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PERSONAL COMPUTERS: HOW ARE THEY USED IN THE AMERICAN HOUSEHOLD

by

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Scope and Method of Study: This study developes a "post purchase usage survey" for households that own personal computers. The survey was designed, conducted, and analyzed over a period of two months. Additionally, an in-depth look was taken at the entire computer revolution, personal computers, and the changing role households are playing in the computer revolution.

Findings and Conclusions: Personal computers used in the American Household have passed the stage of primarily being used by hobbyist or for only playing games. Home users are adapting a wide variety of applications to home computers. However, the American consumer, for the most part, is willing to give up leisure time for programming activities. But, the consumer is willing to purchase woftware which will provide a similar utility. Nevertheless, these findings have enforced this researcher's belief that personal computers in the American home have become the norm.

ADVISOR'S APPROVAL 

PERSONAL COMPUTERS:
HOW ARE THEY USED IN THE AMERICAN HOUSEHOLD

Report Approved:

Advisor

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Table of Contents

Chapter 1:	Introduction	p. 1
Chapter 2:	Computer Explosion	p. 5
Chapter 3:	From Locked Backrooms to Desktops and Living Rooms	p. 25
Chapter 4:	Home Computers	p. 47
Chapter 5:	Analysis of Survey Results	p. 58
Chapter 6:	Conclusion	p. 98

Table of Figures

	Page
Figure 1	7
Figure 2	14
Figure 3	20
Figure 4	21
Figure 5	22
Figure 6	24
Figure 7	29
Figure 8	32
Figure 9	38
Figure 10	42
Figure 11	45
Figure 12	54
Figure 13	55
Figure 14	56
Figure 15	57
Figure 16	58
Figure 17	77
Figure 18	78
Figure 19	79
Figure 20	80
Figure 21	81
Figure 22	82
Figure 23	83
Figure 24	84
Figure 25	85
Figure 26	86
Figure 27	87
Figure 28	88
Figure 30	89
Figure 31	90
Figure 32	91
Figure 33	92
Figure 34	93
Figure 35	94
Figure 36	95
Figure 37	96
Figure 38	97

CHAPTER I: INTRODUCTION

Prior to the 1950's information processing was often a cumbersome and repetitive process. Therefore, most companies maintained a limited approach to information processing. Often long range plans existed only in the minds of key members of the management team. Analysis of past performance and future projections were severely limited by the availability of information and the limited processing capabilities. Effort such as mineral exploration or market penetration were often undertaken not because of extensive data computation and formulation, but only on the intuition of management.

To the average American automation meant automobiles, electricity, and running water. Information processing consisted primarily of information gathered from the media and personal finances. With the invention of the computer and the evolution of computer technology, a seemingly static society acquired a dynamic attribute which has affected every lifestyle in the United States. Technological advancements in the 1960's and 1970's propelled computer technology into every facet of the American lifestyle.

What is the Computer Age? How, in less than thirty-five years, has the introduction of commercial computers completely changed our society? This once feared and mystical force has become a critical and integral part of every corporate structure. The 1970's saw the transformation of information processing from a necessary corporate function to a key corporate asset. Computer software is now valued and protected as other corporate assets. Not only has this revolution changed the business community, it has

automotated the lifestyles of millions of Americans, helped make space travel routine, and has been directly involved in raising the levels of health care.

Are there any bounds this revolution can not cross? Perhaps the most dramatic phase was the introduction of personal computers. The seventies saw the introduction of microcomputers in the business community. Soon the home was invaded and a new phrase was coined: home computers.

Not even Wall Street has been spared. Hundreds and thousands of "high tech" corporations have been born in this revolution. Such corporations have long been financial success stories and a tremendous growth sector of the United States economy. This revolution, from its birth to its current stages, and the ramifications are the subject of Chapter 2.

Automation spawned from advances in computer technology have been present in most homes since the 1960's. The introduction of integrated circuitry and computer chips scaled down computer technology to a size and price feasible for home use. Microprocessors have a wide range of uses, from appliances and automobiles to communication equipment.

However, as significant as these advances were, their scope was limited. Functions were predetermined. Therefore, the utility of the microprocessor though tremendous, was limited. Not until the introduction of the home computer was this limitation removed. A home computer, a personal computer used in the home, afforded the American household the ability to process information as it saw fit. Although initially limited, the consumer could formulate, accumulate, process, and generate data independently. Market demand from both home and business users pushed technology past these limitations. Thirty-two bit microprocessors and both hard and floppy disks have increased the capabilities of personal computers to a level that far exceeds the capabilities of the original commercial

computers. These computers were so large they had to be housed in gymnasiums. Chapter 3, "From locked backrooms to desktops and living rooms", provides a look at the personal computer wave.

The acceptance of home computers has raised new questions. For the first time the computer revolution required profound input from the household users. Outside of computer games, all activities on the computer required direct input and action from the household user. While software packages and software companies flourished, these packages still required interaction, knowledge about the system, input, definition of applications, and the most precious commodity . . . **time.**

In a society that has become accustomed to computer technology providing more leisure time, the personal computer in the home is distinctly different. In the business community personal computers have been used as distributed processing and decentralized computing rools. They have been used to automate and expedite job responsibilities. The savings, utility, and performance are substantial.

Is the same true in the home? Certainly there is no reason why the same could not hold true for household usage. But, is the average household ready and willing to give up leisure time to gain such results? Are households ready to write, maintain, and execute computer applications? How much are computers used in the household? Market analysts feel that every household should own a home computer. But what are they currently used for? Are they luxury items?/status symbols? Do they provide any utility for the household?

These questions have been addressed in a consumer survey of households that own personal computers. Chapter 4 contains the survey, its design, and its purpose while Chapter 5 provides the population in question, the survey results and an analysis of the findings.

Chapter 6 provides a summary of the survey findings. It also makes some predictions about the home computer market as well as the next phase of the computer revolution.

CHAPTER II

COMPUTER EXPLOSION

What is a Computer?	p. 8
History	p. 9
The War Efforts	p. 11
Stages of the Computer Explosion	p. 12
Impact of Computers in Business	p.15
Case Study Computers in Industry:	
Phillips Petroleum Company	p.18
Information Processins is Big Business	p.23

No one event has had more impact on a society than the introduction of the first commercial computer in 1951. Though very primitive by 1984 standards, it captured the minds of the scientific community and the fears and imaginations of the American public. Until the 1970's most Americans still thought of the computer as large machines with thousands of flashing lights. With the poliferation of computers in the business community and the evolution of personal computers the public has since been exposed to a realistic and exciting industry.

Not only have computers become an integral part of successful industries, the industry itself has been a financial bonanza. Revenues for the top 100 U.S. based Data Processing vendors for 1982 topped 78 billion dollars[1] (Figure 1).

What were the origins of this explosion? What changes has it spawned? What does the future hold? Let's address these questions.

THE TOP 100 (1)
(U.S.-based vendors, ranked by 1982 dp revenues)
(partial listing)

RANK	COMPANY	1982 REVENUES (millions)
1	IBM	$31,467.6
2	DEC	4,019.0
3	Burroughs	3,809.5
4	Control Data	3,301.1
5	NCR	2,915.3
6	Sperry	2,800.5
7	Hewlett-Packard	2,268.0
8	Honeywell	1,685.0
9	Wang Labs	1.321.5
10	Storage Technology	1,030.0
11	Xerox	975.0
12	TRW	958.5
13	General Electric	850.5
14	Data General	803.8
15	Texas Instruments	746.7
16	Tandy (Radio Shack)	725.0
17	Automatic Data Processing	704.0
18	Computer Sciences	683.4
19	Apple Computer	663.8
20	Electric Data Systems	555.6
26	Commodore Int'l	420.0
100	American Management System	70.0
TOTAL FOR THE TOP 100		$78,382.5

What is a Computer?

The Encyclopedia of Computer Science and Engineering gives the following definition for a computer.

> "The digital computer is a machine, a machine that will accept data and information presented to it in its required form: carry out arithmetic transfer, and logical operations on this raw data; and then supply the required results in an acceptable form."[2]

While computers may be digital or analog the vast majority are digital. The analog machine measures input signals by the magnitude of the signal while digital machines measure the number of signals. Analog machines are usually special purpose machines used in scientific applications while digital machines are general purpose computers [2]

Since the 1950's computers have been defined by their configurations. While technology has advanced most computer systems can still be defined by the following functional units:

a) Input unit

b) Central processing unit (CPU)

c) Output unit

The input unit receives and converts raw data for processing while the central processing unit performs the actual processing. The CPU provides the main memory, the arithmatic processing unit, and the control unit for the system. Likewise, the output unit provides the facilities by which the processing results can be stored or transmitted back to the users. Computer systems in the 1980's may range from one central processing unit to a network of CPU's. For example, Phillips Petroleum Company currently has a corporate computing facility in Bartlesville, Oklahoma which links 8 CPU's and billion bytes of disk memory.[3] (Figure 4)

History

Most people in the United States are well aware of the technological advances and the power of computers in the 1980's. But what progression paths did the industry follow? What were the forerunners to modern computers?

The earliest mechanical aids for mathematical computations were developed in the seventeenth century. The French scientist Blaise Pascal, was credited with the invention of the most famous of these machines in 1642. In 1824, Charles Babbage began working to combine calculating devices with mechanical sequencing devices. His work produced a machine called the "Analytical Engine". It performed the computations of a central processing unit while being controlled by an input and output punch card system. Though Babbage's work was quite significant, his efforts were primarily unknown to those who worked on the early computer projects during World War II [4].

Herman Hollerith formulated the idea of using punch cards for representing data. He developed a system of sortors and tabulating machines for the United States Census Bureau in 1890. This system was highly successful and was readily adopted for business accounting functions. Hollerith's company later combined with two other companies to form the Computing-Tabulating - Recording Company. In 1924 the company was renamed the "International Business Corporation" or "IBM". In 1937, IBM and Howard Aiken of Harvard University completed a large scale calculator, the Harvard Mark I. This machine could multiply two 23 digit numbers in six seconds. It was a combination of both mechanical and electromechanical devices connected with punch card machines. The Harvard Mark I marked the

beginning of the digital computer. Both IBM and Harvard developed several machines after the Harvard Mark I. [5]

The War Efforts

World War II placed heavy demands on computational capabilities. Many efforts were undertaken in the United States. Bell Telephone developed a series of relay calculators for a communication network. IBM performed Research and development on numerous calculating devices and produced card programmed calculators. However, the War effort was not unique to the United States. England developed computers for the specific purpose of breaking the complicated German code. After the War it was disovered that Germany had developed a calculator capable of storing 64 floating point numbers in 1941. This machine is thought to have been superior to the Howard Mark I. [5]

With the end of the War a shift occurred in the direction of computer technology. For the first time the potential of using computers in business applications was tapped. The UNIVAC (Universal Automated Computer) was the world's first commercial computer. The first of 46 UNIVAC's was purchased in 1951 by the U.S. Census Bureau. The UNIVAC had internal storage of approximately 120K (K=1024 bytes). In 1984 many personal computers have 256 K. [6]

IBM didn't introduce its first commercially used computer until 1952. In just five years IBM controlled 55 percent of the commercial market. Since its formation in 1924, marketing has always been a key to IBM's success. This was never more evident than in their move to this commanding number one position. In 1982, IBM's sales out-distanced the rest of the computer vendors by 27 billion dollars (Figure 1). In its 68 years which includes the Great Depression, IBM has never had a lay-off and never failed to make a

profit [7]. In 1983, IBM was the sixth largest corporation in the United States in terms of sales [8].

Stages of the Computer Explosion

The advancement and evolution of the computer industry can be divided into four distinct generations.

The First Generation

The first generation of computers contained vacuum tubes. Machines like the ENIAC, completed in 1946, contained 19,000 tubes (10). Various types of main memory characterized the first generation computers: [5,9].

