these products is the Troubleshooter line which can test, diagnose and print out repair instructions for complex printed circuit board assemblies, including units with microprocessors on-board.

5. MARKETS

- Plantronics marketing efforts are singularly oriented to communications carriers.

  - In the U.S., these are the telephone companies, primarily the Bell System.

  - Internationally, these are the government owned telecommunications authorities and international record carriers such as Cable and Wireless, mentioned earlier.

  - International business represents about one-third of Plantronics revenue.

- The Bell System represents over one-third of Plantronics revenue.

- Switching systems, both from Frederick and from Action, are sold through direct sales organizations.

  - Frederick products are sold primarily overseas.

  - Action products are sold to large U.S. industrial firms.

- AT&T and the other telephone companies in the U.S. represent an annual market for telecommunications products at about $2 billion. Of this, the captive suppliers of these companies: Western Electric, Automatic Electric, Graybar Electric, etc., represent about two-thirds. This still leaves a market of some $700 million annually just to this very limited number of companies.

- Competition for these and end user markets in the U.S. has been picking up sharply over the last few years, particularly since the Carter phone decision and the advent of Bell's Purchased Products Department.

  - Major American companies, such as Exxon, Xerox and IBM, have entered the market with big resources.

  - Smaller companies and new entrepreneurs have been riding new technologies into solid positions in niches, such as PBX's, answering devices, data terminals, voice recognition equipment, etc.

  - Foreign companies such as Northern Telecom, Siemens, Japanese electronics companies, etc., have all been expanding their product positions in the American telecommunications markets.

6. ORGANIZATION

- Plantronics operates their increasing number of subsidiaries as independent operations with each having its own plant and marketing organizations.

However, there is an obvious focus to the entire organization and to the individual subsidiaries which places them all in different segments of the same telecommunications industry.

- The company spends about 7.5% of its total revenue in engineering and product development.

- There are three ex-AT&T officials on the Plantronics Board of Directors. While this probably has some unquantifiable effect on Plantronics marketing efforts it certainly provides Plantronics top management with an excellent perspective on the American telephone industry.

I. PRIME COMPUTER INC.

1. BASIC DATA

PRIME COMPUTER, INC.
40 Walnut Street
Wellesley Hills, MA 02181
(617) 879-2960

David O. Dunn, Chairman
Kenneth G. Fisher, President and CEO

Public Corporation	
Fiscal Year End:	December 31
Total Employees:	1,665
Stock Listing:	NYSE (PRM)
Company Founded:	1972
Products:	Minicomputer Systems
Major Locations:	Framingham, MA Puerto Rico

	1979 (est.) ($ Million)	1978 ($ Million)	1977 ($ Million)
Total Revenues	$140.0	$93.6	$50.0
Net Income		8.4	3.8

2. THE "EDGE"

- Prime's edge is an almost classical example of a good technical product which is magnified by marketing into an impressively successful business.

- Prime's product line, originally and still, is built around advanced architecture, multiple user minicomputer systems. These superminis, in which Prime was one of the pioneers, bring big computer capability to the budget range of medium and, now, small users.

- In addition to pioneering in the use of minicomputers for multiple access applications, Prime pioneered in marketing such systems directly to end users. While Prime's minicomputer competitors concentrated on OEM customers,

Prime moved directly to the end users. These original end users were sophisticated users of computer systems to be sure, but they put Prime into direct touch with the end user marketplace.

- Prime is now extending that end user marketing approach, both downward in user sophistication, with their new Prime Information System series of packaged hardware/software systems, and also extending it in applications with an increasing effort in business data processing applications.

- This product/marketing edge has been of significance to Prime because it has produced simply spectacular growth in sales and profits over the last four years. This rate of growth is unlikely to continue, but Prime appears to be making the right moves to extend their success formula into other segments of the information processing market.

- The significance of Prime's edge for the small establishment marketplace is an expansion of interactive computing capability to a wide range of ultimate users.

- The effect of this expanded capability has been felt by only specialized segments of the small establishment marketplace, namely scientifically and technically oriented companies, such as engineering firms. However, this effect is almost certain to be felt more widely as Prime and their many competitors, who are or will be doing similar things, move their advanced computer concepts downward in the end user marketplace.

- The significance of Prime's edge for its larger competitors has been enormous. The large minicomputer companies, in particular, have observed Prime's success both with superminis and with end user marketing and are, each in a slightly different way, following Prime's path.

3. COMPANY HISTORY

- Prime was founded in 1972 by seven engineers from Honeywell's then declining minicomputer operation.

- These seven men, including computer scientist Dr. John Poduska, Bob Berkowitz, Vice President Manufacturing, and Joe Cashen, Vice President Engineering, came to Prime with backgrounds not just in minicomputers but in minicomputers with multiple access software and virtual memory. These concepts had been developed at MIT's project MAC and furthered in NASA's Electronics Research Center, and were in the public domain when Prime was established.

- With these concepts and a market vacuum formed by Honeywell's withdrawal from the minicomputer business, Prime moved into the market with a running start.

- In 1975, with revenues running at a $10 million annual rate, Kenneth G. Fisher, also from Honeywell, was brought in as President. Fisher brought with him a marketing team and a business concept of concentrating on end user sales rather than the OEM market on which Prime and all of the other minicomputer manufacturers were then concentrating.

- The Prime computers, with their multiple access architecture and software, were ideally suited for end user applications.

- Prime was also staying well abreast of the latest computer technologies. For example, they were one of the leaders in the use of MOS memories on their systems.

- Prime has now reached a point where over 90% of its sales are to end users and over half of its personnel are marketing people.

- Revenues have risen from the 1975 level of $10 million per year to a forecast $140 million in 1979. In fact, Prime's recent growth rate of over 50% annually has been deliberately held down by management in recent months.

4. PRODUCTS

- Prime's main products are large multi-user, minicomputers. The first of these were the 300, 400 and 500 series models.

