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EFFICIENT DATA HANDLING AND INEFFICIENT MARKET STRUCTURES

Working Paper 85-403*

by

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and

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Efficient Data Handling and Inefficient Market Structures
Marion G. Sobol and Albert Kagan

INTRODUCTION

The computer industry in the United States has experienced unprecedented growth since the first commercial unit was introduced in the 1950s. Traditionally, through the 1960s and middle 1970s, the market characteristic of supply was the mainframe computer. The emphasis on equipment type changed in the 1970s as mini-computers and, more recently, microcomputers began to proliferate and increase in market share, both in dollar values and units sold (Verity, 1984).

Conventional market dynamics of the mainframe market can be defined as an example of classical differentiated oligopolistic structure. The industry has a dominant firm (IBM) that is the price leader and uses extensive non-price competition. IBM is one of the leading companies in yearly advertising expenditures to foster its image of a leading participant in the mainframe market. Other forms of non-price competition used by IBM within this market are (1) conceptual perception of a quality differential in its product line; (2) brand loyalty doctrine that is conveyed via quality, dependability, and service; (3) family of service products -- as you as a user grow, we as a supplier can sustain and structure your growth.

Using this non-price competition IBM now dominates the large computer market with approximately 80-85% of market share. Principal competitors are Honeywell, Burroughs, Univac, Control Data (weak), and NCR. This position of market dominance has tied many buyers to IBM. They fear other suppliers may go out of the market. Buyers are also wary of switching from IBM because of the data and software adaptations that may be needed. Moreover communication
program modifications may be necessary with a switch. General compatibility problems may arise if a change in vendors occurs. This concept of buyer reticence to switch is also a characteristic of oligopoly structure. Oligopolistic markets exhibit imperfect information relative to other vendors, compatibility of systems and protocol communications.

Policy implications of oligopolistic markets in terms of economic issues are as follows: (1) product output tends to be restricted and market price(s) are elevated above the optimal level, due to pricing levels that are above marginal costs; (2) sales promotion in terms of advertising is overused and potentially wasteful; (3) individual firms don't produce at maximum efficiency leading to poor fixed cost allocations and inefficient resource usage.

As the computer market began to change in the 1970s and early 1980s with the introduction of the microcomputer, the market participants first exhibited monopolistic competition as there were comparatively many vendors in the market arena. With IBM's introduction of the PC, the market structure has begun to change. Competitors have left the micro market or have tried to establish a niche within the market -- e.g., IBM compatible or special purpose machines (APPLE for educational use).

The micro market has not been established long enough to show the classical effects of a mature oligopolistic market, but certain trends appear to be developing. IBM has established a large share of the market which has forced competitors to realign production and marketing efforts (Verity, 1984). Certain suppliers now advertise as IBM compatible machines that mimic the DOS operating system and have an architecture similar to the PC. This has also led to a burgeoning number of companies producing software that can be used by the PC. This development in itself may foster oligopolistic structuring as IBM
competitors cannot sustain software introductions and updates. In essence, they will default the market to the IBM and IBM compatible systems.

As AT&T continues its entry into the micro market, principally with a machine that will operate with the UNIX system that may support DOS software, we see the potential for a highly differentiated oligopoly or duopoly to be established. AT&T's market entry is being heralded by extensive promotion and advertising expenditures to accentuate the differential nature of its product. However, the UNIX system at present requires considerably more memory than the DOS operating systems.

The existing micro market has been predicated in part on compatibility of software and hardware (Oren, 1984). IBM has promoted the concept of communications with the PC and the mainframe and the relative ease with which this can be attained. Given the premise that an oligopolistic (or duopolistic) market is sustained on imperfect information, the compatibility issue may indeed foster more market proliferation for IBM and other suppliers selling a full line (micro to mainframe) package.

This paper examines the economic implications of oligopolistic competition in the microcomputer market and, more specifically, the types of non-price competition that are being used by current market participants. Computer advertising in some of the current literature will be examined to ascertain the extent to which companies are trying to combat trends toward oligopoly or duopoly by advertising compatibility with IBM equipment. If it is not presently feasible or even if the public is not aware that there are such possibilities, the economic consequences are the accelerated development of oligopolistic or duopolistic competition. Compatibility may provide a more freely competitive market as it is an answer to some of the problems created by product differentiation; however, compatibility takes many forms. An over-
view of compatibility will be presented in this study. Then, a brief theoretical contrast of pricing and manufacturing policy under oligopoly or duopoly as opposed to pure competitive conditions will follow. This will include some speculation as to what might occur in the computer industry. Finally, some policy alternatives to avert oligopolistic conditions will be presented.