(1) Mercury Delay Line Storage

(2) Electrostatic Storage

(3) Magnetic Drum Storage

(4) Magnetic Core Memories

The Second Generation

In 1959 transistors began replacing vacuum tubes in computers. This marked the beginning of the second generation. This technological advancement reduced the size of computers and at the same time increased the functionality of large scale scientific and commercial data processing systems.[9]

The Third Generation

Most machines announced between 1964 and 1975 are considered third generation machines. Many of these machines used integrated circuits and large scale integration (LSI). IBM introduced the 360 and 370 series during the third generation. These upwardly compatable machines had many

features which became standards for the industry. Examples included 8 bit byte representation of characters and nine-track tapes. The third generation also saw the success of other mainframe manufacture such as Control Data Corporation (CDC), Burroughs, and Honeywell. Digital Equipment Corporation (DEC) was highly successful in the latter stages of the generation with minicomputers. The DEC PDP-11 became a standard in the microcomputer industry [9].

The Fourth Generation

Although there is no one concept that singles out fourth generation machines, there have been significant advances in computer technology since 1974. Faster and cheaper machines have produced more users and larger applications. The fourth generation has seen the continued evolution of traditional mainframe technology. But more importantly, it has seen dramatic expansion at both the high and low ends of technology. The high end has seen the introduction of vector processors or "Super Computers". Vector architecture deviates from the traditional scalar architecture providing the capability for high speed algorithmic computations. Though once used primary in government laboratories, vector processors produced by Cray Research and CDC are more widely accepted. Current projections call for a "4-Nanosecond" vector processor by 1986 (Figure 2).

On the low end of the computer spectrum minicomputers and microcomputers have experienced unrivaled growth. Large scale integration, computer chips, and economics of scale have afforded both unlimited marketability. The market for microcomputers has not been limited to industry. It is estimated that by January 1984 over "4 million" personal computers will have been bought by American Households [10]. Home use of personal computers will be discussed in detail in Chapters 3 and 4.

HIGHTLIGHTS OF CRAY 2 (13)

1) Six to twelve times faster than any existing system.

2) Twelve million word memory, currently the CRAY 1's have a four million word memory.

3) Four nanosecond cycle time, currently the CRAY 1's have a 12.5 nanosecond cycle time.

4) CRAY 2 will use a four processing system architecture.

5) The CRAY 2 will be submersed in a clear flurocardon liquid for cooling purposes.

6) The CRAY 2 will be one-tenth the size of a CRAY 1. It will be 26 inches in height and 38 inches long.

Impact of Computers in Business

As the cost of computer systems decreased it became readily apparent that computers would become an integral part of the business community. This fact is very evident in the 1980's. From large corporations to sole proprietorships, businesses have been forced, often reluctaantly, to join the computer revolution. Corporate executives can no longer look at the computing department as a necessary evil. The 1970's and 1980's have witnessed the transformation of computing resources, both hardware and software, into key corporate assets. It is not uncommon for the upper level manager who once viewed computers as inappropriate tools for decision making, using a time sharing technical or taking a portable personal computer home or on a business trip. There is a chance that managers could depend too much on computer technology, but the positive benefits outweigh the negatives.

Information Equates to Power

The computer explosion has reshaped corporate America. In industry today, the competition is often measured by its ability to quickly and effectively incorporate new technologies. Information processing is the key link in this corporate process. A close examination of most corporations will reveal that the key corporate entities command and receive the largest quantity of computing resources. But to maintain this leverage of information power, companies and their employees must adapt. This recent editor's message in "Computer Decision" addresses this point.

> "Age old, proven methods become obsolete overnight, while techniques unimaginable last year threaten to transform industries. Companies and individuals must adapt to survive and adapt quickly to prosper. It falls to chief executive officers to lead corporations through this revolution" . . . . . "the fundamental difference between those who prevail and those who falter is in the ability to foresee and react." [11]

Corporations are integrating computer technology into areas of industry that were not traditional application areas for computers. CAD/CAM (Computer Aided Design/Computer Aided Manufacturing) have revolutionized design and manufacturing efforts. Savings are realized not only in man time and elapsed time but in materials costs. Testing that was once done at great expense in time and materials can be simulated on a CRT screen an infinite number of times. Gene Bylinsky made this comment in the Fortune magazine article, "A New Industrial Revolution Is on the Way".

> "If wisely and widely applied, CAD/CAM could overcome the productive stagnation that has led to questions about the ability of American industry to remain competitive on the world scene. This modestly named technology pioneered and developed in the U.S., has a power of explosive significance." [12]

Office automation and microprocessors have made great strides as corporate standards. Word processing systems and telex systems have proven to be key sources of information processing power as well as information networks. It is predicted that during the 80's businesses not households will be the largest market for personal computers.[13]

But not all attributes of the computer explosion have been beneficial to the computers users. One such area has been computer crime. While computers have afforded corporations, government agencies, and individiuals the ability to process information, they have provided what has many times been easy access to confidential computer data. FBI studies have shown that the average theft in a computer related crime has been over $100,000 while armed robbery has an average of $3000.[14] This so called "White Collar Criminal" has not always been a highly educated computer professional. In 1983 several Milwaukee teens dialed into the government nuclear weapons lab in Los Alamos, New Mexico from a home computer.

The business community depends almost exclusively on computer technology for day-to-day operations. This centralization leaves business both small and large vulnerable in the event of natural disaster, fire, and sabotage. Therefore, disaster recovery efforts have become and will increasingly be a necessary effort of every computer shop. Disaster recovery is simply the ability to recover the pre-disaster state of a computing facility. This effort must be transportable because in the likelyhood of such a disaster the existing facility probably would be rendered inoperable. Such efforts require enormous outlays of man time, duplication of systems, data bases, and tremendous cash outlays for storage and additional security for the disaster recovery files. Disaster recovery could be viewed as a "corporate computing life insurance policy". Small businesses are especially vulnerable because of small computer staffs who exercise much power in the small firms, and the inability to financially support disaster recovery efforts.

Case Study Computers in Industry: Phillips Petroleum Company

Phillips Petroleum is an international company headquartered in Bartlesville, Oklahoma. Phillips is engaged in the exploration and production of petroleum products. Additionally it conducts exploration activities of other energy resources and supports a broad based chemical company. At year end 1983, Phillips had assets of 13.1 billion and a total work force of 28,400.[15] Fortune magazine ranked Phillips as the 10th largest oil company and the 16th largest company in the U.S. by sales in 1983[8].(Figure 3)

Utilization of computing resources is a key link in Phillips' corporate structure. Currently Phillips estimates that 1 out of every 8 employees works with word or data processing equipment and by 1990 that percent will increase to 1 in 2. At the end of 1983 Phillips had over 3000+ terminals, 500+ word processors and 250+ personal computers.[16]

This all encompassing use of computing technology requires enormous man time and expenditures. The Information Services organization of Phillips (IS) currently has about 850 employees. This figure does not includes computing personal employed directly by other organizations in the company. Worldwide DP expenditures for 1983 totaled $119,095,000.[18]

Hardware facilities are centered around the central corporate computing facility in Bartlesville. (Figure 4) Fifteen thousand computer jobs are run at the facility monthly. Over 400,000 online commands are executed daily with 1500 linear miles of paper printed monthly. In addition to the central complex numerous mainframes, micros, and minis are supported at remote sites by IS.(Figure 5)

Current efforts at Phillips which adhere to this aggressive computing history include:

1) The development of a three-dimensional seismic system for use on the Cray Vector Processor.

2) A point of entry sales system for company service stations.

3) The implementation of a company-wide computing education services named AIM. "Automated Information Management" (AIM) has three objectives:

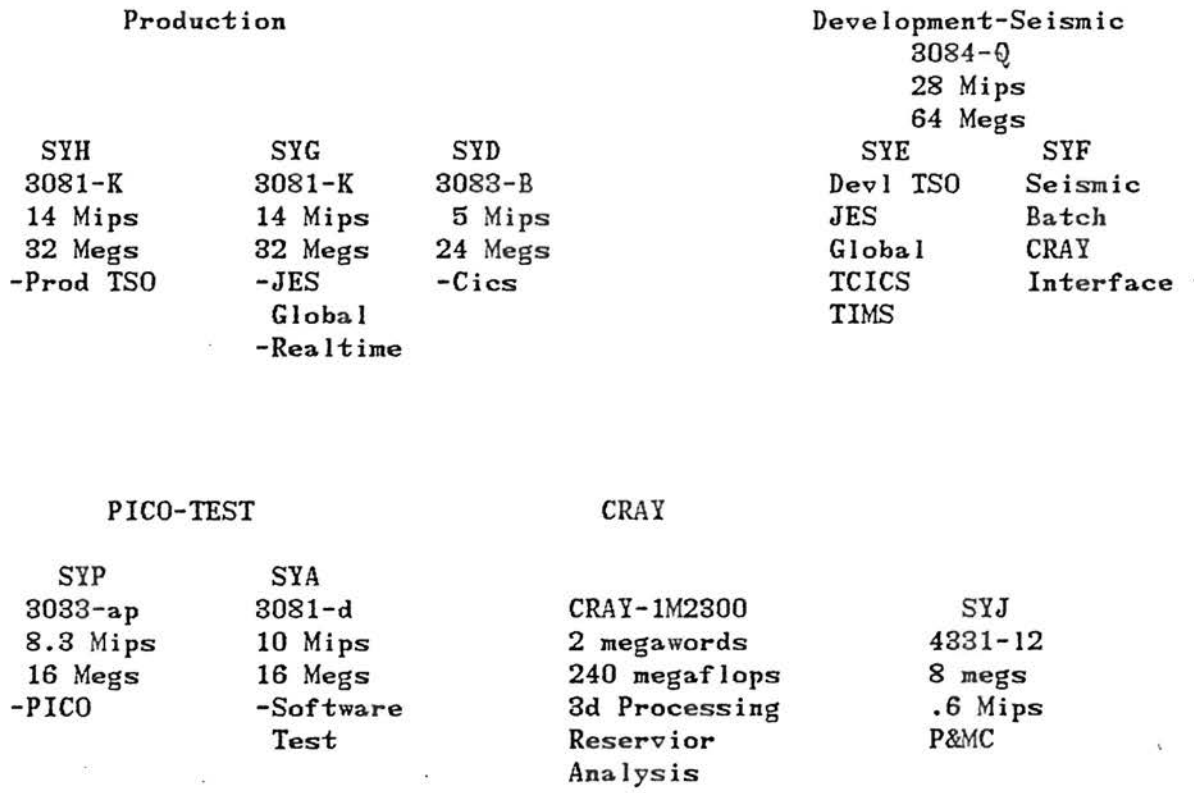
> "1) to increase employee awareness of computer-based technologies that can be used by them directly, and without the need for the programming traditionally done by data processing professionals
> 2) to help potential users overcome any inhibitions they may have related to using these capabilities
> 3) to provide a focal point for potential users to obtain information or assistance."[19]

FIGURE 3

FORTUNE MAGAZINE'S
TOP 20 FIRMS IN 1983
RANKED BY SALES (8)

RANK	COMPANY	RANK BY NET INCOME
1.	Exxon	2
2.	General Motors	3
3.	Mobil	11
4.	Ford Motor	6
5.	IBM	1
6.	Texaco	12
7.	E.l. du pont Nemours	13
8.	Standard Oil(Indiana)	5
9.	Standard Oil of California	8
10.	General Electric	4
11.	Gulf Oil	14
12.	Atlantic Richfield	9
13.	Shell Oil	7
14.	Occidental Petroleum	25
15.	U.S.Steel	489
16.	Phillips Petroleum	18
17.	Sun	34
18.	United Technologies	28
19.	Tenneco	19
20.	ITT	21

Phillips Petroleum Central Computing Complex
Site Configuration
February 29,1984 (18)



Phillips Remote Site Facilities (16)

1. Six IBM 4341's ,running the MVS operating system.
2. IBM 4331's running both VM and DOS operating systems.
3. Six IBM 8100's.
4. Eleven Digital Equipment VAX 11/780's.
5. Datapoints Arc Systems with 204 processors.
6. Numerous other computers of various makes and models including IBM, Datapoint, Hewllet-Packard.