- In January 1979, Prime introduced a new 32 bit series - the 450, 550, 650 and 750. The 450 is oriented toward the system builder application while the others are continuing in the end user, multiple access mode which Prime has found so successful.

- Prime offers a broad line of peripheral devices for these processors, but it obtains these devices from OEM manufacturers and apparently expects to continue this policy.

- Since Prime has been orienting its efforts toward sophisticated end users, it offers no applications software but an extensive number of computer languages and utility programs to allow users to develop their own application programs.

- Recently this mode has changed somewhat with the introduction of three new systems called Prime Information Systems. These end user systems are being offered with end user software and hardware in a single package. The software has been developed by Devcom, a Bellevue, Washington system house. The software is compatible with the Reality software package used on smaller Microdata systems. The target market for these new packaged systems are first time computer users and Microdata users who have outgrown their present system.

5. MARKETS

- Prime's major market has been medium sized, sophisticated end users. Generally, this has meant high technology companies with highly interactive and scientific kinds of data processing applications.

- Business data processing is about one-third of Prime's market and is becoming a larger factor.

- Prime has an estimated 2,000 customers today and claims that 25% of their business comes from growth from their existing customer base.

- The new Prime Information Systems product line represents another new facet of the company's marketing strategy. They are establishing a network of 20 to 30 dealers to market these systems as complete packages, including software, to end users. Prime expects this network of dealers to generate as much as $10 million this year and $20 million in 1980.

- Prime's competition has increased sharply this year.

  - The price of IBM's mid range computer systems, the size which Prime competes against, has decreased significantly with the announcement of the 4300 series early this year.

  - DEC introduced their supermini, the VAX line, in 1978 and it is a 32 bit machine, comparably powerful to the new Prime product line.

  - Hewlett-Packard introduced a supermini, the HP 3000-III, which also impacts the Prime product line.

- These competitive offerings, new products from well established companies, impact Prime from both the business applications side (IBM) and from the scientific applications side (DEC and H-P) and will almost certainly produce a slowing of Prime's great success in the supermini market.

- On the other hand, Prime's new moves into packaged systems for less sophisticated users may be very successful. It represents one of the very limited number of growth paths for smaller user establishments with growing data processing requirements and a level of use sophistication beyond, but not far beyond, the introductory stage.

6. ORGANIZATION

- Prime had a total of 1,665 employees as of the end of 1978.

- Of these more than half are involved in marketing. This fraction is almost twice that of the other minicomputer companies whose primary sales effort is to OEM customers rather than end users. It is roughly comparable to the amount spent on marketing by IBM.

- Prime spends 6-7% of its annual revenue on R&D.

J. THE REYNOLDS AND REYNOLDS COMPANY

1. BASIC DATA

THE REYNOLDS AND REYNOLDS COMPANY
800 Germantown Street
Dayton, OH 45407
(513) 226-0808

Richard H. Grant, Jr., Chairman
Edwin F. Strasser, President
Robert G. Timberlake, Executive Vice President

Public Corporation	
Fiscal Year End:	December 31
Total Employees	2,909
Stock Listing:	NASDAQ (REYNA)
Company Founded:	1866
Products:	Business Forms and Information Systems and Services
Major Locations:	7 Printing Plants 7 Regional Computer Centers 96 Computer Sites

	1979 (est.) ($ Million)	1978 ($ Million)	1977 ($ Million)
Total Revenues	$165.0	$140.2	$113.8
Net Income		11.9	9.8

2. THE "EDGE"

- Reynolds and Reynolds' basic edge is a long standing, carefully nurtured relationship with their primary customers, the automobile dealers. This relationship, initiated about 50 years ago, has progressed through a range of technologies and continues in the mode of the Reynolds and Reynolds salesmen as a key consultant to the automobile dealer's information handling operations.

- At the same time, R & R has, most of the time, maintained a current position with the technological state of the art with their services. For example, when CARS, one of R & Rs' major competitors, came up with a computer generated

daily operating control report in the early 1970s, R & R quickly responded with the very successful VIM II system.

- More recently, R & R was the first major remote computer service vendor to offer in-house computers to their larger customers. This was accomplished in 1976, well before ADP and National CSS came up with their highly publicized offerings.

- Basically, R & Rs' edge continues to be the consulting relationshilp which their large and well supported field sales organization has developed with the auto dealers.

- The significance of this edge for Reynolds and Reynolds is the security which it provides in their control of their own market position. It allows them to understand their customers needs and provide for them, and it allows their customers to expect R & R to solve these needs.

- The significance of this edge for the small establishment marketplace is the demonstration that a company, specializing in one industry sector of that marketplace and placing a significant percentage of their effort on marketing, can maintain solid sales growth and profitability.

- The significance of this edge on R & Rs' larger competitors is the demonstration that the small establishment marketplace, even a specific segment of it (in this case automobile dealers) is large enough to support a number of competitors, particularly those with a strong set of customer relationships, such as Reynolds and Reynolds.

3. COMPANY HISTORY

- Reynolds and Reynolds was founded in Dayton in 1866 as a commercial printing company. In the late 1930s the company was purchased by Dick Grant, the father of R & Rs' present board chairman. Dick Grant had just retired as Vice President of Sales of General Motors, where he is credited with

having moved Chevrolet ahead of Ford in sales volume. He recognized the need for a standard system of accounts for automobile dealers and moved R & R into specializing in business forms for automobile dealers.

- R & R built this strategy into a position of overwhelming leadership in the provision of forms for auto dealers. The forms business represented $69 million in revenue to R & R in fiscal 1978, most of it in the automobile dealer market.

- In the early 1960s, R & R moved into the computer services market with the purchase of Controlmat, a Boston firm which offered accounting services on electronic tab card equipment.

- These accounting services were restructured to operate on computers and R & R started offering batch accounting services to their automobile dealer customer base.

