

A PROCEDURE FOR ANALYZING THE COMPUTER  
REQUIREMENTS OF SMALL BUSINESSES

by

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## CHAPTER 1

SMALL BUSINESS COMPUTER SYSTEMS (SBCS) --  
PERSONAL COMPUTERS, MICROCOMPUTERS

Computerization is one of the biggest challenges facing successful small businesses today. This is because many people, being unfamiliar with computers and computer terminology, are totally unprepared for computerization. By combining the successful small business owner's or manager's knowledge of the business with their desire to improve the business, a successful approach to computerization can be made.

This paper is intended to help small businesses interested in computerization. The paper does not pretend to teach everything there is to know about computers. Instead it provides a step-by-step procedure to determine the written specifications of a suitable computer system for a small business. It is aimed toward the small businessperson who is unfamiliar with computers, who is not currently computerized, who has not yet purchased a computer, but who feels a computer might enhance the business.

Definition of a Small Business Computer System

With rapid developments in modern technology it is becoming more and more difficult to categorize a type of computer in specific terms. Technology has increased the functional capabilities and storage capacities of computers in general and decreased size and price. The new smaller computers are as powerful as the typical larger computers but are slower in computation speed.

Corresponding with decreased size and price, computer use has increased. These trends have allowed computerization by many businesses who previously were unable to afford computers. The prices of small computers have become low enough to allow popular use. These small machines are further divided into two general types, small business computer systems and personal computers.

A personal computer is usually a general purpose computer, which is a standalone system, that relies on conversational interaction between itself and its user [DAT]. A general purpose computer is programmable and capable of working in a wide variety of applications. A typical personal computer system combines a general purpose computer with a keyboard for data entry and a CRT screen. Personal computers can handle a limited configuration of peripherals. Available peripherals include cassette tapes, diskettes, printer, etc. Prices range around \$2,000 or less depending upon peripherals added.

A small business computer system is not a specific piece of hardware. The term instead refers to the configuration or physical makeup and arrangement of equipment to be used. Basically a small business computer is an office machine that processes data entered by the user and produces calculations, reports, or graphs according to the user's directions. It can perform almost any record-keeping or information-handling operations that a business usually performs as well as perform many other desirable tasks that is not economically feasible to perform manually [DAT]. In contrast to a personal computer, a business computer system generally must produce hard-copy reports. These can be read and circulated within a business, a luxury not needed

in personal computer use. Because a business system also requires storage of large files and programs, disk storage is a necessity.

Small business systems vary widely in configuration and price. A typical price range is from \$5,000 at the low end to a high of \$100,000 [SEV]. It is obvious from this price range that the equipment configurations vary. A basic minimal system typically consists of a central processing unit, a keyboard/CRT unit for data entry, a disk unit for file storage and a printer for hard-copy output.

#### Brief History of Small Computers

The origin of personal and small business computers is relatively recent. It wasn't long ago that computers were thought to be machines of great mystery and only a few people understood them. For many years the only computers were large mainframes used by companies in the category of "Big Business".

Smaller, less expensive equipment was desired. This resulted in the development of the minicomputer. A technological breakthrough in the mid 1960's, the integrated circuit (IC) or computer-on-a-chip, permitted the creation of small computers. By the early 1970's small micro or personal and business computers became a reality. Since then many systems have been developed and made available for individual users.

Recent developments are larger main memories and cheaper disk storage. These developments have lowered the cost of small computers and made it feasible for the smaller businessperson to enter the computer world. It is likely that main memory and disk storage

improvements will continue. The desires of users and potential users has a significant effect on development issues. Future trends are discussed in greater detail later in Chapter 1.

### Current Applications of Small Business Computers

Typically small business computer systems have been used for accounting and business data processing. Increasingly as computers are becoming programmed to do more complex and varied tasks, they are being used to substitute for the tasks people once performed manually. Businesses also find that because of computer speed and accuracy they can generate reports that would not be cost efficient or time effective if produced manually. Once programmed, the computer can rapidly duplicate a task over and over as the data changes. Decisions made can now be based on information that is more current and extensive than that in manual systems.

Businesses have already expanded the use of computer systems into many areas of their companies. These include inventory control, and control over job costing and work in process. Billings, sales and revenue analysis are other areas which computers effectively handle. Businesses that must maintain records about people have found computerization very helpful. Potential use seems infinite and is only limited by one's imagination.

Business managers have found computers useful because they can make decisions with accurate, current computer produced information. Inventory can be controlled extremely closely because a computer can be programmed to give up-to-the-minute reports on extremely short order. A

manager can monitor how fast inventory is turning over or if it is moving at all. Programs can be written to allow a manager to project sales and estimate profits based on similar past sales and seasons. All this, properly used, increases profits.

Any business could benefit in a practical way from a properly selected and used small business computer system. It is basic business sense that if one can lower production costs without cheapening a product or expand services without adding overhead then profits will increase. A properly selected and used computer can help a company gain a competitive edge by:

- 1) reducing labor costs, by using computers instead of people;
- 2) increasing productivity, by means of reduced paperwork;
- 3) controlling escalating clerical expansion, by computerized filing and billing;
- 4) improving customer service, by publishing inventory reports;
- 5) better cost accounting, through constant verification;
- 6) reducing inventory, through closer inventory control;
- 7) enhancing management efficiency, through a management reporting system.

Improvement of any of the areas in the above list could increase a company's profits.

Another important computer use is data communication between computers. One method of communication is through the use of an acoustical coupler, called a modem, and telephone lines. A computer or terminal produces electrical pulses. A modem, connected to the sending computer or terminal, converts the electrical pulses (digital signals) into acoustical waveforms (sounds) that can be transmitted over telephone lines [CLI]. The user dials a designated telephone number

which is connected to the receiving computer. After the telephone connection is made, a high pitched tone is heard on the line. The user puts the telephone handset into the modem, and computer to computer communication is now complete. This capability allows a small computer to connect to other large computers and the wealth of data they can store. The use of the terminal and modem allows communication with a computer from any location with a telephone. This greatly enhances the use of the small business computer, as it becomes capable of communicating with and accessing the information from large computers. It could also be used to send information of small branches to the home office. A small business can expand its own computer system with the use of specialized equipment. This could enable remote terminal locations for immediate inventory update and faster processing of orders.

#### Users of Small Business Computers -- Two Distinct Types

There are two categories of computer users; scientific and business. While the uses are somewhat interchangeable, more efficient use will be achieved by consideration of the differences. A company needing a business application will be handicapped by a computer system planned for scientific use and vice versa. (See Chapter 1, Small Business Computer Systems are Sold Through Various Outlets and Chapter 2, How a Computer System Can Help Attain Objectives.)

Scientific applications have typically required small amounts of input data; large, numerous, and sometimes difficult calculations; and small amounts of output data. A scientific problem may have only 100 or

fewer input data values, but require processing of thousands of difficult formulas and produce only a few lines of output. Obviously the main concern in this type of problem is computational speed. Input and output device speeds are usually not critical because of the relatively small amount of data. Recently, however, scientists have been using computers to gather data. In these cases the input capacity requirement might be extremely high. Perhaps the main point here is that computer uses vary greatly even in a narrow field. Therefore each potential application should be carefully evaluated and specifically designed.