Information Processing is Big Business

Although it has been less than thirty-five years since the first commercial computer was installed the data processing industry has not only infiltrated big business, it has become big business. In 1982 the top 100 data processing companies had revenues of over $78 billion.[1] (Figure 1) In 1981 the micro segment of the industry showed the largest percentage gain of any segment with a 52.7 growth in revenues [46]. (Figure 6) Apple Computer alone experienced total revenues of $401 million. This represented an increase of 143%.[46]

However, not all of the industrial growth has been experienced in hardware sales. In 1982 the top two SPS companies (Software Products and Service Companies) accounted for over $17.1 billion in SPS revenues and over $95.9 billion in total revenues.[47]

In just six short years Apple Computer alone has increased its yearly revenues from $77,400 to nearly $1 billion.[52,53]

MAJOR MICRO MANUFACTURERS FOR 1981(46)

		1981 Revenues (millions)	% CHANGE
1.	Apple Computer Inc.	401.1	142.7
2.	Tandy Corp.	293.0	95.7
3.	Hewlett-Packard	235.0	17.5
4.	Commodore International Ltd.	140.0	34.6
5.	Gould	140.0	40.0
6.	Cado Systems Corp.	68.2	34.7
7.	Cromemco Inc.	59.0	31.1
8.	M/A-COM (Ohio Scientific)	25.0	25.0
		Average Growth	52.7%

CHAPTER 3: 'FROM LOCKED BACKROOMS TO DESKTOPS AND LIVING ROOMS"

What is a Personal Computer p. 26

Birth of a New Niche p. 28

The Personal Computer Industry p. 31

How Have Personal Computers Been Used in the American Society p. 35

Personal Computers in the Home p.39

Personal Computers in Education p.41

Software - P.C.'s Version of 4-Wheel Drive p. 44

Personal computers have had more impact on the American society than any wave of computing technology. For the first time access to computer processing has been made readily available to the masses. No longer are computers mystical machines stored behind closed doors. Personal computers have invaded corporations and households. Computer programming once a black magic practiced by technical wizards is now, in a simplistic form, performed by children and adults of all walks of life. It is predicted that personal computer shipments in 1991 will exceed 12 million units with over 2 million of these going to households [20].

What is a Personal Computer?

Microprocessor, microcomputer, personal computer, home computer, desktop computer,etc. . . . . many people are confused by these terms, and rightfully so. The Encyclopedia of Computer Science and Engineering Second Edition" gives two definitions for personal computing.

> "The term personal computing has been used in two ways. Some have used it to refer to a computing environment in which the user has full and exclusive use of an entire computer system, regardless of the system's uses or ownership. Most people, however, have come to accept the phrase as refering to situations involving relatively inexpensive microcomputers owned by their users and often used for not-for-profit, not-for-business purposes."[21]

The Encyclopedia of Computer Science and Engineering Second Edition also provides the following definitions.

> "A microprocessor, or microprocessing (MPU) is a computer central processing unit (CPU) built as a single tiny semiconductor chip or as a number of chips."[22]
> "A microcomputer is a more complete system than a microprocessor, containing not only CPU logic but also memory for storing programs and data, I/O interfaces for exchanging data with peripheral devices, and timing circuits to control the flow of data within the computer."[22]

Manufacturers coined the term "personal computer" in an effort to broaden marketing of microcomputers. Market analysts consider microcomputers that cost below $10,000 as personal computers.[10] Therefore, for the purpose of this paper, we will use the following definition for personal computers:

> "A personal computer is a microcomputer whose price does not exceed $10,000 and whose use can be in business, education, home, government, etc. . . ."

Likewise, manufacturers have coined the term home computer. While some personal computers have been designed for home use, all personal computers can be home computers. We will use the following definition:

> "A home computer is a personal computer that is used primarily in the home."

"Birth of a New Niche"

In the early 1970's semiconductor manufacturers first offered microprocessors. However, microprocessors did not contain storage devices, main memory or the software that make up a computer. During this period a select group of hobbyists built their own computers. However, this effort was too expensive and too technically demanding for the average consumer.[23]

Public attention was first attracted to microcomputers by a 1975 Popular Science article on the "Altair" microcomputer kit. Although Altair had a poor design and was very hard to use, it caught the imagination of the consumer. Shortly after that article, Byte magazine, the first publication for microcomputing, was founded. As interest grew, many new companies were born with one corporate mission . . . serve the personal **computing** market.[23] In 1977, Commodore and Tandy, both established companies, announced the "Pet" and the "TRS 80" as their entries into this market.

In 1977 and 1978 sales of what is now termed "personal computers" began to escalate. Apple has been a leader in the industry from its birth. Founded by 20-year-old Steven Jobs, Apple has experienced unparalled success. Sales for its six year history have risen from $774,000 in 1977 to nearly $1 billion for the fiscal year ending September 30, 1983.[52,53] (Figure 7) Apple has not been alone. In April of 1983 there were more than 150 personal computer manufacturers. These manufacturers have attempted to address every segment of the personal computer market. In fact many of these segments could and should be considered new market niches. Portable computers and compact computers were designed for mobility while personal computers like the Compag was designed to be IBM compatable [24]. This feature affords Compag the luxury of using vast amounts of existing software written for the IBM P.C.. Machines such as Apple's Lisa and Macintosh, and

Apple Computer Inc.(52,53)

Fiscal Year	Sales (in thousands)
1977	$774
1979	$47,867
1980	$117,126
1981	$334,783
1982	$583,061
1983	$982,769

Hewlett Packard's "Tough Screen Personal Computer" were designed to be user friendly for those who have never used computers. Gavilan Computer Corporation has produced a briefcase computer which weighs 9 pounds but has features found only on more expensive models like the Lisa [25].

These manufacturers have expanded and developed the personal computer niche from an infant industry to over a $10 billion industry in 1983 [26]. In retrospect and from a personal viewpoint the potential for personal computers is now obvious. In 1977 I was a junior Computer Science major in a Physics and Computer science Department. My personal goal was to become a proficient computer scientist. By default, this meant working on large mainframes such as the IBM 370 series. Personal computers in my mind were nothing more than unsuitable imitations of actual computers. I often felt insulted when peers or co-workers would find out my major and inevitably inquire. . . "Do you use an Apple or Radio Shack computer?"

In reality these people were not being offensive to me or my education. The introduction of personal computers had for the first time provided these people access to computing technology. They were looking at my knowledge as a link. Although I have worked six years on large IBM 370 and 3800 series mainframes as well as a Cray 1M, it is my conclusion that personal computers have become and will continue to be an integral function of American corporations. While the scientific applications that I work with require large quantities of memory and tremendous amounts of data transmission they are by no means the norm. Many applications can and have been decentralized by the use of "Distributed Data Processing". Such efforts have integrated minicomputers and microcomputers into various corporate functions. Users who have been enlightened by the personal computer wave demand this capability. Technological advances in personal computers now

make it possible to link personal computers directly into mainframes, thus affoding the best of both worlds.

Finally, has the American society ever failed to support a major technological advancement? NO! Therefore, the acceptance of personal computers should come as no surprise.

The Personal Computer Industry

The microcomputer industry can no longer be considered an infact industry. 1982 sales for the microcomputer market totaled $5 billion while 1983 sales topped $10 billion. Sales are expected to grow to $28 billion by 1988.[26,27] Apple has been the pace setter for the industry. However, IBM's entry into the marketplace has seen this lead diminished and surpassed. (Figure 8) IBM's entry into the market induced excitement and more importantly instant credibility. The high priest of computing technology had finally given its blessings. Figure 8 contains sales results for the top micro manufacturers in 1982.

Not all entrants into the microcomputer market have been as successful as IBM and Apple. Osborne Computer filed for bankruptcy protection in 1983. Osborne produced the first portable microcomputer. Founder Adam Osborne had been one of the first analysts and writers for the microcomputer industry. The corporate mission he established with Osborne was quite simple. . ."make personal computers portable and, therefore, mobile". Osborne's unit was self-contained and easily transported by one person.

Initial market reaction was excellent. During the fall market of 1983 Osborne was the darling of the speculative market which never showed for the dance. While other microcomputer hardware and software firms like Apollo and Lotus were tremendous successes on Wall Street, Osborne

Top Micro Manufacturers for 1982(20)

	Company	Market Share
1.	Apple	21%
2.	Tandy	19%
3.	Commodore	18%
4.	Timex/Sinclair	12%
5.	IBM	6%
6.	Others	25%

1983 Micro Manufacturer Production
(estimated units of production)(57)

	Company	(in thousands)
1.	Apple	480
2.	IBM	440
3.	Tandy	140
4.	Digital Equipment	80
5.	Hewlett-Packard	60

*** Some analysts predict that IBM will account for over 50 % of the market by 1985.(57)

postponed public offering's several times. Then in the spring of 1983 Osborne missed its release deadline for the Osborne Executive II. Distributors and dealers all but quit ordering the Executive I in expectation of the delivery of the Executive II. Lack of cash flow coupled with the existing weak financial condition of Osborne forced it into bankruptcy.

The shakeout was not limited to Osborne. Computer Devices which lost $4.5 billion in 1982 also filed a Chapter 11 petition in November of 1983.[29,30] But perhaps the real shocker of 1983 was Texas Instruments withdrawal from the home computer market. TI had been very successful in its past ventures which were primarily in calculators. Because of the similarities in technology and manufacturing, entry into the personal computer market would appear to provide a synergistic fit for TI.

Texas Instruments had experienced great success in the past through "market-penetration pricing". Under a strategy companies attempt to gain market dominance by building excess capacity, producing high volume and then setting the product price below the competition and thus winning market share.[31] Although initial losses will occur, these should be made up as market dominance continues at lower production costs. TI followed the same strategy for the TI 99/4A, a P.C. aimed at the home market.

TI and companies such as Atari, Coleco, and Commodore engaged in a fierce price war in an effort to gain market share. TI experienced hugh losses. In the first half of 1983 alone, losses exceeded $100 million dollars. [32] In an effort to cut losses TI announced its exit from the home computer market in the fall of 1983. However, in an effort to liquidate the remaining TI 99/4A inventory, they announced the incredible rebate value of a TI 99/4A home computer for less than $50.

Currently the industry is taking new directions. One direction is that of IBM compatability. Companies like Compaq have been very successful by offering IBM compatable machines with features not found on the IBM P.C. Compaq offers transportability, a built-in hard disk and standard graphics. Such compatable machines have a distinct advantage of being able to readily execute the existing software programs already written for the IBM P.C.. [24] The other direction is one that is directly the opposite. Apple, with the introduction of the Macintosh, has introduced a new technology.

The "Mac" is designed for those people who have never used a personal computer. Apple has integrated "Lisa" technology with a menu-driven operating system. Steven Jobs founder and Chairman of Apple made this statement:

> "What we are trying to do is reach the point where the operating system is totally transparent. When you use Lisa or a Macintosh, there is no such thing as an operating system. You never interact with it; you don't know about it. Users are much more concerned about what the computer will do, what it will communicate with, which is the right way of looking at products." [33]

Critics have given Macintosh high marks. Industry has responded quite well too. One firm, Peat Warwick Mitchel & Company, a Big Eight accounting firm, has placed an order for $7.5 million dollars. Because of its portability and ease of use, the firm plans to use the Macintosh on its audits at remote sites.[57]

How Have Personal Computers Been Used in the American Society

As already stated, computing technology has changed the American society. Moreover, personal computers have forced the issue. Students, employees, and executives now have the option of becoming somewhat computer literate. John V. Roach, Chief Executive Officer and President of Tandy Corporation has made this statement:

> "In the course of the next decade, most Americans under 40, if not all Americans, regardless of age, will and must become computer-literate."[10]

Personal computers have had a significant impact on three areas of our society: the business community, thehousehold, and educational community.

Personal Computers in the Business Community

Free enterprise breeds innovation and innovation breeds competition. Businesses from corporations to sole proprietorships, are always looking for the competitive edge, the little something extra that will boost productivity or increase quality. Personal computers have provided much utility for the business community. It is now estimated that close to 2.64 million personal computers will have been installed in businesses by the end of 1983 with this number rising to 12.5 million by 1988. If this projection is realized, one in every four businesses in the United States will own a personal computer.[10]

For many small firms the purchase of a personal computer will be the company's first venture into the computing world. At increasing rates sole proprietors, mom and pop stores and firms with small work forces (50 employees or less) are purchasing personal computers. Such businesses are

finally realizing the cost savings and productivity increases that large companies have experienced for years.