- The input data was prepared either on adding machines with optical font paper tape which was mailed to the R & R computer centers, or on punched paper tape data terminals which were polled from the R & R computer at night.

- These batch data processing services, now largely supplanted by newer computer communications technology, still represent $20 million annual revenue.

- In 1973, after some abortive attempts at an on-line computer service, R & R bought a Tucson, Arizona computer service firm founded by Arnie Cantrell and two local auto dealers. This service, which had about a dozen auto dealer customers at the time, operated with on-line terminals connected to a minicomputer system.

- Arnie Cantrell and his system were brought to Dayton and a strategy was developed of offering on-line services via a number of minicomputer centers distributed around the country. Arnie Cantrell is now VP, Systems Develop-

ment at R & R, and over 200 of these minicomputers are serving over 3,000 customers.

- In 1976 R & R started offering a version of this minicomputer system for in-house use by larger auto dealers. R & R today has over 1,000 of these in-house systems installed.

4. PRODUCTS

- R & R has two basic product lines; a line of manual business forms and a line of data processing systems and services. Both of these product lines are sold primarily to automobile dealers.

- In fiscal 1978, the revenue from data processing, at $71 million, exceeded for the first time that of the forms business, at $69 million.

  - Data processing systems and services have been growing at a 27% AAGR, with the 1977 to 1978 growth at almost 50%.

  - Business forms have also been growing, but at a 10% AAGR.

- R & R data processing products can themselves be classified into four different product lines.

  - The original batch services.

  - VIM II, the on-line services.

  - VIM III, the in-house services

  - Terminals

- The batch services are performed out of six regional computer centers. The service includes various accounting and inventory management packages. There are about 5,000 customers for this service.

- VIM II is the on-line processing service offered through the more than 200 minicomputers around the country. The system is built around a Basic Timesharing, Inc. minicomputer system with 15 to 20 customer premises terminals connected by leased lines to these minis. The VIM acronym means Vital Information for Management.

- The services offered as a part of VIM II are various accounting, inventory control, and merchandising packages. R & R continues to develop additional application packages which can be accessed by customers on the VIM II system. There are approximately 3,000 customers using the VIM II system

- VIM III is a similar system to VIM II but is designed for in-house use by those customers whose volumes have outgrown the VIM II system. There are over 1,000 customers with VIM III systems installed on their premises.

- The terminals used to access both of these services are terminal printers manufactured by GE. The majority of these terminals are T-1232s, which print at 120 characters per second on a 132 column line.

- In addition, R & R has recently started selling terminals to its customers as an addition line of business. These terminals are made by Texas Instruments. The terminals operate both with R & Rs' computer services as well as with new factory communications networks established by automobile companies, such as the Chevrolet Division, in order to improve communication with their dealers.

- R & R has recently established a joint venture called Rey Zon Computers with Zonic Technical Laboratories of Cincinnati. Terminals to be developed by this new venture will be used in conjunction with an upgrade of the batch computer services, according to reports.

5. MARKETS

- R & Rs' markets are, as noted previously, the automobile dealers plus similar kinds of customers, such as dealers of farm implements, construction equipment, motorcycles, etc. There are approximately 30,000 auto dealers in the U.S.

- While the auto dealer industry has had business upturns and downturns, R & Rs' revenue has increased very steadily through both kinds of conditions.

  - During upturns, the dealers' business volume and the paperwork involved in these transactions increases R & Rs' business.

  - During downturns, the dealers use the R & R systems to control costs even more tightly.

- R & Rs' competition in the remote computing services segment of the marketplace is primarily CARS, headquartered in Birmingham, Alabama, and Automatic Data Processing Company's Dealer Services Division headquartered in Portland, Oregon. Both of these companies operate nationwide, as does R & R. There are also some smaller regional competitors, such as AutoTel Services in Villanova, Pennsylvania.

- In the in-house or small business computer sector of the marketplace, the competition is more diffuse, consisting of major companies, such as Burroughs, with relatively weak product offerings in the auto dealer market, and regional operators, such as Insight Systems operating in the Maryland - Pennsylvania market area, but with powerful offerings.

- There is the recurring threat of competition in one form or another from the auto manufacturers themselves. They dictate many of the industry standards, including forms layouts and account numbers and rigorous reporting procedures. Now, with dealer communication networks being established, there is a very direct path by which these processing services could be offered.

This issue is, however, much more dependent on diverse issues, such as the reverberations from Chrysler's financial problems and government reactions, than it is on the technical ways by which the car companies could offer dealer information services.

6. ORGANIZATION

- R & Rs' orientation to marketing is exemplified by the fact that 20% of their total staff is made up of field sales representatives.

- These sales reps, both computer as well as forms reps, maintain a tight, almost consulting, relationship with their clients.

- On the other side of their market, R & R has always maintained a similarly tight relationship with the car companies. A liaison office in Detroit keeps track of such things as account number changes, current parts status, and policies. The information so obtained and passed on to their systems development and field sales force keeps their systems current and their helpful relationship with the dealers very strong.

- Although R & R has maintained a good position with the current state of technology, they, in fact, spend a relatively low share of their revenue, less than 1%, on R&D.

K. ROLM CORPORATION

1. BASIC DATA

ROLM CORPORATION
4900 Old Ironsides Drive
Santa Clara, CA
(408) 988-2900

M. Kenneth Oshman, President
Leo Chamberlain, General Manager - MilSpec Computers
Robert R. Maxfield, General Manager - Telecommunications
Anthony V. Carollo Jr., General Manager - ROLM Operating Cos.

Public Corporation	
Fiscal Year End:	June 30
Total Employees:	2,239
Stock Listing:	NYSE (RM)
Company Founded:	1969
Products:	Computerized PBX Systems and Militarized Minicomputers
Major Locations:	Santa Clara, CA

	1979 ($ Million)	1978 ($ Million)	1977 ($ Million)
Total Revenue	$114.5	$50.3	$32.6
Net Income	11.3	3.6	1.9

2. THE "EDGE"

- ROLM operates in two different businesses: militarized computers and computerized PBX's. This highlight addresses their computerized PBX operations primarily.