By comparison a business requires large amounts of input and output data and large internal storage capacity but less computational capability. Business processing needs are rapid and accurate input and output of data as well as fast access to stored data. A business may have 10,000 charge customers each having several transactions as input data values. A few simple formulas are processed, resulting in output of bills for each customer and many various reports with thousands of lines of print. Occasionally a business might require the use of more complicated algorithms. The typical business computer can handle these as accurately as the scientific computer, but it might take a few milliseconds longer. Typically the time it takes a computer system to perform a business transaction is a factor of the input and output device speed and the time to access the stored data. A computer's computation speed for business applications is usually so fast that it is not a factor in the overall time to do the task.

In any computer the internal speed of the processor and transfer rate of the main memory usually permits many thousands of calculations



per second. Input devices range from about 10 to 400 characters per second and output devices have a range of 10 to 500 characters per second [DAT]. The selection process will lead you to discover the capabilities you want in a computer regarding input, computations, recall, and output speeds and capacities. This in turn narrows your selection time because you only need to look at machinery that fulfills your needs. Similarly it facilitates dealing with salesmen because you can tell them exactly what you want.

#### Small Business Computers are Sold Through Various Outlets

Computer sales are booming. Everyone is getting into the act. You must consider other factors in addition to price and type of computer desired. These other factors include available software, availability of resource personnel, vendor reliability, whether the vendor is capable of assisting your firm's computerization or only wants to sell machines and etc. An examination of sales media may be profitable at this time, as it will enhance your knowledge of information sources and reliability.

Computer stores are specialty retail outlets operating as part of a local or national chain of stores. Most of these stores employ salespersons with considerable expertise who are capable of helping you determine how you can use a computer and how to assemble the various hardware into a configuration to meet your needs. In some cases they may even be able to help you with your software programming needs, or send you to a software programming house.

General merchandise department stores, such as Sears, Penneys, and Montgomery Wards also have computers and sometimes software for sale. Many of these stores conduct surveys to see how well their sales are going and to determine whether they will continue in this area. Thus, a department store may offer less long range support than a computer store. Further, department store sales personnel are not likely to have the same expertise as the computer stores' personnel.

Some office equipment dealers are entering the computer market. They have an established list of business customers, know the problems of small businesses, and usually have in-place service operations. They are already selling and servicing copiers, word processing systems, typewriters, etc. and have people available to handle the service end of the computers.

Large computer manufacturing companies are also entering the small business computer field. Some are offering systems through visiting sales personnel while others are opening retail stores. They have a large amount of in-house expertise from which to draw and usually have a sizeable user's group to help beginners. Because of large size and not having retail stores, large computer manufacturing companies are not as customer-oriented as the smaller independent computer stores. The buyer is advised to consider all these factors when he decides to enter the marketplace.

#### Current and Projected Market of Small Business Computers

In 1980 over 60,000 small business systems were sold. It is estimated that by 1985 over 500,000 systems will be sold and by the end

of the decade the number of sales per year will climb to over three million [DAT]. In the area of small minicomputers and microcomputers, the largest area of expected increase is in the small business computer. Areas receiving the greatest amount of attention in the business world will be merchandise processing, office automation, and point of sale. It is likely that the manufacturers will react to and prepare for these areas.

#### Future Trends of Small Business Computers

You, as a potential computer purchaser, should be aware that the future of computer design may have innovations as advantageous as the past development from mainframe computers to computers on a chip. Knowledge of these future trends in the computer industry will enable you to make allowances for future developments in your present purchases.

A significant development in small business computers is the capability of computers to be connected to one another and with larger systems by telephone lines. This was discussed in more detail earlier in this Chapter. This creates the ability to communicate with people and with the vast stores of information in data banks. Small electronic mail systems have been developed and will probably become more sophisticated and widespread with time. This will allow data transmission to and from large companies giving smaller businesses the advantage of greater resources.

Growth is also expected in the number of preprogrammed application packages that will be available to consumers. These will be designed

for general use rather than a specific company application, but may fit many users' needs. The areas of application covered are increasing daily. Many are being developed with graphic-supported capabilities and will utilize color display screens. Many companies needs will be satisfied by the preprogrammed packages while others may still require individualized programs. Both types of programming have their advantages.

Expansion of storage capacity has been an unending goal of designers. Recent developments show success in larger capacity and lower costs making it likely that this trend will continue. The advances from this point will probably be in design improvement rather than cost reduction.

As information volume increases so do information storage and retrieval methods. One method is a set of interconnected files forming the base of an organization's data processing system, and is called a data base [CLI]. Data base management and user inquiry systems are very popular. Data bases have already been implemented on small computers and show definite trends of continued research and development.

The anticipated growth of computer capacity and utility might cause you to pause before actually spending money. You naturally fear that another breakthrough is just around the corner, and that if you wait, you will be able to get the latest improvement for a similar price. It is urged instead that if you have determined that a computer can help your operation now, buy now. You can take advantage of improvements by dealing with reputable companies capable of designing computer improvements as add-on equipment to a basic system. Awareness of future trends should help you choose the equipment you want today.

## CHAPTER 2

### DETERMINING THE NEED FOR A SMALL BUSINESS COMPUTER SYSTEM

Managers may computerize their firms for a variety of reasons. For example if a competitor has a new computer and just landed a big job, one might ask, "Would that job be mine if I had a computer?" Or possibly a friend or relative has started selling computers and is pushing a purchase of his brand of computer. It is likely that some businesses computerize out of fear of being left out or appearing old fashioned. Perhaps inefficiencies have surfaced in your business. It is reasonable to wonder if a computer could correct these and make your business more profitable. Reasons to computerize vary and some are valid - some are not.

The computer industry is producing equipment for all types of operations. It is an expanding field, and more and more is being written about computers. Advertising about small computers and ways a computer can enhance businesses generally, is widespread on radio and other media. The same advertising makes computerization appear simple, inexpensive and appealing. It can be all three. Capable salespeople and other resource people are available to assist any business interested in computerizing. Nevertheless the company which plans its computerization in a logical manner will undoubtedly end up with a more usable system than the company which succumbs to the lure of the marketplace without planning.

A computer represents more than a financial investment. It represents a business reorganization. Each aspect of a business could feel some effect from computerization. Old procedures might be handled

in a new manner and personnel can expect to adapt a new style of handling data. For example, information once filed by hand may now be handled by the computer. New procedures should be developed to handle the change itself and new information needs. These procedures may include computer access regulations, security regulations, training and updating classes and a standardized format for accepting suggestions in the use of the computer.

As was mentioned in Chapter One, computerization of a business can change its direction. It may also accelerate change within the company. A capacity to handle a larger variety of inventory thus allowing faster, quicker, and expanded service may be noted. The computer will produce reports faster than hand tabulation, allowing up-to-the-minute administrative decisions using current information.

The decision to buy a computer should not be made lightly. It involves a major financial investment and deserves the same amount of research and planning that any other major purchase or investment would require. With the impacts on the business in mind, computerization should be done with great care. If needs and expectations are carefully analyzed and equipment purchases are matched to these needs, the result will be a personalized system, doing a personalized job.

Evaluation of your business for computerization requires certain procedures. Many sources listed the same or similar procedures for computerization, some mentioned the procedures in passing while others were more detailed and specific [BEN, BIG, BOC, CLI, COR, EAS, RAE, SHA]. These procedures have been divided into four main steps. These steps are outlined below based on an analysis procedure proposed by Cohen [COH].

As you proceed through these steps you will find they are interrelated. Some may be done concurrently while others must be performed in sequence. At some point you may find your ideas changing as your goals become clearer due to your analysis and research. This is excellent, but it means you must go back and revise ideas developed in previous steps. Your ultimate decision must be based on the elements of all the steps.