At large firms, personal computers have been viewed as vehicles of "Distributed Data Processing". Increasingly, personal computer technology has been incorporated into non-traditional data processing applications. Additionally, personal computers have been used in an effort to funnel more of the responsibility for traditional data processing applications into the control of the end user. Managers and executives have been a focal point in the increase of personal computer usage. While a status symbol, P.C.'s have become a new productivity tool for management.

Companies with IBM mainframes have readily adapted to the IBM P.C.. Many computing professionals, including myself, believe that the basic mainframe computer terminal will become almost non-existent. Personal computers such as IBM's IBM XT can be linked directly to a mainframe system, thus providing computing professionals the best of both worlds.

The following excerpts from Apple Magazine [34] show the wide variety of corporate clientel and the limitless number of application areas for personal computers in industry.

* Rockwell International - used by the Corporate Planning Department for analysis and calculations.
* Ford Motor Company - financial modeling and engineering graphics
* Procter and Gamble - financial analysis, data acquisition and control, and word processing.
* Touche Ross & Co. - tax planning, strategic planning, graphics, forecasting, and management training.
* E. F. Hutton Life Insurance Company - custom tailoring of life insurance policies.

* Pepperidge Farms - market forecasting, production scheduling, labor studies, simulations, profit/loss analysis.
* Bank of Louisville - formation of a communication link between its 27 branches. P.C.'s are used in applications that range from loan applications to word processing.
* Arthur Young & Company - performance of many functions during external audits .

Figure 9 displays the leading manufacturers of personal computers serving the business community in 1982. These machines generally are more expensive than personal computers aimed at the home computer market.

Leading Manufacturers of
Personal Computers Bought
By Business Community in 1982(10)

	Company	Market Share
1.	Apple	33%
2.	IBM	28%
3.	Tandy	15%
4.	Osborne	10%
5.	Others	14%

Personal Computers in the Home

A home computer is a personal computer used in the home. Although microprocessors such as the Commodore and the Atari are geared for home usage, by definition all personal computers can be home computers.

For the purpose of this paper we will use the following definition with reference to home computers:

> "A home computer can be any personal computer that is used in the home whether it is designed specifically for home use or not."

Again, a personal computer is simply any microcomputer that sells for $10,000 or less.

In September of 1983 it was estimated that some 4 million personal computers were in the nation's households. Just four years earlier there were only about 70,000. Price wars and market saturation have resulted in relatively inexpensive home computers. This low cost factor coupled with the onslaught of software vendors for the home computer market have caused home personal computer sales to boom.[35]

While application areas for home computers are limitless, five key applications areas can be defined:

1. games/entertainment
2. financial planning
3. education
4. banking
5. data base communication[36]

Software sales for home computers approached $625 million for 1982 and are projected to reach $3.7 billion by 1987.[37] In addition to the impressive software sales, home computers are taking over the video game industry. [35]

Richard E. Stears, vice-president of operations for Parker Brothers makes this this observation:

"Video games and home computers are merging." [38]

How are personal computers used in the home? Does this usage compare to industry usage? These questions will be addressed in Chapters 4 and 5.

Personal Computers in Education

Until the mid-1970's education and computing technology experienced a limited relationship. True, many of the early computer systems were developed in conjunction with the research departments of major universities and most large universities taught a computer science curriculum. But computing technology was not available and in most cases desired by the remainder of the academic world. Computer courses in small colleges, secondary, and elementary schools were cost prohibited. More often than not, professors of non-computing curriculums such as business or pre-med avoided computer applications. Often because of the inavailability but also because of the inability of the instructor to interact with the mainframe.

Personal computers have completely restructured the education and computer technology relationship. Acceptance of personal computers in our society have had a three-fold impact on the educational community. First, personal computers provide all educational institutions, from elementary schools to universities, access to computing technology. Second, our society in all aspects is becoming computer literate. Therefore, the educational process has no choice but to adapt aggressively. Finally, the students are demanding computing education. They realize that not only are computing professionals in high demand but that employees of the future must be functional in a computer environment.

While great strides have been made on college campuses, the most dramatic gains have been in secondary and elementary schools [37]. Figure 10 provides a breakdown of the use of personal computers in education. From 1982 to 1983 the use of personal computers in education doubled. In 1983 only 14% of the school districts in the United States were not using computers for

Personal Computers in Education
School Year 1982-1983(37)

68% of all schools in United States had computers

62% of Elementary Schools used personal computers
81% of Junior High Schools used personal computers
86% of High Schools used personal computers

The average High School has 11 computers.
The average Junior High has 7 computers.
The average Elementary School has 3.5 computers.

educational purposes. During the 1982-83 school year the use of personal computers in elementary education tripled.[40]

Personal computer manufacturers have been the catalyst in the educational field. Apple and Radio Shack have well established programs which provide educational grants for machines and the teaching of secondary and elementary teachers.[10] John V. Roach, CEO of Tandy Corporation, manufacturer of Radio Shack personal computers has stated:

> "Society will reap the benefits where students not only expand their minds through the use of the computer but also when they help their parents develop a better understanding of the computer."

Apple, which established its educational foundation in 1978, wants to give every school in the country a personal computer. Pending legislation in Congress that would allow such a write-off to the company is the only roadblock. California recently passed such a bill and in return 9,250 schools in the state received an Apple computer.[10]

Education of children has not been confined to the classroom. Software sales of educational packages for home computers have been quite successful. One manufacturer, Texas Instruments, ran a national campaign in 1983 depicting the educational value of personal computers in the home.[40] One of the less recognized but highly successful educational values of personal computers has been in the area of the physically disabled. Systems for victims of cerebral palsy, speech disorders, vision disorders, and other physically disabling handicaps have been very successful.[41]

Some educators view personal computers in a different light. They view the personal computer as a tool for narrowing the educational gap between the haves and the have nots. Personal computers could function as

an equalizer between suburban schools and intercity schools while providing disadvantages students with new opportunities and a sense of self worth.[42]

Software - P.C.'s Version of 4-Wheel Drive

Automobile manufacturers promote 4-wheel drive vehicles as "go anywhere transportation". Passengers of such vehicles are no longer limited to the established highway system. In essence, software written for the personal computer industry has done the same thing for personal computer owners. Whether used for business, home, or educational purposes, personal computer users now have a vast array of commercially written software aids and packages from which to choose.

Corporations often would not have the motive, budget, manpower, expertise, or calendar time to develop a computer application. In such instances corporations have been willing to purchase packaged software from a third party. In most cases the trade off of between a proven and finished commercial package and an internally developed custom package did not affect the product's utility to the company. Commercial written software for traditional mainframe and mini-computer systems has long been a successful industry.

The same has held true for the personal computer industry. Owners and users often have lacked the expertise or time to develop systems. Yet they realize capabilities and potential of personal computers therefore they have been very receptive to commercially written software.

In 1983, wholesale sales of personal computer software were $2.2 billion. These figures represent more than a 100% increase over 1982 sales.[43] Figure 11 provides a listing of the major producers of P.C. software. Applications are vast and a direct result of consumer demand. This fact is no more evident than in the story of the spread sheet package in "Lotus

Personal Computer Software
Sales (Wholesale 1983)

Hardware Makers	Sales(in millions)
IBM	110
Tandy	110
Commodore	75
Apple	70
Atari	70
Texas Instruments	60
Independents	
Microsoft	68
Lotus	53
Digital Research	48
MicroPro	45
VisiCorp	40
Aston-Tate	22
Peachtree	12
Broderbund	12
Perfect Software	12
Soricism	12
Sierra	12
Synapse	12
Continental	11
Software Arts	11
State of Art	11
Software Publishing	10

1-2-3". Produced by the Lotus Development Corporation, the package provides financial-analysis spreadsheets, graphics and file management. Initially priced at $495, the package is contained on a single floppy disk. Lotus sold 110,000 packages the first nine months and had revenues of $53 million for 1983. [44]

Steven Jobs has not been the only college drop out, boy wonder of the personal computer industry. William Gates started MicroSoft in 1977 after dropping out of Harvard. His company, which originally sold operating systems and programming languages for personal computers and has since expanded into software application packages, totaled sales of $6.8 million in 1983. It is estimated that 48% of all personal computers shipped in 1983 were shipped with MicroSoft software.[44,45]

Is this trend expected to change? NO! While a shake out of companies is expected, sales are expected to rise at a compounded yearly rate of 34%-39% through 1989. Retail sales for 1984 are projected at about $14 billion dollars with wholesale sales of $8.4 billion.[43]

CHAPTER 4: HOME COMPUTERS

Current market speculation p.50

Research Formulation:

Formulation of a Survey to Determine Household Usage of Home Computers p.52

What about home computers? It is estimated that in 1983 over 4 million personal computers were in United States households.[10] This number, depending on which market analyst you subscribe to, is expected to increase dramatically.

Unlike personal computers purchased by industry and business most home computers are not used for a specific function. The business community uses personal computers to increase profitability, productivity, efficiency, accuracy, turnaround, etc. The bottom line is the utility that the personal computer provides.

A personal computer user in the business world is either highly self motivated or required to use the personal computer by management. Industry also provides personal computer users the tools needed for reaching high performance levels. These tools can take many forms:

- hardware that is functionally adapted for the application
- purchase of needed software tools
- additional software and system consultation from computing professionals
- training at all levels of expertise
- recognition of work that has resulted in an increase in performance by the personal computer user
- challenge of expanding one's skills and worth to the company

What motivates the home computer user? Do the same challenges and opportunities in the business community exist for the home computer user?

The introduction of personal computers has made information processing available to the household for the first time. Personal computers were not the first application of computing technology in the American household. This technology has been present since the late sixties in

telephones, televisions, stereos, microwave ovens, etc. These and other advancements have improved the lifestyle of the American household. Appliances like the microwave oven provide owners more free time with less effort. All of the previous applications have two basic characteristics:

1) a predefined function

2) a predefined functional limit

Therefore, the consumer could realistically formulate the product useability and utility.

Personal computers present households with a new challenge. Home computers do not bring instantaneous improvements in the lifestyle of the owners. You cannot simply plug a personal computer in and begin reaping the benefits. Even computer games often take hours of practice to enjoy much less master. The reasoning is simple. . .**microcomputers, unlike all previous entrants of computing technology in the household, do not have predefined functions or functional limits.** This is not to say that personal computers do not have structural differences or limitations such as internal storage or memory capacity. Are structural differences unique to personal computers? No! For instance, televisions come in many sizes, but they still provide a picture. However, what is unique is the direct input required by the household member. Is the household ready to make leisure time available to write, maintain, and execute computer applications? Even with the thousands of commercial software packages available, the user must have a working knowledge of the package, provide the input and translate the output. Personal computer users in business and education have motivational factors such as business competition and peer pressure while home computer owners often have only self motivating forces.

Such points raise some alarming questions. **How much are personal computers in the home used?** Are home computers status symbols or luxury items rather than productivity aids? What members of the households use the home computer? What applications do home computer owners use their machines for?

Current Market Speculation

Much speculation about the use of home computers has been written and voiced. A March 30, 1984 article in USA Today reported that fewer home computers may be sold in 1984 than 1983. Chris Yalonis of Creative Strategies holds this observation:

> "There is a bit of backlash against the functionality, practicality of the machines. . . we won't see another explosion like we saw last year. . . what we saw mostly in 1983 was throwaways."[48]

While it is estimated that 15% to 20% of all families in the United States will own home computers by 1987 [49] many observers feel that existing home computers are under utilized. One school of thought believes that many households have been attracted to home computers by the recent price wars. But these first time buyers have experienced many problems and frustrations. These include:

- Difficulty in using the machine
- Hidden costs such as addition peripherals
- Inadequate manuals or systems documentation
- Maintenance problems
- Frustration in learning to program
- Time consumption[50]

Many have purchased home computers in lieu of video games because of the capability of home computers to do more than just play games. A Gallup poll taken in 1983 revealed that 51% of personal computer owners played video games. This represented the largest use of home computers. Video game sales for personal computers in 1983 were estimated at $2 billion.[10]

Yet another school of thought states that until home computer networks are readily in place, such machines cannot be cost justified.[48] Many see home computers as a medium for services that can be transmitted into the home by communications technology. These analysts feel that the current home computer phenomenon will be short in duration.[51]

However, not all of the responses about home computers have been negative. Some market analysts feel that the home computer market has come of age and that home computers will become commonplace in the household.