- The edge that ROLM has developed over its competitors in the computerized PBX business is a very market responsive product line. Market responsive products in the communications industry have been, until recently, a rare commodity. Standardization and product reliability were the primary characteristics of common carrier provided products. New FCC policies, aided and

abetted by creative companies such as ROLM, have changed that situation over the last few years.

- The market responsiveness of ROLM's products has been developed by defining user needs very well and then using the great flexibility of the digital computer and digital switching techniques to put appropriate solutions in place. None of the technology used pushes the state of the art, but the now-satisfied user neither knows nor cares about that.

- The significance of this edge for ROLM is that being the first to move into this partial vacuum in the market has rocketed them to a visible, profitable position of leadership in the market. While the market vacuum is filling fast with new products from AT&T and other PBX manufacturers, ROLM is now exploiting their leadership position with an expansion of their product line, their manufacturing capability, their R&D, and their distribution channels.

- The significance of this edge for the small establishment marketplace is that ROLM's products are usable by small, as well as large, establishments. Through these kind of intelligent communications control systems, smaller users can obtain some of the network efficiencies which would otherwise be available only to larger organizations.

- The significance of this edge for ROLM's larger competitors is that it is a source of embarrassment to them. That a small company, with no prior experience in the telephone industry, can respond so quickly and so effectively to telephone user requirements puts these large competitors in the relative position of not moving as fast as they could have in their handling of these now demonstrated user needs.

3. COMPANY HISTORY

- In 1969, Kenneth Oshman and three associates saw a need for standard computers ruggedized for military applications. They negotiated with Data General to produce such a version of the Nova minicomputer and sold their first units to defense contractors in 1970.

- The company's name, ROLM, is the first letter of the four founders last names.

- Militarized computers have grown to $29 million in annual sales in fiscal 1979 and ROLM continues to obtain large orders for such units.

- In 1974 ROLM saw a new opportunity in the application of computers to replace electromechanical switching equipment in telephone systems. They developed and delivered a small (400 line) computerized PBX (Private Branch Exchange) in 1975.

- Since that time, ROLM has expanded its product line with smaller units (24 lines) and larger units (4000 lines). They have also, using the great flexibility of the digital computer which is the heart of ROLM computerized PBX added many user features.

- Revenues from computerized PBXs reached $85 million in the fiscal year ending June 30, 1979 and ROLM has almost 2,000 such systems installed.

4. PRODUCTS

- ROLM has developed a line of computerized PBXs ranging from very small to very large. These include:

-	VSCBX	-	24 lines, up to 144
-	SCBX	-	48 lines, up to 200
-	CBX	-	200 lines, up to 800

- LCBX - 800 lines, up to 1500
- VLCBX - Up to 4000

- The features of these CBXs, and it is the user features which make them so attractive to users, include such things as:

  - Route optimization; automatic selection of the least cost route for each long distance call.

  - Call detail recording; a record of each call for departmental or project accounting, as well as network optimization studies.

  - Toll restriction; control of network access.

  - Obviously this is only a partial list of such features.

- Two recent software developments which have greatly enhanced the ROLM CBX product line are:

  - Tandem switching; the ability to interconnect switches rather than just individual telephones. The key element of this feature is the ability to pass along dialing instructions to a distant switch.

  - Electronic Message System; this is a capability to connect data terminals as well as voice telephones to the switch and have the intelligence in the switch to store and forward the data messages between such terminals.

- ROLM also introduced, in the last year, a microprocessor controlled telephone, the ETS 100. This phone, which incorporates a 12 character alpha-numeric display panel, includes many new and useful features such as:

  - Abbreviated dialing.

- Calling number display.

- Call forwarding.

- Call timing, etc.

5. MARKETS

- ROLM sells their CBXs through three separate distribution channels.

  - Independent distributors of interconnect equipment.

  - Independent telephone companies.

  - A field sales organization.

- ROLM has established 23 distributors to sell the CBXs. Of these, three are owned by ROLM. Approximately two-thirds of the ROLM CBX systems and half of ROLM's Telecommunication Division revenue derives from these distributors.

- Interconnect distributors have had an up and down existence for their relatively short lives. The earliest of these businesses trace to the 1968 Carterphone decision by the FCC which allowed "foreign attachments" to be connected to common carrier provided telephone systems.

  - In the early 1970s, a flurry of vendors of electromechanical switches, largely made in Japan, brought the industry some early publicity and growth. Operating problems brought on by these vendors inexperience brought these original interconnect vendors to financial and marketing problems by 1973-1974.

- Two things happened to the interconnect industry in the mid 1970s.

- The FCC essentially expanded its Carterphone ruling to allow interconnection of foreign attachments without requiring interface devices as provided by the telephone companies.

- Advanced feature, computer based, telephone switches were developed and marketed.

- Computerized Tandem switches, devices which interconnect other switches, were introduced by companies such as Danray, now a division of Northern Telecom.

- Computerized PBXs, devices which interconnect telephone instruments, were introduced by ROLM.

- The interconnect vendors went into a new series of "ups" based on these two occurrences.

- Currently the interconnect distributors are in a down mode, largely attributable to their individual, relatively small size and the high capital requirements involved in financing customer CBX sales.

- ROLM's second marketing channel is through the independent telephone companies such as GTE and United Telecommunications. These companies buy ROLM switches and provide them to their own customers. This is the fastest growing segment of ROLM's market.

- The third segment of ROLM's market are the large companies who operate their own private telephone systems. Most of this market has remained very tightly in the hands of the Bell System and its equipment and services. But ROLM has made some significant entries into this market and new product developments seem directly oriented towards that market.