INDUSTRY TRENDS

As a wide range of computer hardware is developed, including micro, mini, and mainframe systems, a prime cost of computer operation has become data entry; as a result, the problem of compatibility, and communication(s) between computers has become increasingly important. In a recent article in Computer User, Archibald (1984) points out,

"In the future, a personal business computer that can't share resources with other units - whether the resource be a piece of hardware (such as a laser printer) a particular program, or data - promises to be a white elephant in the business scene."

An economic policy crisis may arise as a result of this need. If it is possible for microcomputers of one supplier to communicate and work only with mainframes, minis, and micros of the same supplier this will certainly lead to a rather monolithic industry and probably the economic market problems associated with oligopoly. If communication links between different products and vendors are possible and effective this problem can be avoided. Therefore, the vendors of communication devices, both software and hardware, must effectively inform potential users about their product line and its uses to remain viable market participants. This article examines current computer advertising to see if firms are indeed communicating ideas about links and compatibility.

Realization of the importance of the telecommunication links between computer facilities has led to marketing and advertising strategies which have
emphasized communication compatibility with mainframes and other computers. IBM, who manufactures both mainframes and microcomputers, has recently begun to gain an increasing share of the microcomputer market (Verity, 1984). Part of this increase in sales may be due to IBM's excellent reputation within the mainframe market, IBM's constant development of new marketing structures and to the marketing notion that only micros of the same brand will be able to communicate with IBM mainframes for data base access and software use. Similarly, consumers may also feel that they will not be able to utilize peripheral equipment, such as printers and monitors, if they do not purchase the IBM equipment. A content analysis of specific mentions of compatibility with IBM equipment in advertising in popular business media (Time and Business Week), business-oriented computer journals (Datamation and Business Computing Systems), and in Computerworld, a weekly trade journal, are presented in Table 1. This paper will begin with an investigation of the extent and type of communications concerning compatibility with IBM equipment. Then it will explore the results of duopoly and oligopoly market structure. Finally, it will outline methods for counteracting monopolistic influences.

CONTENT ANALYSIS

A content analysis of computer advertising in selection of a popular, (Time) business-oriented (Business Week and Fortune) and computer-oriented periodicals (Business Computer Systems, Datamation and Computerworld) periodical is presented for the period of July and August of 1984.

All computer-oriented ads were counted. The number of ads which mentioned IBM and the number of specific mentions of IBM compatibility within each ad were tabulated. IBM advertisements were not included in this study since we were trying to study attempts of other firms to establish their
### Table 1
Content Analysis of Computer Ads in Selected Business and Computer Journals
July and August 1984