Each step must be written. It is important to remember that the decisions and ideas written down are to be based on business issues, not technical issues. This is because the idea is to make the computer do what the business wants and needs it to do, not to reorganize the business to fit a computer. By considering only business issues, documentation is created for future reference and the manager is forced to examine the business as it is currently operating. Sometimes writing things out puts a new perspective on ideas or exposes relationships that were not obvious before.

#### Step One: Written Long Range Company Objectives

The first step toward designing your specific system, one that will meet your needs, is writing down your business objectives. As a computer is considered a long-term investment, your objectives should cover the same relative time period [FRA]. Currently, your goals and objectives might only be thoughts in your head, general in nature and lacking specific steps to attain the goals. To say, "Make a Profit" is not enough. If you reread Chapter 1, Users of Small Business Computers, you will notice that basic computer needs and capabilities vary. The

purpose of this paper is to help select the proper computer system the first time around. We want the computer designed around the business, not the reverse. Thus you must decide and write out answers to these questions: What objectives do I seek for my business? At what point am I in attaining these objectives? How shall I continue to improve?

Each objective must be written, examined, and explained. With each objective you also need to state the areas in which you expect help from a computer. Some examples follow.

Goal: Better inventory control. A computer might provide instant data relative to amount of stock on hand. This would allow timely reorder and avoidance of overstock. By balancing orders with stock on hand, chances of error, theft, or overstock are reduced.

Goal: Reduction of clerical time. For example, a computer can both calculate and print a payroll thus reducing human work time.

Goal: Reduction of administrative time. By providing accurate reports in a constant format to an administrator a computer might reduce time required to gather data required for decisions.

Thus, areas in which a computer can be utilized can be imagined ad infinitum.

When examining objectives consider the effect computerization may have on the structure and personnel of your company. This may require value judgements as well as hard headed business decisions. Consider whether an elderly parts clerk will fit in harness with a CRT. If not, what will you do? Computerization must be sold to your personnel as a working condition improvement just as it was sold to you as a business improvement.

Therefore, when stating your objectives and goals, be both specific and realistic. You need a realistic evaluation of your current position, short and long-term goals, and definite reasons why or how a



computer can help meet those goals in order to decide if a computer is for you. You need specificity in order to make a reviewable fully analytic decision. Whether or not you then opt to computerize, you cannot help but know your entire situation better.

### Step Two: How a Computer Can Help Attain Your Objectives

The second step in computerizing is planning how to use the computer to meet your objectives. Probably, as noted in Chapter 1, the main purpose of the computer will be to provide accurate, up-to-date information. This information will give you the ability to make knowledgeable business decisions using current information. Therefore, list information sources, ways to ensure that the information is correct, and reasons that information is needed.

The big questions are "How will the computer help you?" and "What information does the computer need in order to provide the help?" For example, if your objective is to reduce Accounts Receivable you must first be aware of the totality of which your company credit policy is made. This might include typical credit terms, exceptions for certain buyers, verification methods for credit applications and etc. Then you must realistically decide how you intend to deal with problems. The computer system will do exactly what you tell it to do. Thus you can order general reports at any desired frequency, you can query for specific accounts at any time, or you can demand anything in between the extremes. If you wish, the computer can prepare and send reminders to late accounts or send printouts to your accountant, banker or lawyer.

The computer could even be programmed to reject or flag orders on delinquent accounts.

The above study of written long range objectives and how a computer can help attain them, lays the groundwork for the systems you will design and specify in your later analysis. Elements to keep in mind are each business objective or goal, the business activities needed to reach these goals, and the information the computer must provide to allow you to perform the activities.

At this point you define what you want the computer to do for you. Not what it can do, but what you will have it do. In Chapter 1 it was pointed out that a computer had to be programmed before it could do anything. When you decide how the computer will help you meet objectives, you simultaneously determine the programs that must be developed to implement the system. Remember that the creation of the programs is a technical and not a management task. Management determines what it wants and a programmer must then write the programs to make the computer produce desired results [FRA].

Stop! Don't run off to seek vendors yet. You are not ready! You have only laid the groundwork and the detailed analysis is to follow. There is still more work to do. The downfall of many computerization efforts occurs at this point. Buyers stop their study and preparation too soon. They buy a computer and then find it does not fulfill all their needs. Others start talking to salespeople only to become confused and uncertain about computers in general.

Even experienced buyers should enter the market place at this point with great caution. Indicate to sales personnel that you are only shopping and are a long way from buying. Tell them you have not yet

defined your needs and expectations. You only want to learn from them, listen to them, talk to them, or go to their sales seminar to learn. In this way, if you decide against their machine you may avoid ill feelings. Simply bear in mind the obvious, a salesman's job is to sell.

This is also a good time to gain all the information you can about computer services. Information is abundant. Talk with other computer users. Seek out similar businesses who have already computerized and talk to the person who is responsible for working with their computer. Most businesses have similar activities, receivables, payables, etc. Find out how others handle these activities. Many seminars are given on small business computers systems, attend these. Gain all the information you can. Go one step further. Write down what you learn. Remember by including all you know now and by proceeding cautiously you reduce the chance of future errors. Computer prices are not increasing with inflation and computers are being improved daily. Improvements include more storage capability, larger memory and faster CPUs. If you are planning properly, time is in your favor.

### Step Three: Resolving the Emotional Factors in Computerization

The third step in computer selection involves emotional factors and how to handle them. You may or may not be aware of your feelings. You might even wonder what role your emotions play in computer selection. Most people are aware that previous experiences have caused strong feelings that direct emotions to the positive or negative side. These

feelings need to be examined to uncover the role they play in your final decisions.

In the opening paragraphs of this chapter, the business decision making procedure and the need for logical thought and research was discussed. Use the same procedure to resolve emotional aspects of computerization. Write down and analyze your feelings. Examine your thoughts and how they relate to your decisions. Emotions and logic are often closely related and many intuitive reactions are very logical. In many cases you may find your emotional feelings valid and useful. By putting your feelings on paper, you may also bring to the surface feelings of which you were only vaguely aware. Examine your feelings. Be aware of the effect they might have on your decisions.

Some common emotional factors that are involved in computerization include data privacy, personnel changes, and etc.

Data Privacy. Will the changed security of your data files bother you? You will need to decide who will have access to files, whether a special security system needs to be designed to keep a nosey employee, client, or competitor from accessing the system, and etc. If you plan a system with several input/output stations, you might want a security interlock on the system to prevent sabotage or error from entering the system from a remote CRT.

Personnel. Can your loyal personnel be retrained--if not can they be reassigned or must they be let go. Can you afford the cost of retraining and temporary low productivity during training.

The Machine. Can you deal with a machine? Machine expense though concededly generally less than human expense is nonetheless real. Machines need maintenance and repair and occasional replacement.

Computers can run for three shifts without tiring, 365 days a year. Can you utilize this capacity?

Computer Control. Who will control the computer? Will you believe the reports? Will you feel the computer is calling the shots and you are being left out? Again, decisions need to be made. Determine how you are going to handle the control and day-to-day running of the computer.

Ownership. Do you want to own a computer for ego needs, a tax benefit, or efficiency. Write down your reasons and acknowledge them for what they are. They might all be very valid, but they might not.

Competitor's Influence. Are you going to purchase the same machine your friend and rival company did? If so it may not suit your needs. In fact if he didn't go through a process similar to that suggested here, his computer might not suit his needs. Perhaps you want a bigger, more expensive computer as a showpiece or to allow for growth. Examine and document your feelings and objectives. Sort them out. Bigger might be better or simply more expensive.