- ROLM has a number of competitors for its intended markets, but the most important of these, by far, is the Bell System. Equipment provided by the Bell

System has not yet reached the level of user features provided by ROLM, but this is a problem on which Bell is working very hard.

- Other companies competing with ROLM are the classical suppliers to the telephone industry, such as Stromberg-Carlson, Northern Telecom, (a subsidiary of Bell Canada) LM Ericsson, NEC America, and others.

6. ORGANIZATION

- ROLM is organized into three divisions, each headed by a general manager.
  - Mil-Spec Computer Division.
  - Telecommunications.
  - ROLM operating companies; this is a division which consists of the three interconnect distributors in Illinois, Michigan, and New England which are owned by ROLM.
- ROLM has a total of 2,239 employees of whom 300 are in the operating companies.

L. TANDY CORPORATION

1. BASIC DATA

TANDY CORPORATION
1800 One Tandy Center
Fort Worth, TX 76102
(817) 390-3700

Phil R. North, Chairman and President
Lewis Kornfeld, Executive Vice President - Radio Shack Division
John V. Roach, Executive Vice President - Radio Shack

Public Corporation	
Fiscal Year End:	June 30
Total Employees:	20,000
Stock Listing:	NYSE (TAN)
Company Founded:	1963
Products:	Retailing and Manufacturing of Consumer Electronics
Major Locations:	7,000 Retail Stores Worldwide 20 Manufacturing Plants Worldwide

	1979 ($ Million)	1978 ($ Million)	1979 ($ Million)
Total Revenues	$ 1,215.4	$ 1,065.0	$949.3
Net Income	83.2	66.1	69.0

2. THE "EDGE"

- Tandy operates in a number of different markets, but for purposes of this study, the market being considered is the small computer market. Tandy has two distinct edges on its competitors in this market.

  - Tandy has an in place 7,000 location distribution network, many of which have now had two years of experience in selling small computers.

  - Tandy has an advanced position on the small computer learning curve with over 100,000 units manufactured and sold.

- Four thousand of the Radio Shack stores have been selling TRS-80s. These stores, and the extensive advertising and sales promotion program behind them, have established a well recognized position among people with even a passing interest in computers.

- The Radio Shack store personnel have, during that two year period, absorbed a great deal of experience, not only in the technical aspects of microcomputers and their peripheral equipment and software, but much more importantly, in the handling of the customers who buy and use them. While this is by no means the level of expertise of an IBM salesman, neither are the customers.

- In producing over 100,000 TRS-80s, Tandy has produced more computers in two years than IBM has produced in their entire history. The TRS-80s are obviously smaller than any produced by IBM but Tandy's position on the learning curve is nonetheless a very important consideration. This learning curve experience applies not only to the actual manufacturing process but also the software, the relationships with suppliers, the understanding of the marketplace, etc.

- The significance of these edges to Tandy is that they are now in a very solid position of leadership which will be difficult to shake.

- The significance of these edges for the small establishment marketplace are difficult to assess. While many businessmen have bought TRS-80s, the level of useful work they are doing is probably quite small. On the other hand the exposure of these people to the practical use of computers is the most important driving force in the market. How this small establishment user exposure is followed up by Tandy, by other suppliers, and by the users themselves will probably become very clear in the next two to three years.

- The significance of these edges for Tandy's larger competitors is that they are forced to do something in this retail computer marketplace soon, or Tandy will establish a position of strength much like that of IBM in the large mainframe market.

3. COMPANY HISTORY

- In 1963, Tandy Corporation, a small Fort Worth leather crafts business, acquired Radio Shack, a nine store retailer of electronic parts and radio equipment, headquartered in Boston.

- Sales in 1963 of that Radio Shack operation were $12 million. Sales grew to $100 million by 1970, and in the fiscal year 1978 sales exceeded $1 billion.

- Over this period of time Tandy has expanded their network of stores from the original nine to a worldwide total of some 7,300 today, of which 60% are company owned stores.

- Tandy has also increased the level of value added in their retail product line by manufacturing almost 40% of the products in their own manufacturing plants in the United States and in Asia. The TRS-80 computer is manufactured in Tandy plants in Texas.

- The success of the TRS-80 was apparently as much of a surprise to Tandy as it was to anyone in the industry. It has only been in recent months that production has been able to keep up with demand for the computer. Radio Shack stores are still in a back order situation for much of the peripheral equipment, accessories, and documentation.

- During 1978, Radio Shack took steps to strengthen their grip on this personal computer marketplace by opening a number of computer centers, stores specializing in computers. As of June 1979, there were 38 such stores open, with plans to open at least 50.

4. PRODUCTS

- Radio Shack sells a wide range of consumer electronic products, but for purposes of this study, we will restrict the comments to the Radio Shack computer line.

- The TRS-80 was introduced in August of 1977. Since its introduction, well over 100,000 of these systems have been sold, more than the combined total sales of all of the rest of the microcomputer manufacturers.

- The TRS-80 was sold originally for $599.95 for a basic 4K memory configuration with a cassette deck. Additional memory and peripheral devices, such as printers, communications interfaces, and floppy disk memories, could drive the price up into the thousands of dollars. The average system price was about $1,200.

- The original $599.95 price, recently reduced to $499.95, was the price breakthrough that put the unit within reach of tens of thousands of customers who would not otherwise consider a computer.

- Software and peripheral devices were produced for Radio Shack by OEM manufacturers and software houses, and continue to be added to the TRS-80 microcomputer catalog.

- In May of this year, Radio Shack introduced the TRS-80 Model II. This is a faster machine with 32K bytes of memory, built-in floppy disk, an 80 X 24 line CRT screen, 76 key keyboard with upper and lower case characters, and a 10 key numeric pad.

- The TRS-80 Model II is priced at $3,450 and is directed at the small business user.

5. MARKETS

- Radio Shack's original target with the introduction of the TRS-80, was the home computer hobbyist. They have found, during their almost two years of market experience with the TRS-80, that the markets have been more related to small businessmen, education and the small branches of bigger businesses.