<table>
<thead>
<tr>
<th>Types of Ads</th>
<th>Journals*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Micros, Mainframes Hardware</td>
<td></td>
</tr>
<tr>
<td># of Ads</td>
<td>9</td>
</tr>
<tr>
<td># Ads Citing IBM</td>
<td>1</td>
</tr>
<tr>
<td># IBM Citations</td>
<td>5</td>
</tr>
<tr>
<td>2) Applications Software</td>
<td></td>
</tr>
<tr>
<td># of Ads</td>
<td>2</td>
</tr>
<tr>
<td># Ads Citing IBM</td>
<td>-</td>
</tr>
<tr>
<td># IBM Citations</td>
<td>-</td>
</tr>
<tr>
<td>3) Peripherals</td>
<td></td>
</tr>
<tr>
<td># of Ads</td>
<td>-</td>
</tr>
<tr>
<td># Ads Citing IBM</td>
<td>-</td>
</tr>
<tr>
<td># IBM Citations</td>
<td>-</td>
</tr>
<tr>
<td>4) Communications Hardware &amp; Software, Modems</td>
<td></td>
</tr>
<tr>
<td># of Ads</td>
<td>-</td>
</tr>
<tr>
<td># Ads Citing IBM</td>
<td>-</td>
</tr>
<tr>
<td># IBM Citations</td>
<td>-</td>
</tr>
<tr>
<td>5) Systems Software Hardware &amp; Software, Modems</td>
<td></td>
</tr>
<tr>
<td># of Ads</td>
<td>-</td>
</tr>
<tr>
<td># Ads Citing IBM</td>
<td>-</td>
</tr>
<tr>
<td># IBM Citations</td>
<td>-</td>
</tr>
<tr>
<td>6) Security, Disks, Cleaners, Power Surge Controllers, Paper, etc.</td>
<td></td>
</tr>
<tr>
<td># of Ads</td>
<td>-</td>
</tr>
<tr>
<td># Ads Citing IBM</td>
<td>-</td>
</tr>
<tr>
<td># IBM Citations</td>
<td>-</td>
</tr>
<tr>
<td>7) Service, Books Education</td>
<td></td>
</tr>
<tr>
<td># of Ads</td>
<td>-</td>
</tr>
<tr>
<td># Ads Citing IBM</td>
<td>-</td>
</tr>
<tr>
<td># IBM Citations</td>
<td>-</td>
</tr>
</tbody>
</table>

*Advertisements for IBM computers are not included in these counts as the prime concern of the analysis is the reference to IBM equipment in ads of other firms.
The general public journal (Time) contained only ads for micros and mainframes. There were a total of 9 ads throughout the period. One of these mentioned IBM five times.

Business-oriented journals (Business Week and Fortune) featured ads in four areas

1) Micros and mainframes
2) Applications software
3) Peripherals
4) Modems and network communications packages and equipment

The majority of ads were for microcomputers, mainframe computers and applications software. Somewhat less than one-third of these ads (for computers other than IBM) mentioned compatibility with IBM. Similarly in the applications software ads category, one-third mentioned that they could be used with IBM equipment. The ads for peripherals were heavily linked to IBM usage. Forty percent of the ads for peripherals mentioned compatibility with IBM. Modem and network communications advertisements discussed IBM modestly; out of a total of 48 ads only 3 mentioned links to IBM equipment. It is surprising that these advertisers didn't take advantage of the opportunity to stress links of IBM and other equipment.

In the computer-oriented journals, we find a wider variety of advertising types, starting with the journal least oriented toward computer professionals, Business Computer Systems, which is a bi-weekly publication, then Datamation (a monthly journal) and Computerworld, a weekly newspaper. The advertisements in these computer-oriented journals covered seven topical areas:

1) Micros, mainframes
2) Applications Software
3) Peripherals (excluding communication devices)
4) Modems, communications devices and communications software
5) Systems software
6) Security, disks, cleaners, power surge controllers and paper
7) Service, books, education
The ads for microcomputers and mainframes mentioned IBM less than 25% of the time, slightly less than the ads in the general public-oriented journals did. About 35% of the applications-oriented software ads mentioned IBM. This was similar to the percentage of mentions in the more publicly-oriented journals.

The mentions of the compatibility of peripherals were similar to those in Business Week and Fortune for the computer professional publications. In Business Computer Systems which is more oriented towards the layman than Datamation, almost 50% (22 out of 46 ads) mentioned compatibility with IBM. In Computerworld, 53 out of 158 ads mentioned IBM compatibility while in Datamation, 9 out of 55 ads discussed compatibility. These nine ads, however, mentioned IBM 43 times.

In analyzing the topical area of networking hardware and software as well as modems, about 42% of the 168 ads mentioned IBM. Thus, the more professional journals were more likely to have ads for communications capabilities and were more likely to point out their compatibility with IBM devices. This trend appears consistent with a more computer sophisticated reader being interested in network communications and software communications packages than compatibility with IBM in general. In other words, the ads are scaled to the level of the reader.