President of the Computer and Business Equipment Manufacturers Association, Vilo E. Henriques, states:

> "Increasingly, people believe the personal computer is as necessary as the telephone or the TV. . . more and more it's an educational thing, a personal professional use or a hobby rather than a game thing."[10]

Larry Stockett, Chairman of P.C. Telemart, Inc., also states:

> "Parents will begin to feel that it's their responsibility to make a personal computer available to their kids. . .if they don't their kids are going to be behind. They won't be able to compete with many of their peers." [10]

Research Formulation: Formulation of a Survey to Determine Household Usage of Home Computers

With such diverse and conflicting opinions in the home computer industry, I concluded that a survey of home computer owners would provide an appropriate and timely analysis of the "post purchase usage" of home computers.

Because of the magnitude of the survey, the time requirements, the lack of manpower, and the lack of a "budget item" to provide for this research, a mail survey was chosen as the medium for gathering data. Formulation of the survey was done primarily by this researcher. However, upon re-examination of the survey draft and the discovery of a similar survey in Consumer Report[54], six questions from the Consumer Report survey were incorporated into the final survey.

Figures 12, 13, 14, 15, and 16 are samples of the surveys that was used. The survey was designed for all households which own home computers. Again, home computers for the purpose of this survey were defined as:

> "Any personal computer that is used in the home whether it is designed specifically for home use or not."

The survey was intentionally designed to be broad in scope. It is felt by this researcher that the households which own home computer are very diverse. The following is a list of areas in which an attempt is made to sample in the survey:

- Demographics
- Length of ownership
- Manufacturer distribution
- Application areas
- Activity amounts

- Number of hours of usage
- Non-users
- Users
- Total hardware investment
- Total software investment
- Computing exposure outside the home
- Regularity of usage
- Lengths of computer session
- Purchasing activities
- Software acquisition
- Educational usage
- Word processing usage

Stanley K. Walton
Oklahoma State University
Stillwater, Oklahoma
Student ID 216235
Status: Graduate Student

This survey is a consumer survey designed for households which own personal computers. Owners of all brands and models from TI's to IBM PC's are needed. This survey will be used by the above mentioned as fulfillment of partial requirements for a Masters of Business Administration Degree from Oklahoma State University.

This is not an attempt in any way to compile a consumer list for possible solicitation. While the results of this survey will be published, your individual participation will remain confidential.

Questions regarding the validity of the student's efforts can be directed to :

Dr. Curtis B. Hamm
College of Business
Oklahoma State University
Stillwater, Oklahoma

Please return the survey to the address listed below by April 9, 1984. Thank you very much for your efforts.

Stanley K. Walton

Phillips Petroleum
352 IC, EX 4544
Bartlesville, Oklahoma 74004

or

4724 N.E. Michigan
Bartlesville, Ok. 74006

Household Personal Computer Usage

Please circle or fill in the appropriate answer. Some questions may have more than one answer.

1). How long has your household owned a personal computer ?

a) Less than 6 months
b) 6 months to 1 year
c) 1 to 2 years
d) 2 to 4 years
e) Over 4 years

2). How many personal computers does your household own ?

_____

3). What brand(s)/model(s) of personal computer(s) does your household own ? (e.g. AppleII, IBM PC, KayproII)

a)_____ c)_____

b)_____ d)_____

4). Is any member of your household a member of a computer hobbyist group ?

a) Yes b) No

5). How active is the most active member of your household in a hobbyist group ?

a) Not applicable
b) Inactive
c) Active
d) Very active
e) An officer

6). How many members of your family write software for use on your personal computer(s) ?

_____

7). Is a personal computer used for your family's personal finances ?

a) Yes b) No

8). Do you use your personal computer(s) for record keeping ?

a) Yes b) No

If yes, please indicate which areas.

1)_____ 3)_____

2)_____ 4)_____

9). Do you use your personal computer(s) for tax purposes ?

a) Yes b) No

10). Did you or will you compute your 1983 income taxes using a personal computer(s) ?

a) Yes b) No

11). Please list the household members who use your computer(s). Estimate the hours each spends weekly on the various activities listed below. If the amount is less than one hour please indicate the increment. If there is no activity please leave the field blank.

		Hours per Week				
	Age	Programming	Word Processing	Acctg Fincl.	School/ Education	Games
a.	_____	_____	_____	_____	_____	_____
b.	_____	_____	_____	_____	_____	_____
c.	_____	_____	_____	_____	_____	_____
d.	_____	_____	_____	_____	_____	_____
e.	_____	_____	_____	_____	_____	_____
f.	_____	_____	_____	_____	_____	_____
g.	_____	_____	_____	_____	_____	_____

12). Please list the ages of all household members who do not use the computer(s) ?

a) ____ b) ____ c) ____ d) ____ e) ____ f) ____ h) _____

13). Do any of your children who reside at home have their own personal computer ?

a) Yes b) No c) Not applicable

14). Please estimate the total cost of your hardware(computers and peripherals) ?

$_____

15). Please estimate the total cost of software you have purchased.

a) Amount bought with the initial purchase of the system(s)

$_____

b) All other purchases $_____

16). Does any member of your household use a computer at school or work ?

a) School b) Work c) Both d) Neither

17). When was the last time someone used your personal computer(s) ?

a) Today

b) Yesterday

c) The previous weekend

d) The previous week

e) During the last 30 days

f) More than 30 days ago

18). Please estimate the average number of days a week that your personal computer(s) is used ?

a) 1 b) 2 c) 3 d) 4 e) 5 f) 6 g) 7

19). Please estimate the number of hours a week your household's personal computer(s) are used.

a) 0 c) 1 - 5 e) 10 - 20 g) 30 - 40

b) Less than 1 d) 5 - 10 f) 20 - 30 h) Over 40

20). Please estimate the number of hours your household's personal computer(s) are used on Saturday and Sunday.

a) 0 c) 1 - 5 e) 10 - 20 g) 30 - 40

b) Less than 1 d) 5 - 10 f) 20 - 30 h) Over 40

21). Please estimate the length of a normal computer session in your household.

a) Less than 10 minutes d) 1 to 2 hours

b) 10 to 30 minutes e) 2 to 3 hours

c) 30 minutes to 1 hour f) Over 3 hours

22). Please indicate the time span in which your PC is used the most.

a) 6am - 12pm c) 6pm - 12am

b) 12pm - 6pm d) 12am - 6am

23). On the average, how many weekdays, Monday through Friday, are your household's PC's used each week ?

a) 1 b) 2 c) 3 d) 4 e) 5

24). Did you purchase your PC(s)

a) In a computer store c) By mail e) Other

b) In a retail store d) From an individual

25). Do you feel the services your PC(s) has provided your household have resulted in a monetary savings ?

a) Yes b) No

26). Please describe your household's personal computer usage.

a) Much greater than expected
b) Slightly more than expected
c) About what was expected
d) Less than expected
e) Much less than expected

27). If your household uses a personal computer for word processing please indicate application areas.

a)_____ b)_____
c)_____

28). Please circle any of the following sources from which your household gets software.

a) Purchase at a store
b) Mail order
c) Write their own
d) Copy from friends
e) Hobbyist groups
f) Other

29). Has your household experienced any downtime in the last 12 months?

a) Yes b) No

30). Please circle any of the following peripherals you own.

a) Color monitor
b) Monochrome Monitor
c) Color TV used with your computer(s)
d) BW TV used with your computer(s)
e) Modem/acoustic coupler
f) Cassette recorder
g) Printer
h) Joystick or Game paddles
i) Disk drives
j) Other

31). Does your household use an on-line information service ?

a) Yes b) No If so which one(s)_____

32). Have you purchased commercially written software which you no longer use ?

a) Yes b) No

33). What is the highest level of education attained by someone in your household ?

a) Some HS or Less
b) HS Graduate
c) Some College
d) College Graduate
e) Some Grad/Professional School
f) Grad/Professional Graduate

34). Please categorize the household income bracket.

a) $0 - $20,000
b) $20,000 - $30,000
c) $30,000 - $60,000
d) Over $60,000

35). Please list the principal occupation(s) of the household ?

1)_____ 2)_____

36). Please indicate your household's expected purchasing activity(s) for the next 6 months.

a) Hardware b) Software c) Peripherals d) No purchases

CHAPTER 5: ANALYSIS OF THE SURVEY RESULTS

Bartlesville Demographics p. 60

Survey Administration p. 62

Processing the Data p. 62

Survey Results p. 65

Correlation Between Questions p. 72

Analyses of the Survey Results p. 73

Once it was decided that a survey would be used as the research tool it became necessary to determine a survey population. Initially, an effort was made to design a survey that could be administer to only owners of one brand of home computer. My first choice was Apple. However, after contacting Apple for solicitation of a customer file, I came to the realization that a sampling of such a population would be too much for one person to attempt. Most personal computer manufacturers including Apple do not maintain a file of past purchases. Instead they sell directly to authorized dealers (e.g. Microage Computer Store). I contacted several computer store owners in an attempt to get a copy of their customer files. However, each time I was turned down because of the confidential nature of such files.

At this point I re-examined the criteria of the population. I needed home computer owners. It was immaterial if they had an IBM P.C. or a TI/99A. What I did need was a surveyable population. With this direction the survey was redesigned to focus on consumer use of home computers.

Although the survey was completed it still had to be administered. At this point, I took a sample survey of fellow employees. Of the first 69 people I surveyed, 30 had personal computers. While a majority of these were fellow computer programmers, many were not and many computer programmers like myself did not own a personal computer. With this initial success I committed myself to an extensive survey of fellow employees and members of the Bartlesville community. Therefore, I used Bartlesville as my population.

Bartlesville Demographics

In 1983, Bartlesville, Oklahoma had an estimated population of 38,500. Located approximately 50 miles north of Tulsa, Oklahoma, in

Washington County, it is the corporate headquarters of Phillips Petroleum Company. Population for the 30 mile radius exceeds 92,000.

Bartlesville demographics are directly effected by the presence of Phillips' corporate influence. These include:

- An average spendable income per household of $25,127.
- A hugh percentage of the population is employed. Washington County has a population of over 50,000 and a work force of over 26,000.
- A low unemployment rate. On December 31, 1983, Washington County had an unemployment rate of 5.3%.
- Phillips has approximately 7,000 employees in Bartlesville. Because many of these jobs require college and advanced degrees, the household education level in Bartlesville is quite high.

Based on these facts, "Does Bartlesville provide a good population for the survey?" Will the results be skewed because of the influence of Phillips Petroleum?

Recent surveys have found that families with an annual income of $25,000 or more comprise 90% of the households that purchase personal computers.[20] It should also be noted that households with higher levels of education are more likely to have used computers in their education or employment. It would therefore be logical to assume that those households would be more receptive to home computers.

With these thoughts in mind, one fact remained. A surveyable population was needed. As a full time employee and graduate student, my time and ability to support such an effort outside of Bartlesville would have been very difficult. Therefore, the population sample consists of largely

Phillips Petroleum employees who, as Bartlesville demographics have shown, represent Bartlesville quite well.

Survey Administration

After the sampling of fellow employees, I enlisted the aid of various friends throughout the Company and community in an effort to gether completed surveys. My initial goal for the sample size was 50.

The method used was simple. We randomly asked peers and co-workers if their household owned a home computer. If they did, we then asked them to complete a survey and mail it back. Additionally I attended a meeting of the Bartlesville Area Computing Society and presented this project and solicited the help of the members present. 17 of the 300+ members were in attendance.

While approximately 450 people were approached, I have record of only 350. Some people asked to help in the survey failed to count the people solicited. Of the 350, 88 or 25% of the households surveyed owned personal computers. I also randomly mailed surveys to 25 members of the Bartlesville Area Computing Society.

The entire sampling process covered a period of approximately 3 weeks, March 16, 1984 through April 9, 1984. 128 surveys were completed and returned.

Processing the Data

One hundred twenty-eight responses represent a tremendous amount of data. Twenty years ago it would have taken may weeks and much man time to process, analyze, and draw conclusions from such a survey. However, computing technology provides the researcher a tremendous advantage. Information processing expands to analysis capabilities of the researcher.