- Even the home hobbyist turns out to be more of an incipient entrepreneur than a pure hobbyist.

- One of the biggest single markets which Radio Shack has penetrated with theTRS-80 is schools. These are mostly high schools but there have also been many sales to colleges and quite a few to grammar schools. Many school districts such as Dallas and Philadelphia have each bought quantities (50 to 100 so far) of TRS-80's for computer education classes.

- Radio Shack's primary competition in their computer retailing operations are computer stores, of which there are now approximatelly 1,000. These computer stores are largely independent, though some have loose affiliations with a franchise operation or a small computer manufacturer.

- Further competition is expected when companies such as DEC, TI, and H-P start pushing their personal computers at the retail level. DEC has already initiated such a program and the others are likely to do something along these lines soon.

- Radio Shacks primary competition in their personal computer manufacturing operations are today an assemblage of small firms such as Apple, IMSAI, Ohio Scientific, etc., as well as a few larger firms such as Heath, Commodore and Pertec. As previously noted, Radio Shack is selling TRS-80s at a rate which exceeds all of these other companies combined.

- The general expectation is that the real competition has yet to be heard from. The big minicomputer companies, previously mentioned as probable retailers, are doing some stirring around in the marketplace, but have not yet demonstrated any serious committment to it.

- As Radio Shack moves up from the under $1,000 personal computer market to the more serious small business computer market, competition starts to become a much more obvious and important factor.

- Many companies, large and small, are producing small business computers, many of them in Radio Shack's under $10,000 range.

- Many other companies are bringing these small business computers to market with all of the software and other customer support.

6. ORGANIZATION

- Tandy's primary operation is the Radio Shack Division.

  - Radio Shack has more than 7,300 retail stores worldwide

  - Approximately 6,000 of these are in the United States.

  - The number of stores is currently growing at about 10% per year.

- Of Tandy's 20,000 employees, over half are involved in sales related activities.

- Tandy spends 9% of its revenue on advertising, but has no formal budget for R&D.

M. WANG LABORATORIES, INC.

1. BASIC DATA

WANG LABORATORIES, INC. One Industrial Avenue Lowell, MA 01851 (617) 851-4111	Dr. An Wang, Chairman and President Harry H. S. Chou, Executive Vice President John F. Cunningham, Executive Vice President
Public Corporation	
Fiscal Year End:	June 30
Total Employees:	7,725
Stock Listing:	ASE (WANC)
Company Founded:	1951
Products:	Computers, Word Processors, and Related Peripherals
Major Locations:	Lowell, MA and other Massachusetts locations Belgium Ireland (Proposed)

	1979 ($ Million)	1978 ($ Million)	1977 ($ Million)
Total Revenues	$321.6	$198.1	$134.3
Net Income	28.6	15.6	9.1

2. THE "EDGE"

- The edge which Wang has on its segments of the information marketplace is, like so many other companies, based on technology. But Wang's edge is not a single, narrow technology. It is a broad based, rapidly expanding, systems oriented technology.

- This technological edge might be called systems integration. It is based upon a recognition of the increasing interrelationships of the many elements of information systems. These include the relationships between:

- Data processing and word processing.

- Computers and a variety of peripheral devices.

- Communications and information processing.

- And most importantly, an information product development process based on users' needs.

- It is this last point which Wang seems to have mastered better than most companies. Wang has a remarkably high batting average of bringing development projects to profitable revenue production. This is attributable to a great deal of creative and careful product planning.

- Most of Wang's data processing sales to date have been to smaller companies, whereas their word processing sales have generally been to very large companies. At this point it is somewhat unclear as to where Wang's strategy of integrating word and data processing will take them in the marketplace, but it is a strategy which has powerful implications for users, large and small.

- The significance of Wang's broad technological edge on the company itself is that it imposes a continuing pressure to keep it up. Wang's constitutuents, stockholders, customers, employees, and indeed its management expect this edge to be continued, but as the scope widens of the technology needed to maintain this edge it becomes more difficult to keep up.

- The significance of Wang's system technology edge for the small establishment marketplace is that it brings the advantages of integrated systems to this marketplace. While the impact of such capabilities on the small establishment marketplace from Wang or from anybody else have berely been felt at this time, such integrated systems capabilities are needed more by small establishments than by larger establishments and the ultimate significance is that much greater.

- The significance of Wang's edge for its larger competitors is potentially enormous. Large competitors like IBM are already struggling with the problem of how to implement integrated functional systems within their independent, functionally organized operating groups. A company like Wang, bringing such systems to the marketplace places great, and perhaps even disruptive, pressure on these information industry giants.

3. COMPANY HISTORY

- In 1951 Dr. An Wang, one of the early pioneers in computer technology, started Wang Laboratories to produce special purpose electronic devices and systems.

- In 1964, Wang Laboratories started to produce electronic desk calculators. At the time the market was still dominated by electromechanical, hugh keyboard devices from Marchant, Monroe and Friden.

- For eight years Wang Laboratories pursued that market with modest success, but by 1972 hand held electronic calculators were destroying the market for desk top units.

- Wangs revenues in 1972 were $39 million.

- In 1972, the company introduced a word processor unit to compete with IBM's Magnetic Card Selectric Typewriter. This unit was the Wang Model 1220, and it also was built around a Selectric Typewriter.

- In 1971, Wang also introduced its first computer system, the 2200T.

- Since that time, steady, and in fact, rapid expansion of the Wang product line has increased revenues at a 40% AAGR, and net income at a slightly faster rate.

- One of the most significant product developments from Wang was its introduction, in 1976, of a multiple work station word processing system. This was the first implementation of such a system for office applications. More importantly, it was the visible beginning of the integrated system strategy which has given Wang its current technological edge on the marketplace.