Specific subject ads that did not appear in the public-oriented journals, such as systems software ads, were frequently displayed in Computerworld and moderately available in Datamation. Approximately one-third of these ads cited IBM. Ads for security controls, disks, cleaners, power surge preventers and paper cited IBM approximately 11% of the time. It seems evident that this type of equipment can be used on all computers. Similarly, an analysis of ads for service, books and education reveals that 17% of these ads mentioned IBM.
Therefore, about one-third of the advertisers in business- and computer-oriented journals mentioned IBM compatibility. There were relatively few ads for communications devices to link computers in the business journals and these ads failed to mention IBM. The lack of IBM mentions was probably due to the reader's assumption that the average businessman was primarily purchasing either a microcomputer and/or applications software. The buyer was not concerned about the communications protocols between different types of computers. On the other hand, almost half (42%) of the ads for communications devices, hardware equipment and software packages in the computer-oriented journals mentioned compatibility. As business computer acquisitions increase, there will be an accelerated concern about communications with mainframes, other micros and different brands of computers. Consequently advertisers will need to be more conscious of communication problems. This type of communication may become important to other firms who wish to maintain or increase their share of the market. Perhaps marketers of software and hardware will need to combine with communications software and hardware dealers to stress the available interaction of equipment. In order to further understand the possibilities for the interaction between different brands of equipment, a brief review of compatibility possibilities is appropriate.

**COMPATIBILITY ISSUES**

A. **Compatibility Between MicroComputers**

Compatibility which is being heralded as a solution to the problem of the potential market dominance of IBM, turns out to be a complex issue. As Steven Cook (1984) has said in reference to the compatibility of PC's, "there are

1Steven Cook, "How Compatible is Compatible?" PC World, Vol. 1, #1, pp. 40-44.
almost as many kinds of compatibility as there are products for the PC. "1
Furthermore, the issue of compatibility between PC and mainframes presents
even more problems. "There are often cases where the PC and mainframe of the
same manufacturer are not compatible." Cook goes on to cite seven levels in
which a microcomputer might be compatible with the IBM-PC. They are
Level 1: Media compatible - Ability to read and write disks in a format
used by the IBM PC
Level 2: Processor compatible - Machines use 8088 or an 8086 microprocessor.
Since the 8086 can perform certain operations
more rapidly, programs that are time sensi-
tive may demonstrate problems on the differ-
ent processors.
Level 3: Operating system compatible - Should support the same operating system
such as MS-DOS.
Level 4: Component compatible - Can use plug in boards from IBM-PC.
(plug compatible)
Level 5: Character set and keyboard compatible - Display the same 256 character codes and have
keyboards with the same keys.
Level 6: Video compatible - The video must be memory mapped and have the
same memory addresses as the PC.
Level 7: System compatible - The machine must duplicate the IBM's archi-
tecture. That is, RAM, ROM, I/O and all
other addresses are in the same location.

If any computer were compatible in all these respects they would be exact
duplicates of the IBM and hence their designers would be open to litigation.
According to Cook, most compatible computers fit classes one through three.
They have the same disk format, the identical microprocessor (8088 or 8086)
and use MS-DOS. Some are compatible at the fourth level (a plug-in line
enables them to use the same circuit boards), fifth level (same character set), and sixth level (video-interface), but only a few offer the total compatibility of RAM, ROM, I/O and identical addressing.

B. Compatibility Between MicroComputers and Mainframes

Of greater concern is the question of links between mainframe and microcomputers. Generally, it has been deemed relatively easy to transfer data from the mainframe to the micro, however, this may require some amount of data conversion.

"There are even a number of cases where the same program spread sheet, for example, exists on different computers and the data formats produced by those spread sheets are not interchangeable.

This could occur for a number of reasons that relate either to the implementation of the packages or differences in the precision (number of degrees in a number) and the mathematics available on the respective computers. It is usually necessary to massage the data brought from the mainframe and convert it into the form needed by the specific applications package you are using." (Richard Roth, "Making Connections in the Shadow of the Mainframe," Computerworld, October 15, 1984, pp. 1071)

Transfer of software is usually more difficult than data transfer, although sometimes different versions of the same software may be available for computers using different operating systems. Other problems which may arise in forming the links are discussed in ICP Business Review August/September, 1984.

These are the physical layers of compatibility such as incompatible cables (flat ribbon vs. co-axial). Incompatible protocols such as asynchronous vs. synchronous transmission may also cause difficulty in the linkage between mainframe and microcomputers.