Glamour and Prestige. Do you plan to impress clients with the fact you are computerized? If so the physical appearance of the system will be important to you. On the other hand, maybe your computer will be most effective in your warehouse or supply area, where the physical appearance is not as important.

Influence by Relatives or Friends. Are people you are close to pressuring you to purchase a certain system? This makes it hard to objectively select the best system to suit your needs. If the individual is really a friend he will respect your rights and tell you if his machine will meet your needs.

Whatever your emotional leanings, an analysis will help you deal with them and see them as they are. If they are childish and unimportant, you can discard them. If on the other hand they are deeply rooted in common sense, they should be treated with respect as they evidence reality. At any rate, having classified your emotions, you can proceed, understanding their effects on you as a potential purchaser.

#### Step Four: Determining a Company's Ability to Use a Computer System

Step four in the logical process of computerizing is determining the real ability of a company to install and implement a computer system. A computer is an instrument that requires a disciplined approach for effective, efficient use. This means the using company must be disciplined as well.

Company discipline in the computer sense means systemization of routine and records. This requires organization, plans, and control, as well as command attention to see that the plans are followed. One purpose of these plans is to direct information to the computer. The situation to be feared is where the computer receives incomplete or incorrect input. This results in bad information and reports to the decision maker. This situation can be avoided somewhat with proper programming. However, efficiency is gained by a standard operating procedure which directs and forces correct input to proper terminals. A proper program will still search for errors or omissions, but finding none, will print correct, timely, data the first time. If incorrect or incomplete data is discovered, a planned procedure directs backtracking to the originator of the data. This facilitates correction and directs

attention to problem areas. Thus, discipline not only aids the computer operation, but may smooth the entire business operation.

In small businesses the president is often the worst offender against discipline. For example if a schedule is set, it may be changed frequently. Records may not be recorded systematically, or delegation of responsibility may be sporadic. Effective computer utilization requires that written systems be in effect and routinely followed. This may be hard to do because the small business owner might carry the knowledge of the business in his head rather than having written routines. Business directors must learn that information carried in their heads and not computerized leads to incomplete reports. While it is possible that they can then extrapolate correct reports by allowing for their own internalized data, the reports become worthless or even dangerous when read by one who lacks the added knowledge. This also causes other employees to lose respect for the system. Basically they see the decision maker make a choice which seems incorrect in light of the printed data. They can reasonably conclude either that the data is of no use, in which case they will not work to maintain it, or that the decision is wrong in which case they lose respect for the decision maker.

Three areas needing examination to determine the ability to use a computer system are data, organization, and personnel.

### Data

Earlier in Step Two, tasks were developed to help achieve company objectives. In order to complete these tasks certain information must be available to the computer. Verify that the needed information is currently available. If not, develop a system to supply the information.

The referenced information may as well be presented to the programmer in terms he can use. Computers are number oriented. This means the company should be number oriented. Something frequently overlooked is the use of item or part numbers. These are used for both inventory and ordering. Billing requires account numbers for customers. If a company is not number oriented, a delay may arise in getting a system operating. The company needs to examine its ability to provide a numbering system and then decide how the system would be implemented. Probably a good salesman can help here. This might be an area where another company's system can be superimposed on your own or modified to fit your needs.

### Organization

To insure a smooth flow of information, a system must be established for the collection and processing of data as input and for utilizing the reports that come from the computer. Information normally flows along organizational lines. An organization chart could be used here. Initially be generous with information supply, solicit employee advice. Then later, you can discover ways in which you can economize on reports.



## Personnel

The personnel aspect requires that the right person be in the right place to manage data and the computer itself. This requires delegation of authority. It also may mean upgrading of personnel. This is done by retraining current employees or by hiring new employees with a computer background or computer experience.

To effectively use a computer, a business manager must understand his personnel. He must evaluate their abilities, their relationships, and their needs. Computerization may represent a threat to employees. They may fear losing their job, either by being replaced by the computer or not being able to adapt to the new computer system. Many people are afraid of change and lack the ability to adapt to change.

Employee ability needs consideration. Do key employees have the necessary aptitude to use the equipment and reports produced? Consider how much training will be required to make the transition from manual operations to computer operations. Think of how the training might take place. Determine the roles employees might be involved in when development and implementation occurs.

Employee relationships need to be evaluated and strengths and weaknesses assessed. Computerization often means the sharing of information. A rivalry in your business between employees or departments is a potential problem spot. A computerized business takes cooperation, it is a team effort. Files and reports are often shared as information overlaps departments. Emotions must be replaced by logic. Management must help resolve conflicts and encourage cooperation.

Consider the employees' motivation level and morale. Human factors should not be underestimated when computerization is being planned. The

manager must be aware of the employees needs and fears and be responsive to them. If a spirit of unity and teamwork can be established, the transition process is almost sure to be positive. The attitudes and capabilities of the people involved can make or break a system.

Through this step of the planning process, the manager needs to take detailed notes when examining and evaluating the company's present situation. If any of the basic areas of data, organization and personnel are lacking in discipline, the manager must determine the steps necessary to establish those disciplines in order to begin the implementation process.

At this point in the process, one should have comprehensive reports stating (1) business objectives, (2) how a computer can help attain the objective, (3) emotional factors involved with computerization and (4) the firm's structural, human, and systems capabilities to computerize operations. Remember all four of these tasks are business problems, not technical problems.

Having determined the need for a small business system and having examined and evaluated the business as a whole, it is time to turn attention to the current procedures and document the information requirements of the system. This too requires primarily a knowledge of the business and an intimate knowledge of the business operations. Involving personnel in this step may lead to greater involvement, higher morale, and unity needed for successful planning and implementation of the proper computer system for the company.

## CHAPTER 3

### DOCUMENTING THE INFORMATION REQUIREMENTS

Analysis and documentation of a business's information requirements is a comprehensive process. Many businesses often perform this step after they have purchased a computer rather than before. By completing this process before the selection of equipment the needs of the company will be defined in terms both the company and prospective vendors will understand.

Analysis and documentation is a critical step in the computer selection process but it need not be overwhelming. By using the following guidelines each company can structure the documentation to their individual situation [COH].

Recording information needs before equipment selection helps to avoid errors of too little equipment, too much equipment, or the financial drain of constant conversions. Record the information needs. Write down company sources and uses of data, trace the flow of information inside the company, and design the systems to provide the necessary flow. By doing this the size of the system requirements, in computer terms, will be determined. Analysis and documentation step provide the answers for the following questions.

1. What kind of information is needed?
2. What form must the information take?
3. From where will the information come?
4. How much information is needed?
5. How often is the information needed?
6. How will the user communicate with the computer?

Businesses vary widely and the method of documenting will also vary. The procedure of analysis and documentation that follows is applicable to most businesses but will need some minor alterations to

fit individual situations. It is written for a business as a step-by-step guide which will usually direct progress in the most efficient manner.

### An Analysis of Current Business Procedures

An analysis of a company's business procedures is a mechanical step that should be done by someone in the company who is very familiar with the procedures. It does not require a programmer. This analysis requires knowledge of the company rather than a technical knowledge of the computer. Depending on the company size one person may not be able to handle this operation and you may want to delegate this step to several employees. If so to insure a complete accurate document you will want a capable, knowledgable person as coordinator. The bookkeeper would probably analyze all the accounting transactions. The department heads might document the inventory procedure. Service managers would likely prepare the section involving the ordering of repair parts and forms presented to the bookkeeper for billing. It is essential that the procedure go full circle, thus the need for a coordinator becomes obvious. Only a few of the possibilities have been listed, but each company will have to adjust the analysis procedure to fit its needs. To be analyzed properly your company's current procedures must be expressed in terms meaningful to the company and to prospective computer vendors.