4. PRODUCTS

- One of the most striking things about Wang is the breadth of their product line, both in size range and in the number and variety of peripheral devices.

- A less striking, but ultimately much more important aspect of the Wang product line, is its growing capability to perform multiple functions.

- The two major categories of products in the line are data processing and word processing. With applications software and communications capabilities tying these two product lines together, Wang is increasingly pushing these lines as parts of what they call Integrated Information Systems.

- The basic element of the data processor line is the System 2200 originally introduced in 1973. This product has been enhanced and expanded since that time to included a broad line of computer systems ranging from the PCS II at $4,800 up to the VS 100 model, introduced this June for a price of up to $800,000.

- Wang's line of word processing systems is now led by the OIS (Office Information Systems) 125, 130, 140, and 145. Wang continues to offer the WPS series as well. These systems range in price from $10,000 to $100,000.

- Wang claims to offer a total of 68 different peripheral devices in support of their data processing systems. These include display and printer based terminals, output printers, card readers, plotters, and various disk and magnetic tape storage devices.

- The word processing line also has a series of peripheral devices including a communications capability, CRT based work stations, various kinds of high speed printers, and letter quality printers and photo typesetters.

- The phototypesetter line resulted from the acquisition of Graphic Systems Inc. in 1978. An increasing percentage of the other peripherals, particularly the printers and work stations, have resulted from internal development by Wang.

- One of the very interesting peripheral products developed at Wang is their image printer. Based on copier-like printing technology, it is unit which operates directly from a word processing system or computer. It produces 18 pages per minute in a variety of type coats and print formats.

5. MARKETS

- Wang participates in two major segments of the information handling market, that is the word processing segment and the data processing segment.

- The word processing market segment can be further divided into the standalone segment and the multistation or shared logic segment.

  - Wang is the clear leader in the shared logic segment.

  - Although Wang started with standalone word processors and still maintains such units in its line of word processors, other companies are well ahead of Wang in terms of market share of standalone units.

- While the competitors in the word processing market manufacture both standalone and shared logic systems, the major competitors are suppliers of standalone equipment. These are primarily IBM's Office Products Division, Xerox, the Redactron Division of Burroughs, Vydec, Lanier, and number of smaller companies. IBM is the leader of the group because of its long history of Selectric typewriter based word processor devices.

- The data processing segment of Wangs marketplace can also be subdivided, and in many different ways. For purposes of this study we will use the subdivision used by Wang themselves. Their segments are:

  - Information processing. These are small business systems by Wangs definition.

  - Problem solving. Engineering and scientific applications, typically found in laboratories of companies and universities.

  - Distributed Data Processing. Interconnected small computers and intelligent terminals capable of performing some local processing and, with communications capabilities, interconnecting to other computers to perform multi-location related data processing.

- Wang participates, with different methods and against different types of competitors, in all of these market segments.

- In the Information Processing (Small Business Computer) segment Wang operates in close harmony with a number of software houses to provide solutions to the small establishment customers for this equipment.

- The competition in this Information Processing segment are the mainframe companies, primarily IBM with its low end equipment such as the System 3 and System 34 and now the System 38, the various minicomputer companies and their networks of system houses, and the special small business computer makers such as Basic/Four Corp.

- In the problem solving (scientific) segment Wang operates from its own expertise in software and scientific peripherals such as plotters and digitizers.

- Its competitors here are primarily the big minicomputer makers such as Hewlett-Packard and DEC.

- In the Distributed Data Processing segment Wang does not appear to have a clear strategy. Wang, like most other vendors in this marketplace, and users as well, appear to be trying to find a capturable niche among the various competing system approaches which comprise this market segment.

- Wang considers its competitors in this marketplace to be DEC, Datapoint, Sycor, Four Phase, IBM Series 1, Data General, Olivetti and Nixdorf. This, perhaps more than anything else, seems to indicate an intelligent terminal plus type strategy toward their DDP markets.

6. ORGANIZATION

- Wang is very much a one man influenced company. Dr. An Wang, the founder, is still very much in control of the company.

- This is not to suggest that the company is limited to the capability horizons of Dr. Wang, broad though they obviously are. For example, John Cunningham, now Executive Vice President, brought significant marketing and sales talent into the company since joining the company in 1970.

- Wang employs a total of 7,725 people worldwide. About 40% of these people are involved in sales and service.

- Wang spends about 5% of its revenue on R&D and about 2% for advertising.

IV THE IMPACT ON LARGER COMPETITORS

IV THE IMPACT ON LARGER COMPETITORS

A. THE MOST SIGNIFICANT IMPACT

- The most significant impact which the leading edge vendors have on their larger competitors is caused by the business examples which these smaller companies bring to the marketplace.

- Whether their edge is based on new products or on new marketing techniques, the edge developed by these vendors is highly visible to customers, competitors, regulators, sources of capital, and anyone else with a vested interest in the related market.

- The examples set by these leading edge vendors impacts their larger competitors in a number of possible ways.

  - An annoying extra burden such as providing a higher level of customer support, as exemplified by Bowne and by MDSI.

  - An acceleration of new product developments and introductions as accomplished by Rolm and by Tandy.

- A new system concept or even an industry standard which must be met, sometimes at very high cost. MDSI has accomplished that with a numerical control computer language, and Telenet has done the same with the X.25 communication standard.

- A position destroying approach which may necessitate an entire new corporate strategy. Perhaps the most dramatic example of this was the original Carterphone case which changed many very basic strategies in the communications industry. In more subtle ways Datapoint, in distributed processing architectures, and Tandy, in retailing of computers, are accomplishing much the same results.

- The impact of these market examples, while disruptive to the larger competitors in the short run, are ultimately more of a benefit than a detriment to large companies and certainly to their customers. Once convinced of the value of these new products or concepts (and the business success of the leading edge vendors is very convincing indeed) the large companies have the resources to implement and expand these approaches to a level which is orders-of-magnitude greater than the small leading edge vendors could have accomplished themselves.