Links between mainframes and micros take four forms (Crocker, 1984). In the simplest form the micro becomes a "dumb terminal" extension of the mainframe. The second form provides for the ability to download data from the mainframe which can be saved and used on the microcomputer. More advanced
links may allow the microcomputer to use a fourth generation language to extract selected summary information from the mainframe. The most advanced product linkages allow data transfer from the mainframe to the micro and from the micro to the mainframe. It becomes obvious from this review of the different possibilities of compatibility, that compatibility is a complicated issue. The advertising which is currently used in about a third of the ads may help to stem the tide of oligopoly to some extent; however, the wide variety of ways in which data, software and hardware must mesh may lead many customers to prefer to choose one line of equipment for their computer hardware. If this happens there will be a strong likelihood for the development of duopoly or an oligopoly situation in the micro as well as the mainframe market. In the next section an economic analysis is presented which outlines some of the results of duopoly and oligopoly in terms of market price, quantities produced, and product quality.

MARKET MODEL AND IMPLICATIONS

Many market models for price equilibrium and price determination have been proposed for oligopolistic competition and its extreme form duopoly. The initial explanation for oligopolistic competition was posed by Cournot (1838). Cournot devised a market scenario for two sellers, selling an undifferentiated product. Cournot's model can be applied, in today's market, to the competition between IBM-PC's and IBM compatible PC's. Cournot's model assumed no entry to new competitors. Existing competition was predicated upon production interactions (increase or decrease). His conclusion was that this type of market competition led to noncompetitive equilibrium (i.e., the market clearing price is higher than that attained by a competitive market).
Since Cournot's model was published various researchers (Edgeworth, 1925; Hotelling, 1929; Chamberlin, 1933; Sweezy, 1939; and Von Neumann and Morgenstern, 1953) have proposed refinements and added more assumptions to better explain the effects of oligopolistic and duopolistic market environments. Recent studies by Friedman (1977), Kirman and Sobel (1974) and Marschak and Selten (1974), have applied game theory and stochastic processes to oligopoly theory, inventory problems in oligopolistic competition, rational reaction functions, to the characteristics of oligopolistic/duopolistic markets.

Two market scenarios for the microcomputer market appear applicable in explaining the market environment. The first model explains duopoly theory with a differentiated product, e.g., IBM, Apple, AT&T. Micros are differentiated because the operating systems are respectively MS-DOS, CPM and UNIX.

Consumer aggregate demand is:

\[ u = (\alpha/\beta)Q - 1/2 \beta Q^2 - 2\sigma^2/\beta(1 + y) - \sum_{i=1}^{2} P_i Q_i \]  \hspace{1cm} (1)

with:  \[ \sigma^2 = [(Q_1 - Q_2)/2]^2 \]

- \( \alpha \) = Intercept of consumer demand function
- \( \beta \) = Regression coefficient of consumer demand function
- \( Q \) = Quantity Demanded
- \( \sigma \) = Variability of supply (aggregate)
- \( Q_1 \) = Contingent demand for Firm A
- \( Q_2 \) = Contingent demand for Firm B
- \( P_1 \) = Market price (Firm A)
- \( P_2 \) = Market price (Firm B)
- \( C \) = Point where firms A & B have equal average costs
- \( A \) = C (non-differentiated model)

\( y \) measures the substitutability of products (vendors) in solving for quantity demanded the following solution occurs:
\[
Q_1 = \frac{1}{2} \left[ \alpha - \beta (1 + \frac{y}{2}) P_1 + \frac{\beta y P_2}{2} \right]
\]

\[
Q_2 = \frac{1}{2} \left[ \alpha + \frac{\beta y P_1}{2} - \beta (1 + \frac{y}{2}) P_2 \right]
\]

The solution can be illustrated in Figure 1. This figure illustrates the situation of imperfect substitution (differentiated product) within the microcomputer market. The axes are structured to Firm A and the variables are related to Firm A. This figure is predicated upon price changes of Firm A, assuming that Firm B's price is fixed to \( P_2 \). At point \( H \) Firm A has priced itself out of the market, relative to Firm B.