By the time you are ready to analyze the procedures of your company you should be ready to examine every aspect of its operations and the information flow necessary to make it run smoothly. New ideas and reports or procedures may evolve at this point. These verify the need

to evaluate all procedures both separately and as they interrelate. Thus this examination not only helps to computerize but also helps evaluate, modernize, and improve your business procedures.

The analyzer should make a list of the relevant data items in each procedure to be computerized. A list or outline form is simpler and more precise than a written report at this stage. Include everything you or any of your employees feel is important. The main concern is to include everything that is necessary to run your business the way you intend. You must assume nothing. Each area of the business must be examined completely and objectively. The planned new system should maintain and improve the flow of information while adjusting to special requirements of the computer. Duplication or irrelevant items will be handled later when the list is developed in detail.

Matters that the analyzer should consider for maximum computer utility should be included in the list. Matters of policy need to be considered. These include such things as how overdue accounts are handled and how employee absences are recorded. This would be a good time to evaluate policy matters and make changes if desired. Make a list of reports the computer is to produce. Include special formulas needed by your business. Specify the way you want to interact with the computer.

As the list is developed you may find some areas fall into a category which we might call, "Everybody performs this operation," and feel a prewritten 'package' will suffice. Analyze this area with care. Packages are designed and programmed for general use. You want to ensure this package performs all your functions and is capable of producing all the reports needed to interrelate or make decisions.

Buyers sometimes fail to scrutinize these areas because they assume it has already been done when the package is written; this may be untrue. Packages are general, you are specific. You must know if the package will satisfy your needs, so analysis is still needed.

### Expansion of Analysis into a Detailed Outline

As you continue to develop and design your system you will be working with reports, flowcharts, files and input (CRT screens). (See Appendix 2.) These should be developed concurrently because they are so interrelated. Cross-referencing assures naming consistency, inclusion of every piece of needed data and elimination of duplicate data.

Cross-referencing can be simplified! Set up a notebook with the four separate sections; reports, files, inputs (CRT screens), and flowcharts. As mentioned earlier since these sections are developed simultaneously their order in the notebook is not important. Individual preference can direct which comes first in the notebook. Each of the four sections will first be briefly described and followed by a detailed description.

The flowchart section should be made up of a flowchart with a heading and number for every included procedure. Analytic and explanatory material should be included with each flowchart for reader clarification.

The CRT screen (or input) section should include all the different forms on which the original input data is gathered. Each input document that will be displayed on the CRT screen should be numbered with a C-Prefix and a sequential number.

The files section follows a similar pattern. Use an F-Prefix and sequential numbering to identify individual files, for example an Accounts Receivable file number would be, F-1.

The reports section handles all the reports the computer is to produce. The reports should be labeled with an R-Prefix and a number in sequential order.

Coordination is needed. Return to the flowcharts and record the corresponding number for each file, report, and CRT screen. Note that one file, CRT screen, or report may appear on several flowcharts. Thus changes in one section may cause a change in another section. By careful comparison and coordination of sections you will discover errors, omissions and faulty logic.

#### Flowcharts-Data Flow-Section

A flowchart is needed for every procedure you are going to computerize. The flowchart does not need to be elaborate, but must be accurate. It is a map, simply used to follow data input on a CRT screen, files that are accessed, and the reports to be generated. It includes all of the data flow from input through output on the flowchart. The flowcharts' purpose is to show the relationship between all the data elements in a given procedure. It shows the data flow through the system, how the elements are interconnected, what the controls are and where they are needed. Like a map, well designed flowcharts utilize symbols for simplicity and universal application; therefore insist that standard computer symbols be used. The examples will be shown in computer symbols which are available in template form.

(See Figure 1.) To construct flow charts you must consider four elements.

Element One. How do you intend to give information to the computer, where does the input data originate, and what does the CRT screen format look like? The data will probably come from some document. For example if an Accounts Receivable payment is received, the customer name or number, amount of payment, invoice number, etc. will be provided by a document. The CRT screen will display what the computer prints or prompts and what data the operator needs to enter.

Element Two. What files are needed? Every file involved with this procedure must be shown.

Element Three. What reports are produced in the activity? The reports must be shown. This allows the analyzer to verify that all necessary data is available from input or accessible from files to produce the reports.

Element Four. What do you expect to happen to that information? Include a brief note as to why the reports are produced. This builds in a double check on whether or not a given report is needed. Further, a computer system must include controls to account for human error just as your current manual system has controls. When files are changed, updated, or deleted (file maintenance) an "audit trail" should show a "Before" and "After" appearance of the file [SCH]. Thus the flowchart should direct the viewer to other aspects of the computer operation in order to allow verification of each step as information changes. For example, an aspect of control is avoidance of fraud or error. When a transaction is recorded, such as payment received or paid, a report



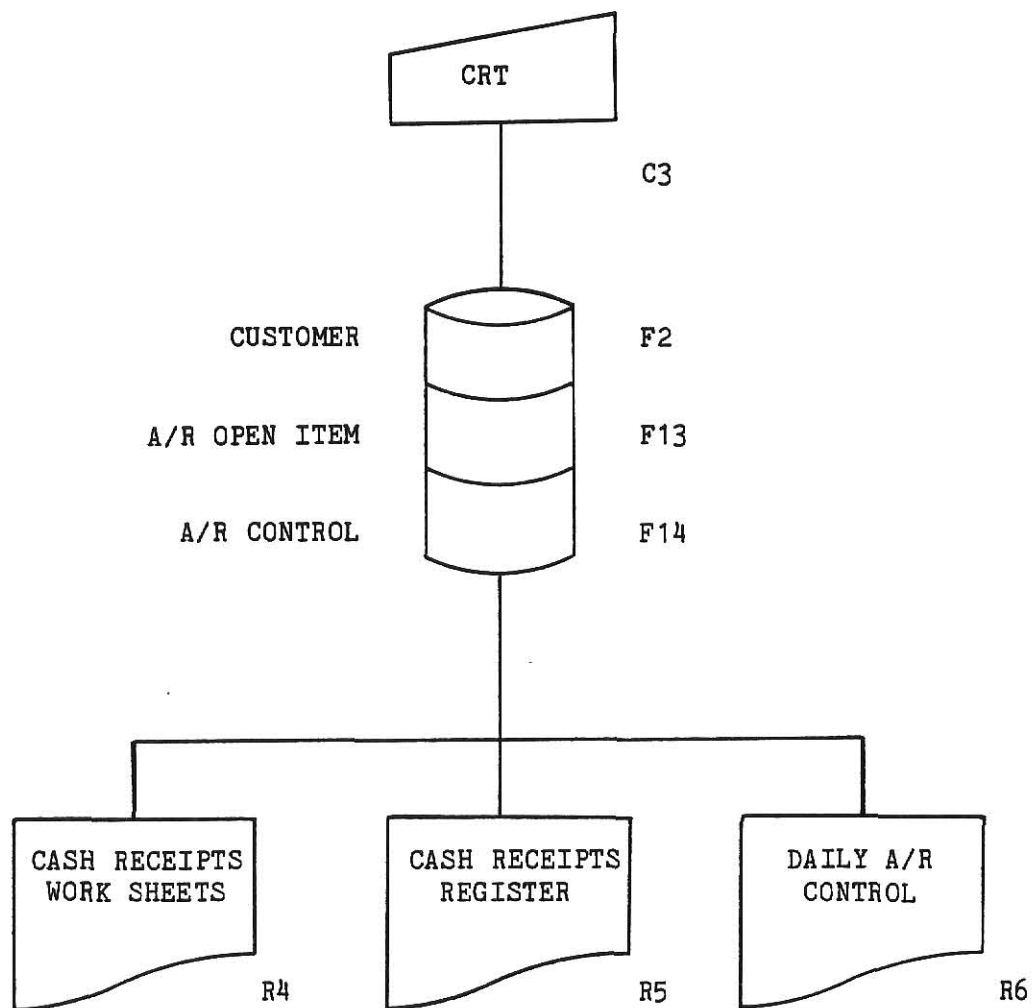


Figure 1. Flowchart for accounts receivable, cash application [DAT]