- But the implementation process by big companies takes time. It is during that time that the leading edge vendors can accomplish tremendous growth and profitability, reaching a point of becoming a big company themselves, for example, DEC, or successfully merging with a larger company, as for example, Telenet or National CSS.

B. OTHER IMPACTS

- The leading edge vendors are in direct competition with larger companies, but in general, the value of the market share which they pre-empt is not significant to the larger companies.

- The possible stimulation of a host of emulators, small or even large size new competitors in a market, is of much greater consequence to the large established firms. For example, the computerized PBX pioneered by Rolm has, in fact, attracted many potentially strong competitors to the PBX marketplace. The position destroying successes of Carterphone and MCI, and more recently Telenet, has attracted the giants of other markets (for example, IBM and Xerox) into the new to them communications market.

- A final kind of impact by the leading edge vendors on their larger competitors is a positive one. Some of these leading edge vendors, namely Centronics, Dataproducts, and Plantronics, have developed their edge by doing business through the large companies in their industry.

- The products of these leading edge vendors have allowed their large OEM customers to expand their own product line by the private labelling of the smaller companies' products to the business advantage of all parties, including the ultimate customers.

- Whether any such arrangements can be maintained in the long run has yet to be seen in the volatile information industry.

V THE IMPACT ON THE SMALL ESTABLISHMENT MARKETPLACE

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A. TYPES OF IMPACTS

- The leading edge vendors impact the market directly by the actions which they take and also indirectly by the actions which they cause or allow other, often larger, companies to take.

- Of the two types of impacts, the indirect effects are the most significant in the long run because of the magnifying effect on the kinds of large companies which are caused to take action.

- The direct impacts, while smaller in scope and permanence, have great significance both to the companies creating the impacts, as well as on the small establishments which benefit from the products or services made available by the actions of these leading edge vendors.

B. THE DIRECT IMPACTS

- The edge by which the leading edge vendors impact the small establishment marketplace can take three forms.

- New products and services built upon new technologies, such as the Telenet packet switching service.

- New products and services built upon existing technologies but newly applied to user functions, such as Rolm's line of computerized PBX systems.

- Products and services brought to the marketplace in new ways such as Plantronics' use of the Bell System to sell their products to end users.

- The significance of any of their actions on the small establishments, which are users of the resulting products or services, is that they allow the small user to perform at an acceptable cost the same kinds of information handling functions that his larger competitors have been able to perform.

- This "big user capability" made available to small establishment users, while apparently a point of very narrow significance, is the common thread through all of the leading edge vendors analyzed in this study.

  - Some leading edge vendors make this kind of capability available only to a specific industry or type of user, for example, Reynolds and Reynolds in the auto dealer industry, or Compugraphics in printing and publishing.

  - Some vendors make it available only through cooperative relationships with system vendors, for example, Centronics and Dataproducts working with the minicomputer manufacturers.

  - Some vendors provide this big user capability only to establishments with unique application requirements regardless of size, for example, Manufacturing Data Systems, Inc. with machine tool users or Bowne with high volume text generating organizations.

- The point is that the small establishment users of the products or services of these leading edge vendors are able to perform information handling functions which might otherwise be restricted to only their large and well capitalized competitors.

C. THE INDIRECT IMPACTS

- While the direct impacts of the leading edge vendors are relatively small, the indirect impacts of their activities are enormous. The leading edge vendors demonstrate a successful product or service or mode of operation which then creates huge pressures on their competition, particularly their larger competitors, to emulate or in some other way respond to the leading edge vendors' activities. These pressures can, and usually do, come from many sources.

  - Customers who would like to have the same kind of product features or support.

  - Regulatory agencies who, with help from their constituents, visualize the leading edge vendors as being more responsive to the customers' needs.

  - The stock market, which sees every successful small venture as a major threat to one of the large companies.

  - The large company's own employees and even management who recognize the merit of the leading edge vendor's approach (in fact may have recognized its merit long before) but also recognizes the difficulty of the re-orientation which would be required within his own company in order to follow such an approach.

- The net effect of all of these pressures, resulting from the example given by the leading edge vendor, is that the large companies must, and do respond, however ponderously. The new product or new marketing approach demonstrated by the leading edge vendor is implemented by the larger companies, and then by the entire industry, to the ultimate advantage of all users, including small establishments.

APPENDIX A: METHODOLOGY

APPENDIX A: RESEARCH METHODOLOGY

- INPUT selected 50 companies from the approximately 1,500 information industry vendors on which files are maintained.

- The selection criteria were as follows:

  - There had been rapid, current, or at least recent growth of revenues or market share, or both.

  - The company was not one of the top four or five companies in its field.

- Of the 50 companies selected, the available data was reviewed for adequacy.

  - In many cases certain critical information, usually financial performance, was unavailable. The companies for which data was unavailable were usually one of two categories.

    . Private companies.

    . Subsidiaries of larger companies.

  - In some cases additional information was requested by INPUT and was made available by a spokesman for the company.

- The basic sources of data for each of the companies analyzed consisted of:

- Annual reports and 10Ks.
- Product literature.
- Press clippings and articles.

- Ultimately, 13 companies were selected for detailed analysis.
- For each company, INPUT examined information in the following areas:
  - History of the company.
  - Background of key personnel.
  - Present and past product lines.
  - Organization structure and facilities.
  - Market performance.
  - Financial performance.
  - Key markets and customers.
  - Sources of competition.
- INPUT then evaluated from this information the edge which each of these 13 companies had developed, and the manner of its development and its significance.
- A highlight report was prepared for each company, including the important information about the company as it developed and a summary of INPUT conclusions about that company's edge.

- The edges developed by this set of 13 companies were then grouped and classified in different ways and analyzed for commonality and significance.

- Analyses were made, in particular, of the impact which these different types of edges have on the larger competitors and on the small establishment marketplace.