Equation 3 calculated the Point \( H \).

\[
P_1 = \frac{[(\alpha/\beta + Y/P(P_2))/(1 + y/2)]}{\text{with } Q_1 = 0}
\]

\[
P_2 = \overline{P}_2
\]

\[
\overline{P}_2 = \text{Fixed price of } P_2
\]

As firm A begins to reduce market price (relative to Firm B) the demand for Firm A will increase along \( HH_1 \). Firm B may lose potential customers if this pricing strategy continues. At point \( H_1 \) price reduction has forced Firm B out of the market; in other words, \( Q_2 = 0 \). Equation 5 calculates this price:

\[
P_1 = \frac{[(1+y/2)\overline{P} - \alpha/\beta]/(Y/2)}{\text{The essence of this discussion is that price competition within the microcomputer market is futile. The market will realign itself around the dominant participant (IBM) and other competitors will leave the market. Figure 2 illustrates the market equilibrium situation of contingent demand of price duopoly with identical products. This is explained by assuming that Firm A charges a fixed price } p_2 \). The demand of Firm B's product will vary as it
Figure 1. Demand associated with differential products in the microcomputer industry under duopoly. (All price and capacity combinations are examined.)

\[ Q = \frac{1}{2}[\alpha - \beta(1 + \frac{y}{2})P_1 + \frac{6y}{2} P_2] \]

At \( D = D_1 \); \( Q_1 = (1+y/2+y)(\alpha - \beta P_1) \)

At \( D = D_3 \); \( Q = \alpha - \beta P \)
Figure 2. Demand associated with non-differential products in the microcomputer industry under duopoly.
changes its price from $P_3 = \alpha/\beta$ to $P_2 = 0$. The line $DHSH_1$ shows the pertinent demand curve. With $P_3 > P_2$ Firm A would capture the entire market assuming it has enough plant capacity to service (satisfy) demand. The only point of market equilibrium is when $P_2 = P_3 = A$. At this point neither firm is making a profit or a loss. Neither firm is motivated to cut price as it would only incur losses to both participants. Consequently, neither firm is encouraged to raise price as it will lose its entire market share to the other firm.

At any price higher than $P_X = C$ it would only be advantageous for a firm to slightly undercut the other. Therefore, no price above $A$ can be in equilibrium and any price below $A$ the firms are losing money on each sale, and are directed to raise its price to at least $A$.

This is an illustration of a market situation where an IBM PC can be perfectly replaced by an IBM compatible. In this situation IBM would lower its price to below point $A$ long enough to drive Firm B (compatibles) out of the market. In actuality this is what IBM has done with the introduction of the PC Jr., AT and XT machines.

Both solutions describe the difficulty of price competition within an oligopolistic/duopolistic market. The viable strategy to take by a market participant would be to use non-price competition. The objective should be the creation of a differential product advantage. This would make price competition possible within a restricted entry market (duopoly). Market participants using a pricing strategy as a basis of competition within a non-differentiated oligopoly/duopoly are prone to failure because the dominant market participant (IBM) will lower its price.

Survival within the microcomputer market will need to be achieved via successful product differentiation where the consumer can gauge price in relationship to product attributes. Therefore, non-price competition such as
advertising, promotion, options, warranties, service, product performance, and quality are the keys to market survival, not price cutting and manipulation tactics.

It would be possible for price competition to occur in the differentiated duopoly model when the consumer perceives price as a measure of product segmentation and attribute quality. The use of price competition within the non-differentiated duopoly model is not appropriate because of the dominant market participant concept and its influence on market price.

POLICY ALTERNATIVES TO COMBAT MONOPOLISTIC TENDENCIES

A. Sales of More Plug Compatible Equipment

One solution to the monopoly-oligopoly problem raised by IBM is the sale of plug compatible manufacturers (PCM's) equipment. These are systems which plug into IBM's computer systems. These systems, which started with peripherals such as keypunch, data entry equipment, and tape drives, were pioneered in the late 1960s by Mohawk Data Sciences and Telex. During the mid-1970s, PCM production was extended to mainframes by Amdahl, Magnusen, Itel, Storage Technology and others, including Japanese manufacturers. Two factors are needed for this type of manufacturer to succeed. First, advertising is necessary to keep the consumer aware of the possibilities of cheaper and/or more efficient equipment. Secondly, the PCM must cope with competition from potential monopolists.