Once the data has been translated to a computer storage device (e.g., a disk), the researcher can use various statistical software packages such as SPSS or SAS to expedite and expand the analysis function. The researcher does not need to be a statistical expert. He or she only needs to know how to apply the various relationships and tests. The software package provides the needed statistical tools. After the various statistics have been generated the researcher needs only to interpret the results.

The key benefit to such analysis is the ability to retest various results under different stimuli or conditions. Computer based research is like CAD and CAM (page). Tests can be reformulated and restructured with relative ease for significantly less time and money.

Although there are 35 questions on this survey (Figures 12, 13, 14, 15, 16) there were actually 117 possible answers for each survey. The following steps were taken in processing this survey:

1) Determination of the input format of each survey.
   a. One survey per record
   b. The survey records would reside in a disk dataset
   c. The record length would be 236 bytes for each survey
2) Establishment of a coding scheme for data entry
3) Generation of 2 ISPF TSO screens for entry of the surveys onto the disk dataset
4) Entry of the 128 completed surveys
5) Generation of a SAS program for use in processing the survey data
6) Processing using the SAS program. Various statistical tests were generated.
7) Conclusions were generated by SAS and stored on TSO.

8) Headings were added to the survey results and then printed on a laser printer at the Phillips Central Computing Site. These results (Figures 17-38) were incorporated directly into the MBA report.

While I am a computer programmer, I am not a proficient data entry clerk. It is estimated that between 25,000 and 30,000 key strokes were performed during the data entry. Although approximately 14 hours were spent in data entry, only 50 to 100 hours were used to complete steps 1 - 8.

Survey Results

As stated earlier the survey is designed to reveal "post purchase usage" of home computer users. The remainder of Chapter 5 will be devoted to the composite survey responses for each question as well as correlation tests between various questions. Several of the questions have more than one answer. Because the survey was conducted by mail, the answering of each question could not be insured. Therefore, not all of the respondents answered every question. Such questions were flagged and will be denoted.

Each question will be briefly presented and the findings discussed. A figure containing the question and composite results has been compiled for each question.

Composite results

Question 1 (Figure 17)

76.5% or ninety-eight of the one hundred twenty-eight households surveyed have owned personal computer(s) for two years or less. Of these, 19% have purchased home computers in the last six months, while 39.8% have owned personal computers one to two years.

Question 2(Figure 17)

81.2% of the households own only one personal computer. Two households owned three personal computers while twenty-seven owned two.

Question 3 (Figure 18)

The survey population owned one hundred fifty-two personal computers. Twenty-four different types were represented in the survey. The Commodore 64 was the popular model followed closely by the Apple II's and the TI 99/4A. Commodore was the leading manufacturer with 27.8% of the

population. Apple was second with 18.5% while IBM finished with 8.6%. Radio Shack, a subsidiary of the Tandy Corporation had the most models represented with five. However. the TRS models accounted for only 7.5% or eleven of the machines.

Question 4(Figure 19)

65% of the households surveyed were not associated with a computer hobbyist group. Forty-five households in the survey were.

Question 5 (Figure 19)

Thirty-one of the forty-five households which were members of a hobbyist club reported that at least one member of the household was active in a hobbyist group.

Question 6 (Figure 20)

57.8 %of the households responding had only one person who wrote software for the household's personal computer. An additional 30.4% had two people who wrote software. No households reported more than three people.

Question 7 (Figure 20)

46% of the households responded that they did use their personal computer(s) for the family's personal finances.

Question 8 (Figure 21)

60% of the households used personal computers for record keeping. Respondents recorded forty-five different record keeping applications. These ranged from checking/savings accounts to a family tree. Home inventory was the top response with mailing/address lists second..

Question 9 (Figure 22)

Forty-nine households or 38% used a personal computer for tax purposes.

Question 10 (Figure 22)

Twenty-nine households or 22.6% used a personal computer to compute 1983 income taxes.

Question 11 (Figure 37)

This question attempts to determine the households usage of personal computers in five application areas. It also accumulated the number of users and their ages. For the purposes of computing usage averages all increments of hours were rounded to the nearest half hour. Therefore, the minimum usage for any application is one-half hour. Only four households did not respond.

The largest number of users reported for any household was six. Two hundred ninety-three users were identified or 2.36 users per responding household. Users nineteen years of age and over totaled one hundred seventy-two or 58.7%. The highest age recorded was sixty-six and the youngest, two. Games had the most respondents with one hundred sixty-six (79%) households, but programming had the highest weekly household usage mean of 3.24 hours. Programming also had the highest number of total hours. Accounting/financial applications had the lowest number of responses.

Question 12 (Figure 38)

Seventy-seven of the households have at least one member who does not use the personal computer. Five members of one household was the largest number of non-users.

The average age of the one hundred fifteen non-users is twenty-five.

Question 13 (Figure 23)

Twelve households had children, who resided at home, who owned a personal computer.

Question 14 (Figure 24)

The one hundred twenty-eight households estimated a composite outlay of $263,240 for hardware (computers and peripherals). This represents a mean value expenditure of $2,056.56 per household. The minimum hardware cost reported was $46 while the maximum was $11,000. Although by definition we have limited personal computers to computers costing less than $10,000 dollars, it is assumed that the $11,000 represents significant peripheral purchases. However, if this observation is disregarded, the mean value expenditure for the remainder of the population is $1,986.14.

Question 15 (Figure 24)

An estimated $22,440 was outlayed for software at the initial purchase of the system. 57.7% or seventy-four households reported purchasing software with the initial purchase of the system. The maximum estimated purchase was $4000 while the mean purchase for the seventy-four households was $175.31.

An estimated $26,855 of software has been purchased in addition to the initial purchases. 76.6% or ninety-eight of the one hundred twenty-eight households have purchased software after owning a personal computer. The maximum estimated purchase was $2000 while the mean purchase was $209.80.

Question 16 (Figure 23)

Only 14% of the households did not have a household member who used a personal computer at work or at school.

Question 17 (Figure 23)

82% of the households surveyed indicated that someone had used the household's personal computer the last week. Only 9% responded that it

had been more than thirty days since the household's personal computer had been used.

Question 18 (Figure 25)

25% of the households responding indicated that the household's personal computers were used an average of six days a week. Average usage of one day per week received a 23.4% response. No household indicated seven day usage. There were four surveys with no response.

Question 19 (Figure 26)

43.7% of the households spent less than five hours a week using the household's personal computer. 24.2% indicated usage of ten to twenty hours a week while three households indicated over forty hours of usage a week.

Question 20 (Figure 26)

69.8% of the households responding use their personal computers less than 5 hours on weekends - Saturdays or Sundays. Two households did not respond.

Question 21 (Figure 27)

Computer sessions in 42.2% of households have an average length of one to two hours. Only six households have average sessions of over three hours.

Question 22 (Figure 27)

77.2% of the households indicated that the time span of 6 pm to 12 am was the time most computer usage took place. One household did not respond.

Question 23 (Figure 25)

Forty households or 32.5% of the households responding averaged one day of usage for the weekdays, Monday through Friday. Five households did not respond.

Question 24 (Figure 29)

54% of the households purchased a personal computer at a retail store. 47% had made a purchase at a computer store. Because households could have more than one machine, question 24 could have more than one response.

Question 25 (Figure 29)

Only twenty-eight households indicated that use of a personal computer had resulted in a monetary savings to the household.

Question 26 (Figure 30)

Sixty-five households or 50.8% of the households indicated that post purchase computer activity was about what was expected. However, 25.8% of the households indicated less usage than was expected.

Question 27 (Figure 30)

51.5% of the households indicated some word processing activity was performed on the personal computer. Twenty-seven different areas of application were denoted. 39.5% of those responding used the household's personal computer for personal letter writing. Other uses varied from Bible study to a family newsletter.

Question 28 (Figure 31)

Households indicated a wide variety of sources of software. Most respondents indicated more than one source. The percentages below indicate the number of households who acquire software from each source:

Purchased at a store	80%
Mail order	55%
Write their own	98%
Copy from friends	66%
Hobbyist groups	49%
Other	16%

Many of the responses indicated magazine articles as an additional source of software.

Question 29 (Figure 32)

Only 28.1% of the households had experienced downtime in the last 12 months.

Question 30 (Figure 31)

Printers and disks had the highest level of response with 58.6% and 63.3%, respectively.

Question 31

Only seven households indicated use of an on-line information service. Two households subscribed to two information sources and one to three.

Question 32

28.1% or thirty-six households have purchased commercially written software which they no longer use.

Question 33 (Figure 33)

43.7% of the households have some member that has a graduate degree. Only two households did not have a member who had attended college.

Question 34 (Figure 34)

69.8% of the households earned between $30,000 and $60,000 yearly while 27.3% had a total household income of over $60,000.

Question 35 (Figure 35)

Thirty-six different occupations were listed by the households. Three households also indicated that its members were retired. Seventy-two

of the households indicated two principal occupations for the household. Of these eleven listed housewife/homemaker as an occupation.

Question 36 (Figure 36)

31.2% of the households indicated they planned no purchases of hardware, software or peripherals in the next six months. However, seventy-two households or 56.2% of the respondents plan to purchase software during the same period.

Correlation Between Questions

Correlation is a measure of the linear relationship between two variables. Several correlation computations were performed on the composite survey results.

Comparison of the average computer usage with other questions produced some interesting results. Question 18 asked for an estimation of the number of days per week of usage. Both question 14 and 15B which relate to cost of hardware and software purchased after hardware ownership had slightly positive correlation values.(Figure) We concluded that the more a household has invested in hardware and software, the more days a week it will use a personal computer. This positive correlation with hardware and software cost also holds true for questions 19 and 20 which contains hours of usage per week and for the weekend. However, there is no significant correlation relationship between usage questions 17-19 and future purchase activities question 36.(Figure 36)

Question 11 was divided into five different variables. Each of the five computer activities were totaled for each household. These totals which we will refer to as applications were then correlated with other questions. There was no statistical significance between question 17, last time of computer usage, and the 5 application variables. This was also true for

question 36, the purchasing activities for the next six months. Therefore, we can concluse that there is no correlation between current computer activities and future purchases and the last time of usage.

However, there was a positive correlation between all of the five activities variables and questions 18, 19, 20 which measure the weekly amount of computer usage. We therefore can conclude as should be expected, that as usage of the personal computer increases so will the activity in the five activity areas.

Word processing activity displayed a positive correlation with the amount of hardware and software that was purchased. The larger the cash outlay for hardware and software the higher the activity level for word processing. This was not true for the other four functions.

Analysis of the Survey Results

Composite results have provided us with some interesting observations. 76.5 percent of the households surveyed are relatively new users of personal computers. Many have probably purchased personal computers because of the mass marketing push and price wars. However, this rush into the computer age has been somewhat restricted. The majority of households own only one personal computer.

From our population one cannot make a distinction about manufacturer dominance. Several manufacturers such as Commodore had good showings in the home market. But Apple, which is primarily geared for industry and education performed extremely well. In those households that owned more than one machine, manufacturer loyalty was not a dominant trait.

Home computers have passed the hobbyist stage. While still a significant segment, the personal computer has passed from a hobby stage into the first stages of providing utility for the household. While this utility is

increasing, coding of software for personal computers has not been widespread among household computer users. One person per household is still the norm.

An increasing number of households are using personal computers to computerize record keeping. But a small number have advanced to a level of trust or expertise to perform computations in which they must assure validity. This is reflected by the low number of households using personal computers for tax computations. Tax computation is a good measure of population usage because it is an activity that the entire survey population must perform.

Our findings that 61.7% of the households use personal computers for games confirms and exceed findings of a 1983 Gallup poll which found that 51% of personal computer owners played. As in Gallup, this activity was the most recorded activity but programming activity had the largest composite activity [10].

Total cash outlays for hardware and software exceeded the expectations of this surveyor. The total estimated expenditures exceeded $312,000. This presents a mean investment of $2,441.68 per household in hardware and software.