Cathode ray tube (CRT) shows data input screens. Disks contain the master and working files. Reports show the data output.

should be made to show whether the account balances. This control step might instigate more reports than originally planned.

### Reports

Your report outline must include every detail, nothing can be assumed or left out. As you design the report, remember that the programmer is only responsible for what is described to him.

An extremely detailed outline showing every aspect of the report you are going to computerize is needed. It must include all pertinent data, headings, columns, total indicators and subtotal indicators. The same outline should also deal with the sequence and number of lines and any unusual features or unique computations in the report. Output timing control, governing frequency and regularity of report production, is also necessary.

An output format of the report should be made. It cannot be stressed often enough that everything thought essential should be included. For realism, use actual titles where titles remain constant. Represent data that varies with X's to show the formal formatting. If computation is to be performed or if figures are to be listed the formatting may be done with 9's to indicate numeric data. Details can also be handled by utilizing actual data to construct the report.

Some headings and columns do not cover all necessary details. Special comments must be included somewhere on the report to cover these details.

As examples, the production timing of reports must be shown. Production timing shows whether this report is produced weekly, monthly,

daily or on demand. The number of ways the report may be produced must be decided, as the report may be produced for every individual account, by department charges, or by the divisions. If the report needs a capability of grouping accounts into departments, referred to as rolling up departments, and then showing subtotals by department with company totals, plan it now. All of the above is necessary for complete, accurate report generation. (See Figure 2.)

Explanation of the Sample Report, Figure 2. The computer will print the report showing the name of the division, the customer's number, and the customer's name. The report will show all open (unpaid) invoices, and for each will show the invoice number, the invoice date, the invoice amount (originally billed), the amount applied to date (cash received and/or discount taken), and the balance due. The column headed "Amount to Apply" and the column showing "Discount Allowance" will be used for the accountant to record the amounts of money to apply.

The report will be printed by division, by customer, and then showing each invoice. All open invoices will be shown. There will be totals entered for the invoice amount, the amount applied to date, and the balance due, for each customer.

Finally, this report is prepared on demand for each customer from whom a check was received and where investigation is deemed necessary by the Accounting Department prior to recording the transaction on the computer.

Reports also assure that all the files are available to produce the reports. Therefore, you must verify that the computer has all the data

DIVISION \_\_\_\_\_ DATE MM/DD/YY Page XX  
 CUSTOMER NO. \_\_\_\_\_ CUSTOMER NAME \_\_\_\_\_

1	2	3	4	5	6	7
INV. NO.	INV. DATE	INV. AMT.	APPLIED TO DATE	BALANCE	AMT. TO APPLY	DISC. ALLOW.
XXXXXX	XX/XX/XX	\$XXXXXX	\$XXXXXX	\$XXXXXX	A	B

C D E

- \* Record A, B
- \* By Customer, By Invoice
- \* All open invoices will be shown
- \* Totals by Division and Customer on C, D, and E
- \* On demand

Figure 2. Cash receipts worksheets [DAT]

needed by that report. This requires cross-referencing with files and CRT screen.

### Files

Construction of files, and files themselves are a major step in moving toward computerization. Files store data to produce reports. Therefore all data needed for reports must be available to the files from input or by internal computation. Logical and complete files ease file access and enhance report generation. Remember, computer files are basically no different from the files you are currently maintaining manually except they are located in the computer. Therefore you must interact with the computer to retrieve the information. Logical structuring of files reduces access time. However, while logic is important, don't worry about technical accuracy which is the programmer's job. Instead, worry about completeness. This is essential to good reports.

Earlier in this paper it was explained that reports require files, and files must be designed to fulfill reports. Thus by examining all requirements of reports you have decided to produce, you will be able to determine the number and types of master files needed and all the data elements needed in the files.

Now you must determine the volume of space required to store each file. This will be an estimate rather than an exact requirement because you must allow for changes and expansion. To estimate needed space properly, break each file into records, each record into elements, and then describe and measure the elements. The total of the space required

for all the elements of the file is the basic measure of the file size. An example of the steps to follow in file development are shown below.

Step 1: File Order. Using an F-Prefix, number each file sequentially in the upper right-hand corner.

Step 2: File Nomenclature. Give each file a name. Verify consistency. Check everywhere the file is used to see that the name is correct. Use the flowchart to assure the name used there is the same as in the file section.

Step 3: Number of Records. List the largest number of records expected to be in the file at any one time.

Step 4: Data Element Size. Accurate space allocation for data elements is important. Data elements in the record should be listed in sequence and each element named and numbered. List the size and type of each element. You are now concerned with computer storage so allow for the largest expected size and all anticipated growth. An error in estimation could cause significant reprogramming.

Special considerations include:

- A. Punctuation. Punctuation will be produced per your report specifications as the report is printed. Since the computer uses its own form of punctuation representation and does not store commas or periods, do not include punctuation in your space count.
- B. Data Element Type. The type of data to be in each element must be specified. If it is alphabetic only, (letters), designate it as "A". If numeric only, (numbers), designate it as "N". If alphanumeric, (both), designate it as "A/N".

C. Numeric vs. Alphabetic. Some computers act differently on numeric data than on alphabetic data. If the computer is to compute interest on the data element known as, account balance, the largest allowable finance charge must be assumed and the type numeric must be specified. If the largest possible charge is \$999.99, a five character field is needed for numeric data.

Step 5: Explanatory Material. If the data elements are not self explanatory, notes or examples should be included in the file description. If you have used a coding system this is the place to describe the code. Printing styles may be included here as well, show how output is to be printed including punctuation.

Step 6: Record Size. The total space requirement of all data elements, including slack requirements is the finished size of each record in characters. Record this total figure at the bottom of the data file description.

Step 7: File Size. At this point it is wise to again add still more buffer space to each record to account for unforeseen increases or simple omissions. The amount added depends on the comfort zone of your estimation and evaluation of space in Steps 3-6 above. Too little space may require costly readjustment. Place this new record total at the top of the page where record size is indicated. Figure the total characters needed for this file by multiplying the size of record by the number of records. (See Figure 3.)