A look at the storage peripherals (PCM) market indicates that the recent bankruptcy filing of Storage Technology, Inc. (October 1984), and the demise

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2McClelland, F., p. 191.
of Control Data Corporation (CDC) may have led Memorex to look for greater opportunity. However, unlike Storage Tech, which aimed at 35% of the market, Memorex aims for a 10% market share.\textsuperscript{3} In addition, Japanese companies like Fujitsu and Hitachi hope to achieve large market inroads due to their production technologies and the relative weakness of the yen.\textsuperscript{4} Yet it seems that if any of these firms become too large and lower prices too aggressively, or innovate to any large extent they will face IBM's new aggressiveness in the form of lowered prices and lawsuits. "Now with IBM's new aggressiveness, and prices so low, it really looks like IBM could have the business all to itself if it would".\textsuperscript{5} A similar type of elimination of competitors has taken place in the input-output terminal suppliers market. Lee Data Corp. of Minneapolis experienced tremendous earnings losses when IBM introduced its new 3178 terminals. Lee is now trying to develop equipment and sell terminals to other types of mainframe customers.

High PCM sales can be sustained if the brand indifference exhibited by many industrial users, who are interested in buying computer products at the lowest prices continues.\textsuperscript{6} This sensitivity to price, however, still gives the major producers the ability to exert inordinate price competition.

\textsuperscript{3}Stamps, David, "Hanging by a Thread," Datamation, January 15, 1985, pp. 34-37.


B. Advertisements of Compatibility

Advice on the methods of maintaining market share is replete with admonitions impacting upon advertising and marketing strategy for survival. This is of particular concern in the emerging computer markets. The content analysis in this paper indicates that only 1/3 of the ads mention compatibility in areas where compatibility is important such as software, peripherals and communications software and hardware. Kathleen Sullivan addresses this issue, "plan on spending at least $10 million to $20 million on advertising and a similar amount of R&D ... Advertise. It does not matter if you have got a great product if no one has heard about it."7

C. Specialization

A strategy recommended by McClelland8 is for a firm to remain small and flexible and specialize in some niche of the market arena. While large firms can take advantage of economies of scale, the experience curve and world-scale markets, this type of firm now has the problem of competing with IBM and yet having to be flexible enough to keep up with continual product and technological innovations. Small size, specialization, stock financing, specific selling organizations, and systems compatibility are regarded as conducive to survival. The only problem with this solution is that instead of setting up monopolistic competition it establishes a monopoly plus a number of much smaller specialized firms. However, since the majority of computer costs are associated with peripherals and software, strategies of this sort may


8McClelland, pp. 37-52.
establish relatively free markets in an important part of the computer supply business and also allow for constant improvements in facilities and services.

D. Government Intervention

Other countries may opt for the use of government subsidies to build businesses that are competitive with IBM and other American computer manufacturers. The Japanese government, for example, is currently helping to finance the development of robotics, fifth generation languages and artificial intelligence. U.S. manufacturers may find that they will need to invoke government aid to protect them from IBM and foreign encroachment. On the other hand, the government may view the growth of one American company like IBM as a deterrent to foreign encroachment in the computer industry. Thus the problem of foreign competition has made the circumstances of handling domestic antitrust threats more complex for the Justice Department. For example, former Assistant Attorney General Baxter has said he thinks that "from the standpoint of the national economy, [IBM's size] is just splendid." Baxter has said "[There is] no rule against having a very large market share. The question is how you come by it and how you keep it."9

Even though the government dropped its major suits against IBM in 1982, and 1984, and IBM was able to settle an antitrust investigation by the European Economic Community, there are a number of legal investigations pending. The Justice Department is looking at a settlement between IBM and Hitachi in a suit where IBM alleged copyright infringement. Certainly actions that are in restraint of trade will need to be considered very carefully in

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9 Warner, Edward, "IBM the Specter of Antitrust," Computerworld, pp. 121-123.
the computer industry. However, this oversight will always be under the shadow of foreign competition.

Thus the viable course of action to deter monopoly or oligopoly effects seems to be excellent design development, specialization in private market niches, advertising and other marketing techniques that accentuate compatibility as well as superior product design. In other words, survival in the computer supply markets will be dependent upon a participant developing successful differential advantage.
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