Software purchases are higher after the purchase of personal computers than with the initial purdchase. This could be a reflection of two things. Households desire to increase the utility of the personal computer and the consumers inability to functionally perform in their first opportunity of unrestricted information processing. Maybe its too time consuming or demanding for the average consumer. However, our findings do confirm the willingness of consumers to purchase software. Software very well could be the "driving force in the industry"[36].

Average usage per household is much less than in the days of only hobbyist ownership. Hours of usage per week is not as meaningful a yardstick

of satisfaction as once could be expected. While 43% of the households used personal computers only 5 hours or less a week, 50% of the households met pre-purchase usage expectations. This lower per week household usage can be contributed directly to improvement in personal computer software and memory devices. "Canned Software" and expanded storage have eliminated much of the overhead that was originally associated with personal computer ownership.

Purchasing activities of both hardware and software display the expansion of the personal computer industry into all segments of consumer retailing. The industry can no longer be considered a cottage industry.

With over 50% of the households reporting word processing activities and the positive correlation with random and software outlays, one prediction can be made. As personal computers become common place, typewriters in the American household will follow the paths of office typewriters. They will be replaced by word processing packages. Further analysis of our results confirm this prediction in that 58% of the survey population already owns a printer of some sort.

Reliability of personal computer systems was surprisingly excellent. This could be a reflection of high quality in manufacturing and the low average weekly usage.

The appearance of on-line information service in several households reflects the aggressive attitude many personal computer owners take. On line services are predicted by many as the next major move of the industry[51].

While salaries and education levels of our population are skewed by the impact of Phillips Petroleum in Bartlesville, these findings are enlightening. Many manufacturers have expressed interest in marketing higher cost personal computers to the home computer industry. Many feel the

low end of the market is much too competitive and volatile to enter. Apple, which has marketed primarily to education and industry, has recently announced a portable Apple II. E. D. Cosby, Jr., marketing manager for Apple, says:

"The Apple II will be marketed to the serious high end user."[8]

Apple defines their user as primarily college educated professionals with school children. Apple's price is expected to be around $1200[28].

The characteristics of our population could not have been better described. As mentioned earlier in Chapter 5, Apple was surprisingly strong at second place in purchases for the population. With the mean hardware expenditure for our population of $2056 the new portable Apple II looks very enticing at a $1200 price range. The findings of this survey would support Apple's findings for this market niche. Mr. Cosby's prediction of 400,000 in unit sales by year-end appear very realistic.

Although the population contained 29 computer programmers the remaining occupations of the population were very diverse. People of all occupations are discovering personal computing technology.

What about potential purchasing activities of households which already own personal computers. 68% of the households planned purchases of software, hardware, or peripherals in the next six months. However, there was no correlation between expected purchasing activities and present computer usage. In essence, they were independent of each other. One can conclude that Vilo E. Henriques of Computer and Business Equipment Manufacturers Association may be right. . .

"Increasingly, people believe the personal computer is as necessary as the telephone or the TV."

1). How long has your household owned a personal computer ?

LENGTH OF HOUSEHOLD OWNERSHIP	FREQUENCY	PERCENT	CUMULATIVE PERCENT
LESS THAN 6 MONTHS	25	19.531	19.531
6 MONTHS TO 1 YEAR	22	17.188	36.719
1 TO 2 YEARS	51	39.844	76.563
2 TO 4 YEARS	18	14.063	90.625
OVER 4 YEARS	12	9.375	100.000

2). How many personal computers does your household own ?

NUMBER OF PERSONAL COMPUTERS PER HOUSEHOLD	FREQUENCY	PERCENT	CUMULATIVE PERCENT
1	104	81.250	81.250
2	22	17.188	98.438
3	2	1.563	100.000

3). What brand(s)/model(s) of personal computer(s) does your household own ? (e.g. AppleII, IBM PC, KayproII)

PERSONAL COMPUTER MODEL	FREQUENCY	PERCENT	CUMULATIVE PERCENT
TI 99/4A	26	17.219	17.219
TRS MODEL 4	2	1.325	18.543
TRS MODEL 100	1	0.662	19.205
IBM PC	12	7.947	27.152
COMMODORE 64	31	20.530	47.684
TRS 804A	2	1.325	49.009
APPLE II OR IIE	27	17.881	66.887
HEATHKIT	1	0.662	67.550
TRS 80 MODEL III	3	1.987	69.536
ATARI 800	6	3.974	73.510
KAYPRO II	6	3.974	77.483
ATARI 400	7	4.636	82.119
COMMODORE VIC 20	11	7.285	89.404
EPSON QX 10	2	1.325	90.728
COLUMBIA	2	1.325	92.053
HOMEMADE GS 100	1	0.662	92.715
VICTOR 9000	1	0.662	93.377
TRS COLOR COMPUTER	3	1.987	95.364
EXIDY	1	0.662	96.026
SYSCOM II	1	0.662	96.689
SINCLAIR ZX 81	2	1.325	98.013
APPLE MACINTOCH	1	0.662	98.675
IBM XT	1	0.662	99.338
TIMEX 1000	1	0.662	100.000

4). Is any member of your household a member of a computer hobbyist group ?

	FREQUENCY	PERCENT	CUMULATIVE PERCENT
NO	83	64.844	64.844
YES	45	35.156	100.000

5). How active is the most active member of your household in a hobbyist group ?

	FREQUENCY	PERCENT	CUMULATIVE PERSENT
NOT APPLICABLE	82	64.063	64.063
INACTIVE	14	10.938	75.000
ACTIVE	26	20.313	95.313
VERY ACTIVE	2	1.563	96.875
AN OFFICER	4	3.125	100.000

6). How many members of your family write software for use on your personal computer(s) ?

NUMBER OF FAMILY MEMBERS WHO WRITE SOFTWARE	FREQUENCY	PERCENT	CUMULATIVE PERCENT
0	12	9.375	9.375
1	74	57.813	67.188
2	39	30.469	97.656
3	3	2.344	100.000

7). Is a personal computer used for your family's personal finances ?

	FREQUENCY	PERCENT	CUMULATIVE PERCENT
NO	69	53.906	53.906
YES	59	46.094	100.000

8). Do you use your personal computer(s) for record keeping ?

	FREQUENCY	PERCENT	CUMULATIVE PERCENT
NO	51	39.844	39.844
YES	77	60.156	100.000

The following types of record keeping activities were recorded :

ACTIVITIES	FREQUENCY	PERCENT	CUM PERCENT
CHECKING / SAVINGS	11	6.790	6.790
LOANS	2	1.235	8.025
TAXES	12	7.407	15.432
STOCKS/BONDS	16	9.877	25.309
BUSINESS	9	5.556	30.864
UTILITES	6	3.704	34.568
LETTERS	3	1.852	36.420
COOKING	2	1.235	37.654
BUDGETS	13	8.025	45.679
MEDICAL EXPENSES	2	1.235	46.914
INVENTORY	18	11.111	58.025
MAILING/ADDRESS	16	9.877	67.901
APPOINTMENTS	1	0.617	68.519
INVESTMENTS	4	2.469	70.988
HOBBIES	2	1.235	72.222
BIRTHDAYS	1	0.617	72.840
ARTICLES	3	1.852	74.691
TELEPHONE NUMBERS	2	1.235	75.926
BILLS	2	1.235	77.160
CREDIT CARD CHARGES	1	0.617	77.778
DATABASE(S)	2	1.235	79.012
FINANICAL	4	2.469	81.481
PERSONAL EXPENSES	2	1.235	82.716
AUTO EXP/MAIN	3	1.852	84.568
CHURCH	2	1.235	85.802
GENERAL HOME USAGE	3	1.852	87.654
CLUB ACTIVITES	1	0.617	88.272
FAMILY TREE HISTORY	1	0.617	88.889
PORTFOLIO	1	0.617	89.506
RESUME	1	0.617	90.123
RECIPIES	2	1.235	91.358
WARRENTIES	1	0.617	91.975
SCHOOL	1	0.617	92.593
CORRESPONDANCE	1	0.617	93.210
VIDEO LIBRARY	1	0.617	93.827
RECORD LIBRARY	1	0.617	94.444
TIME MANAGEMENT	1	0.617	95.062
DOCUMENTATION	1	0.617	95.679
BOWLING / SPORTS	1	0.617	96.296
SCHOOL GRADEBOOK	1	0.617	96.914
BOOK FILES	1	0.617	97.531
LIBRARY	1	0.617	98.148
SOFTWARE DOCUMENTATION	1	0.617	98.765
PHOTOGRAPHY	1	0.617	99.383
ENGINEERING WORK	1	0.617	100.000

9). Do you use your personal computer(s) for tax purposes ?

	FREQUENCY	PERCENT	CUMULATIVE PERCENT
NO	79	61.719	61.719
YES	49	38.281	100.000

10). Did you or will you compute your 1983 income taxes using a personal computer(s) ?

	FREQUENCY	PERCENT	CUMULATIVE PERCENT
NO	99	77.344	77.344
YES	29	22.656	100.000

13). Do any of your children who reside at home have their own personal computer ?

	FREQUENCY	PERCENT	CUMULATIVE PERCENT
NO	116	90.625	90.625
YES	12	9.375	100.000

17). When was the last time someone used your personal computer(s) ?

LAST USAGE	FREQUENCY	PERCENT	CUMULATIVE PERCENT
TODAY	40	31.250	31.250
YESTERDAY	40	31.250	62.500
THE PREVIOUS WEE	25	19.531	82.031
DURING THE LAST	14	10.938	92.969
MORE THAN 30 DAY	9	7.031	100.000

14). Please estimate the total cost of your hardware(computers and peripherals) ?

MEAN HARDWARE EXPENDITURE	MINIMUN EXPENDITURE	MAXIMUN EXPENDITURE	TOTAL EXPENDITURES
$2056.56	$46.00	$11000.00	$263240.00

15). Please estimate the total cost of software you have purchased.

a) Amount bought with the initial purchase of the system(s)

MEAN INTIAL SOFTWARE EXPENDITURE	MINIMUN EXPENDITURE	MAXIMUN EXPENDITURE	TOTAL EXPENDITURES
$175.31	$0.00	$4000.00	$22440.00

b) All other purchases

MEAN POST SOFTWARE EXPENDITURE	MINIMUN EXPENDITURE	MAXIMUN EXPENDITURE	TOTAL EXPENDITURES
$209.80	$0.00	$2000.00	$26885.00

18). Please estimate the average number of days a week that your personal computer(s) is used ?

DAYS OF USAGE	FREQUENCY	PERCENT	CUMULATIVE PERCENT
1	29	23.387	23.387
2	16	12.903	36.290
3	11	8.871	45.161
4	14	11.290	56.452
5	23	18.548	75.000
6	31	25.000	100.000

4 HOUSEHOLDS DID NOT RESPOND

23). On the average, how many weekdays, Monday through Friday, are your household's PC's used each week ?

NO. OF WEEKDAYS	FREQUENCY	PERCENT	CUMMULATIVE PERCENT
1	40	32.520	32.520
2	22	17.886	50.407
3	22	17.886	68.293
4	18	14.634	82.927
5	21	17.073	100.000

5 HOUSEHOLDS DID NOT RESPOND

19). Please estimate the number of hours a week your household's personal computer(s) are used.

	FREQUENCY	PERCENT	CUMULATIVE PRECENT
0	2	1.563	1.563
LESS THAN 1	12	9.375	10.938
1 TO 5	42	32.813	43.750
5 TO 10	20	15.625	59.375
10 TO 20	31	24.219	83.594
20 TO 30	14	10.938	94.531
30 TO 40	4	3.125	97.656
OVER 40	3	2.344	100.000

2 HOUSEHOLDS DID NOT RESPOND

20). Please estimate the number of hours your household's personal computer(s) are used on Saturday and Sunday.

	FREQUENCY	PERCENT	CUMULATIVE PERCENT
0	2	1.587	1.587
LESS THAN 1	21	16.667	18.254
1 TO 5	65	51.587	69.841
5 TO 10	30	23.810	93.651
10 TO 20	7	5.556	99.206
20 TO 30	1	0.794	100.000

2 HOUSEHOLD DID NOT RESPOND

21). Please estimate the length of a normal computer session in your household.