File Number F-2Page 1 of 1Date 9/3/81

## DATA FILE DESCRIPTION

File Name Customer MasterNumber of Records 4,000Record Size 225Total Characters 900,000

Comments \_\_\_\_\_

1 ITEM NO.	2 DATA ELEMENT	3 SIZE	4 TYPE*	5 NOTES
1	CUSTOMER NUMBER	5	N	
2	CUSTOMER NAME	25	A/N	
3	ADDRESS #1	25	A/N	
4	ADDRESS #2	25	A/N	
5	ADDRESS #3	25	A/N	
6	STATE CODE	2	A	
7	ZIP	5	N	
8	DIVISION RESPONSIBILITY	15	N	5@3
9	SALESMAN RESPONSIBILITY	15	N	5@3
10	CUSTOMER TELEPHONE	10	N	XXX-XXX-XXXX
11	CREDIT CODE	1	A/N	
12	CREDIT LIMIT	5	A/N	
13	CREDIT TERMS	5	A/N	
14	STATEMENT CODE	1	A	
15	PRICE CODE	1	N	1-Special
16	MULTI. DIVISIONAL CODE	1	A/N	
17	PRIOR YEAR SALES DOLLAR	10	N	
18	CURRENT YTD SALES DOLLAR	10	N	
19	CURRENT MONTH DOLLAR	8	N	
20	TOTAL A/R BALANCE	8	N	XXX,XXX,XXCR
21	DIVISION CODE	3	N	.
22	NUMBER OF INV. COPIES	2	N	
TOTAL		207		

\* A designates alphabetic data only.

\* N designates numeric data only.

\* A/N designates both alphabetic and numeric data.

Figure 3. Data file description for the customer master file [DAT]



## Inputs

Most small business computers accept information, which is input data, from cathode-ray tubes (CRT), television-like screens, so the information discussed here will pertain only to CRTs. Most of the data in your master file will come from input data. A CRT screen should be made of each source document that collects the data you want in your files. You are making a format which will be used to convey information. CRT screens are similar to reports but not as column oriented. Each CRT screen is given a name and number using C as a prefix for CRT. Be certain the names and numbers are consistent on screens and flowcharts. This is done by preparing charts similar to the detailed report outlines. (See Chapter 3, Reports and Figure 2.)

The charts will contain all the data each CRT screen will display. Picture the CRT screen as a preprinted form similar to your source collection document. The computer provides certain sections called prompts, similar to the preprinted data on the source documents. The user fills in the data or answers the prompts with data that was recorded on the source document.

When you use CRT screens you are interacting directly with the computer. Some code is needed to distinguish between the information the computer provides and the information you as the user enter into the system. You also want to be able to change certain data in the files so still another distinction is needed. The preprinted part of the screen display is just that, printed exactly as it will be seen. You might use XX's to represent data the computer supplies from files. The data supplied from source documents by you, the user, might be represented by

\*\*\*'s. The changeable data might be shown as A's. An example of changeable data would be address.

Each CRT screen should contain a demand for accuracy by the user. The technical term for this is, "Verification of input data." When your system is up and running and you are entering data, when each CRT screen is completed with all the input data, it should be verified for accuracy before being entered into the computer's files. A question, "Is all information correct?", is followed by an order, "If so push 'Enter'." If the user wishes to correct any data, the user answers, "No." This system requires the user to verify all the data entered by the user. This should increase the computer's accuracy which in turn will make your records more accurate. (See Figure 4.)

#### Current and Projected Data to be Processed in Terms of Hardware Procurement

Now that you have analyzed your business and made a notebook for your reports, files, CRT screens, and flowcharts it is time to determine your needs in terms of actual hardware requirements. You have already done most of the ground work. In this section you are concerned with the amount of data you will be processing. To determine equipment requirements you need to look at three specific areas - disk storage, input, and printing.

To estimate transaction volume, and so be able to estimate capacity requirements, use your knowledge of your company's peak and average work load. Transaction volumes, which dictate the computer size and associated costs are an important aspect in the over-all analysis. The data volume is significant. In some businesses, it may be absolutely

CASH APPLICATION

---

CUST. NO. \*\*\*\*\*

CUSTOMER NAME   XXXXXXXXXXXXXXXXXXXXXXXXXXXX  
ADDRESS           XXXXXXXXXXXXXXXXXXXXXXXXXXXX  
                  XXXXXXXXXXXXXXXXXXXXXXXXXXXX  
                  XXXXXXXXXXXXXXXXXXXXXXXXXXXX

INVOICE NO. \*\*\*\*\*

---

INVOICE DATE:   XX/XX/XX  
INVOICE AMT.:   \$X,XXX.XX  
AMT. PD. TO DATE:   \$X,XXX.XX  
NET DUE:       \$X,XXX.XX

AMOUNT TO APPLY:   \$,\*\*\*.\*\*  
CK. OR REF. NO:   \*\*\*\*\*  
CASH DISCOUNT:   \$,\*\*\*.\*\*

ACCEPT, REJECT?   (CR,R)

---

Figure 4. CRT screen displaying input from cash application [DAT]

necessary for the computer to handle peak loads as they occur. In other cases, the computer may be able to distribute the peak loads over extended periods allowing lower requirements for the whole system.

### Disk Storage

Disks, which are available with a variety of storage capacities, are the most common method of storing data. To correctly determine your storage requirements you will need to go back to the File Section you developed. Carefully list all the files, their numbers, record sizes, number of records, and total characters. This is the information you recorded at the top of each file. The following example is a good format to use for this procedure. (See Figure 5.) To find your total estimated disk requirements in characters follow these steps.

Step 1. After listing all of your files and including all the information for each column, the total of column 5 will be the total number of data file characters for all your files. Record that total. It is a part of your total disk requirement.

Step 2. Add a figure equal to 25 percent of the total data file characters to allow space for the computer to perform random access and indexing.

Step 3. Add a figure equal to 20 percent of the total data file characters. This allows for program storage.

Step 4. Add a figure equal to 20 percent of the total data file characters for work files, which are temporary files used for sorting or storing temporary data.

## FILE REQUIREMENTS (On-Line Disk Files)

1	2	3	4	5
NO.	DESCRIPTION	RECORD SIZE	NO. OF RECORDS	TOTAL CHARACTERS
1	Inventory	300	12,000	3,600,000
2	Customer Master	225	4,000	900,000
2A	Customer Ship To Addresses	120	200	24,000
3A	Open Order: Header	220	5,000	1,100,000
3B	Open Order: Detail	100	15,000	1,500,000
3C	Open Order: Comments	50	2,000	100,000
4	Sales Statistics	150	5	750
5	Pending Prices	40	400	16,000
6	Salesman Master	100	15	1,500
7	Commission Detail	50	4,100	205,000
8	Vendor Master	200	600	120,000
9A	Open Purchase Order: Header	150	625	99,750
9B	Open Purchase Order: Detail	100	1,875	187,500
9C	Open Purchase Order: Comment	75	600	45,000
10	G/L Chart of Accounts	70	750	52,500
11	A/P Control	20	5	100
12	A/P Distribution	60	900	54,000
13	A/R Open Invoice	100	2,200	220,000
14	A/R Control	30	5	150
15	G/L Detail	70	800	56,000
16	A/P Open Invoices	75	600	45,000
17	G/L Account Balances	75	750	56,250
				8,383,500
Add 25% Indexes				2,095,875
Add 20% Work Areas				1,676,700
Add 20% Programs				1,676,700
TOTAL				13,832,775

Figure 5. Table summarizing disk file capacity needs [DAT]

Step 5. Total the additional numbers you just added, including the total data file characters, and round this figure up to the next million. Add more if you feel your estimates are low. This is the final figure of your total estimated disk requirements in characters.

You will notice that in each of the five steps extra space has been allotted. Initially this may seem wasteful. In time you will find that extended data is added, utilizing this space. By allowing generous spacing in your initial plans, you allow for this natural growth. The alternative, not allowing for expansion, is likely to result in costly revision at a later date.