	FREQUENCY	PERCENT	CUMULATIVE PERCENT
LESS THAN 10 MINUNTES	2	1.563	1.563
10 TO 30 MINUTES	15	11.719	13.281
30 MINUTES TO 1 HOUR	34	26.563	39.844
1 TO 2 HOURS	54	42.188	82.031
2 TO 3 HOURS	17	13.281	95.313
OVER 3 HOURS	6	4.688	100.000

22). Please indicate the time span in which your PC is used the most.

	FREQUENCY	PERCENT	CUMULATIVE PERCENT
	1		
6 AM TO 12 PM	9	7.087	7.087
12 PM TO 6 PM	19	14.961	22.047
6 PM TO 12 AM	98	77.165	99.213
12 AM TO 6 AM	1	0.787	100.000

1 HOUSEHOLD DID NOT RESPOND

24). Did you purchase your PC(s)

	FREQUENCY	PERCENT
IN A COMPUTER STORE	47	36.719
IN A RETAIL STORE	54	42.188
BY MAIL	22	17.188
FROM AN INDIVIDUAL	7	5.469
OTHER	10	7.813

25). Do you feel the services your PC(s) has provided your household have resulted in a monetary savings ?

	FREQUENCY	PERCENT	CUMULATIVE PERCENT
NO	105	82.031	82.031
YES	23	17.969	100.000

26). Please describe your household's personal computer usage.

	FREQUENCY	PERCENT	CUMULATIVE PERCENT
MUCH GREATER THAN EXPECTED	9	7.031	7.031
SLIGHTLY MORE THAN EXPECTED	13	10.156	17.188
ABOUT WHAT WAS EXPECTED	65	50.781	67.969
LESS THAN EXPECTED	33	25.781	93.750
MUCH LESS THAN EXPECTED	8	6.250	100.000

27). If your household uses a personal computer for word processing please indicate application areas.

	FREQUENCY	PERCENT	CUMULATIVE PERCENT
PERSONAL LETTERS	49	39.516	39.516
FICTION WRITING	1	0.806	40.323
BUSINESS LETTERS	5	4.032	44.355
REPORTS	13	10.484	54.839
RECORDS	1	0.806	55.645
EDUCATIONAL DOC.	1	0.806	56.452
SOFTWARE DOCMENTTATION	3	2.419	58.871
SOCIAL WORK	16	12.903	71.774
SALES	1	0.806	72.581
PERSONAL DATA	2	1.613	74.194
RESUMES	3	2.419	76.613
MEMBERSHIP LISTS	1	0.806	77.419
TABLES OF DATA	1	0.806	78.226
WORD PROCESSING	2	1.613	79.839
MAIL ORDER BUSINESS	1	0.806	80.645
CLUBS / ORGANIZATION	6	4.839	85.484
MAILING LIST/LABELS	2	1.613	87.097
WORK DOCUMENTS	2	1.613	88.710
CHURCH	3	2.419	91.129
ORGANIZATIONAL NEWS	1	0.806	91.935
FAMILY NEWSLETTER	1	0.806	92.742
PUBLISHED ARTICLES	1	0.806	93.548
THESIS	1	0.806	94.355
MISCELLANIOUS DOC	3	2.419	96.774
WRITING	2	1.613	98.387
CONTRACTS	1	0.806	99.194
BIBLE STUDY	1	0.806	100.000

28). Please circle any of the following sources from which your household gets software.

	FREQUENCY	PERCENT
PURCHASE AT A STORE	88	68.750
MAIL ORDER	55	42.969
WRITE THEIR OWN	98	76.563
COPY FROM FRIENDS	66	51.563
HOBBYIST GROUPS	49	38.281
OTHER	16	12.500

30). Please circle any of the following peripherals you own.

	FREQUENCY	PERCENT
COLOR MONITOR	19	14.844
MONOCHRONE MONITOR	45	35.156
COLOR TV USED WITH YOUR COMPUTER(S)	53	41.406
BW TV USED WITH YOUR COMPUTER(S)	22	17.188
MODEM/ACOUSTIC COUPLER	18	14.063
CASSETTE RECORDER	61	47.656
PRINTER	75	58.594
JOYSTICK OR GAME PADDLES	81	63.281
DISK DRIVES	32	25.000

29). Has your household experienced any downtime in the last 12 months?

	FREQUENCY	PERCENT	CUMMULATIVE PERCENt
NO	100	78.125	78.125
YES	28	21.875	100.000

31). Does your household use an on-line information service ?

	FREQUENCY	PERCENT	CUMULATIVE PERCENT
NO	121	94.531	94.531
YES	7	5.469	100.000

32). Have you purchased commercially written software which you no longer use ?

	FREQUENCY	PERCENT	CUMULATIVE PERCENT
NO	92	71.875	71.875
YES	36	28.125	100.000

33). What is the highest level of education attained by someone in your household ?

	FREQUENCY	PERCENT	CUMULATIVE PERCENT
SOME HIGH SCHOOL OR LESS	1	0.781	0.781
HIGH SCHOOL GRADUATE	1	0.781	1.563
SOME COLLEGE	14	10.938	12.500
COLLEGE GRADUATE	43	33.594	46.094
SOME GRADUATE/ PROFESSIONAL SCHOOL	13	10.156	56.250
GRAD/PROFFESSIONAL SCHOOL GRADUATE	56	43.750	100.000

34). Please categorize the household income bracket.

	FREQUENCY	PERCENT	CUMULATIVE PERCENT
$0 TO $20000	3	2.344	2.344
$20000 TO $30000	7	5.469	7.813
$30000 TO $60000	83	64.844	72.656
OVER $60000	35	27.344	100.000

35). Please list the principal occupation(s) of the household ?

	FREQUENCY	PERCENT	CUMULATIVE PERCENT
SYSTEMS ANALYST	22	11.000	11.000
COMPUTER PROGRAMMER	37	18.500	29.500
NURSING	4	2.000	31.500
SEISMIC PROCESSING	1	0.500	32.000
CAFETERIA MANAGER	1	0.500	32.500
HOUSEWIFE/HOMEMAKER	11	5.500	38.000
TECHICAN	8	4.000	42.000
RANCHING	1	0.500	42.500
GEOPHYSICIST	10	5.000	47.500
NOT LISTED	6	3.000	50.500
ENGINEER	26	13.000	63.500
CRAFTS	1	0.500	64.000
SALESMAN	2	1.000	65.000
SERVICEMAN	1	0.500	65.500
COMPUTER SITE ENG.	1	0.500	66.000
MANAGER OR SUPERVISOR	13	6.500	72.500
PHYSICIST	2	1.000	73.500
LAWYER	2	1.000	74.500
SECRETARIAL	3	1.500	76.000
ACCOUNTANT	4	2.000	78.000
COMPTROLLER	1	0.500	78.500
TEACHER	16	8.000	86.500
LOAN OFFICER	2	1.000	87.500
COMPUTER OPERATOR	1	0.500	88.000
WAITRESS	1	0.500	88.500
MATHEMATICAN	1	0.500	89.000
RESEARCH SCIENTIST	2	1.000	90.000
ARTIST	1	0.500	90.500
CHEMIST	7	3.500	94.000
GEOLOGIST	1	0.500	94.500
AUDITOR	1	0.500	95.000
CLERICAL	2	1.000	96.000
RETIRED	3	1.500	97.500
SOCIAL WORKER	1	0.500	98.000
DOCUMENTATION WRITER	1	0.500	98.500
WORD PROCESSING(S.E.)	1	0.500	99.000
TRAVEL AGENT	1	0.500	99.500
FIREMAN	1	0.500	100.000

36). Please indicate your household's expected purchasing activity(s) for the next 6 months.

	FREQUENCY	PERCENT
HARDWARE	27	21.094
SOFTWARE	72	56.250
PERIPHERALS	32	25.000
NO PURCHASES	40	31.250

11). Please list the household members who use your computer(s). Estimate the hours each spends weekly on the various activities listed below. If the amount is less than one hour please indicate the increment. If there is no activity please leave the field blank.

	Hours per Week				
Age	Programming	Word Processing	Acctg Fincl.	School/ Education	Games

MEAN AGE	MINIMUN AGE	MAXIMUN AGE	TOTAL NUMBER OF USERS
25.7	2	66	293

MEAN HOURS PROGRAMMING PER/WEEK PER/HOUSEHOLD	MINIMUN HOURS	MAXIMUN HOURS	TOTAL NUMBER OF USERS
3.80	0.0	25	150

MEAN HOURS WORD PROCESSING PER/WEEK PER/HOUSEHOLD	MINIMUN HOURS	MAXIMUN HOURS	TOTAL NUMBER OF USERS
2.40	0.0	40	97

MEAN HOURS ACCT/FINCL. PER/WEEK PER/HOUSEHOLD	MINIMUN HOURS	MAXIMUN HOURS	TOTAL NUMBER OF USERS
1.05	0.0	20	61

MEAN HOURS SCHOOL/EDUCATION PER/WEEK PER/HOUSEHOLD	MINIMUN HOURS	MAXIMUN HOURS	TOTAL NUMBER OF USERS
1.64	0.0	29	101

MEAN HOURS PLAYING GAMES PER/WEEK PER/HOUSEHOLD	MINIMUN HOURS	MAXIMUN HOURS	TOTAL NUMBER OF USERS
2.71	0.0	20	166

12). Please list the ages of all household members who do not use the computer(s) ?

MEAN AGE OF NONUSERS	MINIMUN AGE	MAXIMUN AGE	TOTAL NUMBER OF NONUSERS
25.02	1	65	115

NONUSERS	FREQUENCY	PERCENT	CUMULATIVE PERCENT
18 OR UNDER	44	38.261	38.261
19 OR OVER	71	61.739	100.000

CHAPTER 6: CONCLUSION

Several conclusions can be drawn from the household computer usage survey we conducted. The saturation level for personal computers has not been reached in the home market. The vast majority of households which have a personal computer own only one. While certain manufacturers faired better than others no one manufacturer has a dominant market position.

The American household has adapted a wide range of activities to the personal computer. No longer are personal computers used for only games or by avid hobbyists. Households are readily moving functions such as record keeping to personal computers.

However, consumers seemingly are not prepared to spend vast amounts of time developing software. On the average, only one person per family writes software for use on the household's personal computer. But, what consumers are willing to do is to make cash outlays for software. Most survey respondents had made some investment in software and a majority of the respondents expressed a desire to purchase additional software in the next six months. Consumers want increased utility from home computers. But they either lack the expertise or the motivation to gain such expertise. A home computer without software could be compared to a television set without an antenna or a cable hook-up. The utility of such a set would be limited.

Home computer ownership is now dispersed over a wide range of occupations and education levels. Most school systems, elementary through college, have personal computer technology. These facts along with the proliferation of personal computers in the business community and the tremendous increase in the availability of personal computer software allows one to draw the following conclusion.

The use of personal computers in the American household will become the norm rather than the exception.

As the next generation of children are exposed to personal computers in their education and as their parents are exposed to personal computers in their jobs, any anxieties or

second thoughts about the potential benefits of home computers will be greatly diminished.

What advances can we expect in the personal computer industry and home computer usage. First personal computers will continue to become smaller and yet more powerful. Currently, advancements in micro chip technology are the only roadblocks. Potentially, home computers will be connected to vast communications and computing networks. Therefore, households could have access to vast amounts of information.

Many analysts believe the advent of personal computers will push the American business community to accept the "cottage industry". It is estimated that by 1990 almost ten million at home workers will be employed in the United States[56]. State-of-the-art communications technology makes such a prediction realistic.

How will the computer revolution as a whole progress? Potentially there are no limitations. Again the revolution will progress only as fast as technology. Much work has been conducted on so-called "Fifth Generation Machines". Cray Research already has announced a prototype for its Cray 2 which is projected to be six to twelve times faster than any system currently in existence. Because of the tremendous cooling problem of a machine this fast, plans call for the submersion of the Cray 2 in a clear fluorocarbon liquid that has a consistency similar to salad oil. This machine which has been called a "fish bowl" will stand 28 inches high and 38 inches long [13].

How will the household be affected by future advancements in the computer revolution? This question cannot be answered. But one speculative point can be made.

American households will gain greater access to all phases of the computer revolution through the continued use and purchase of personal computers.

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