### Inputs

In this section we will determine the number of CRTs you will need to handle your business satisfactorily. The unit of measure you will use is the number of keyboard strokes needed to feed the information into the computer. To determine the number of strokes needed, refer to the CRT screens developed earlier. By counting the number of strokes required for each transaction on a screen and multiplying that number by the frequency of that transaction you will have the total strokes for that screen. For example, if you are processing orders at the rate of 25 orders per day, and each order requires 100 strokes, the total number of strokes needed per day by the order entry screen will be 2,500.

Other factors that need to be considered when determining the number of CRTs needed are CRT location and frequency of screen input. A given business might need CRT screens in multiple locations. It will be assumed one is located in the main business or accounting office. A

warehouse might be a logical location of a second CRT for inventory management. Another might be at the desk of the person who answers customer's questions either in person or by telephone. Normally in determining CRT needs you will only be concerned with CRT screens used daily. CRT screens used weekly or monthly will need to be included in volume count, but unless they have large stroke count then usually don't effect the number of CRTs required. Maybe your company has peak times of the month or seasons which would require an additional CRT. Personal knowledge of your company and subjective judgment will affect your decision of how many CRTs are needed. (See Appendix 1.)

The following format of CRT Input (strokes) is one method of calculating CRT needs. (See Figure 6.)

Using the CRT screens you developed earlier, place the screen number in Column 1. Column 2 holds the screen name. Column 3 tells how frequently the screen will be used, daily, weekly, or how often. Column 4 tells the CRT location if you have more than one CRT. If you have only one, you may delete this column. Column 5 lists the number of strokes (characters entered) per transaction or per CRT screen. If you have determined that peak periods can be spread out over time, use an average or usual number here rather than the maximum number. If you must deal with peak periods, use the maximum number. Column 6 is the number of transactions per frequency. (For example, if you process 25 orders daily, the number of transactions would be 25.) Column 7 is calculated by multiplying Column 6 (number of transactions) by Column 5 (number of stokes per transaction). The product is the total number of strokes required for each screen. The total of all strokes can be found by simply totaling Column 7.

CRT INPUT (STROKES)

1	2	3	4	5	6	7
SCREEN NO.	NAME	FREQ.	LOCATION	NO. OF STROKES PER TRANS.	NO. OF TRANS.	NO. OF STROKES
1	Order Entry	D	Office	200	150	30,000
2	Shipment Confirmation	D	Warehouse	20	150	3,000
3	Cash Receipts	D	Accounting	120	100	12,000
4	Purchase Order Entry	D	Office	100	50	5,000
5	Purchase Order Receipts	D	Warehouse	50	150	3,000
6	A/P Invoice Entry	D	Accounting	100	40	4,000
7	Journal Entries	M	Accounting	50	80	4,000
8	Physical Inventory	A	Warehouse	10	7,500	75,000
TOTALS:		OFFICE	WAREHOUSE	ACCOUNTING	TOTAL	
D	35,000		6,000	16,000		57,000
M				4,000		4,000
A			75,000			75,000
SUMMARY						
Daily	35,000			6,000		16,000
+25% (Misc.)	8,750			1,500		4,000
	<u>43,750</u>			<u>7,500</u>		<u>20,000</u>
+4000=	10.9 hours			1.9 hours		5 hours

Figure 6. How to calculate time requirements for volume keystroking [DAT]



If more than one location was used, the totals of each location are dealt with separately. At the lower part of your sheet or on a separate sheet if necessary, you must record the information by location and frequency.

Columns used here will be totals and locations while the rows will indicate frequency. Add a factor of 25% to each of the location daily totals. This allows for miscellaneous functions such as file maintenance, inquiry, and scheduling of input time by location daily. Divide this new daily stroke figure by 4,000 to determine man-hours of daily use. Divide the number of man-hours by 8 to represent an 8-hour day. The number of days, rounded up to the next whole number represents the number of CRT's or input stations required for each location.

The primary focus here has been on daily input, which is your most critical area. If your calculations were close to another multiple of 8, consider another CRT to avoid other scheduling problems arising from a too tight schedule.

### Printing

A similar procedure determines your printing equipment requirements. Using the report specifications you made earlier, make a table with at least four columns. In column 1, 2, and 3 write the report number, name, and frequency. Columns 4 and 5 are for printer location assuming printers in separate locations. In columns 4 and 5 put the number of lines of print required by each report. (See Figure 7.)

## REPORT REQUIREMENTS (PRINT LINES)

1	2	3	4	5
REPORT NO.	TITLE	FREQ.	COMPUTER	WAREHOUSE
1	Picking Slip	D		800
2	Daily Order Report	D	150	
3	Credit Hold	D	25	
4	Cash Rec. Work Sheet	D	200	
5	Cash Rec. Register	D	120	
6	Daily A/R Control	D	10	
7	Invoice	D	600	
8	Invoice Register	D	75	25
9	Price Changes	D	50	
10	Commission State	M	1,500	
11	Aged Trial Balance	M	2,000	
12	Customer State	M	3,500	
13	Inventory Action	D		100
14	Inventory Valuation	Q	12,000	12,000
15	Physical Inv. List	A		
16	Sales by Customer	R	4,500	
17	Sales by Salesman	Q	20	
18	Purchase Order	D	500	
19	P.O. Register	D	100	
20	Open P.O. by Vendor	W	2,500	
21	Open P.O. by Div.	R	2,500	
22	Open P.O. by Item	R	2,500	
23	Cash Requirement	W	700	
24	A/P Check	D	300	
25	A/P Check Reg.	D	100	
26	A/P Distribution	M	2,000	
27	Vendor Analysis	M	1,200	
28	A/P Control	D	10	
29	Trial Balance	M	1,000	
TOTALS	COMPUTER		WAREHOUSE	TOTAL
D	2,240		900	3,140
W	3,200			
M	11,200			
Q	12,020			
A			12,000	12,000

Figure 7. How to estimate print line volumes [DAT]

The printer's unit of measurement is lines of print. Both heading and information lines will need to be counted. Include On Request reports in your line count if report frequency can be estimated. If an estimate is impossible, you then must allow space in the General Information Reports. Generally, heading lines increase report line totals by ten percent.

There are two ways to submit your print line requirements. The first is to simply tell the vendor how many lines of print you will need in a day and rely on him to provide a printer with adequate speed and performance. The second is to look at the various printer speeds available and divide the lines you need per day by the various speeds and see if the answer is a lower figure than hours available. Determine which printers will meet your needs and request bids.

## SUMMARY

Your documentation is now complete. You know your hardware and software business requirements. You also know your specific requirements of on-line disk storage, the number of CRT's required, and the number of printed lines needed per day, week, month. You are not guessing because you have calculations based on careful analysis.

This makes your equipment search much easier. When you approach vendors you will be able to state specifics and be able to compare and contrast equipment with a high level of expertise. You will know your on-line disk requirements, how many CRT's or how many CRT hours you require and how fast the printer must be to handle your needs. To the degree that you are secure with the work you have done, you will not be vulnerable to high pressure sales tactics or emotional relatives, who feel you must buy their brand of equipment, even if it will not meet your specifications.

You have in addition documented your software needs. You know the specifications and you can approach vendors or dealers and discuss their ability to meet your needs. You have the methods to compare their software packages to your specifications rather than taking them at face value. Your custom programing is also documented and will allow a much faster, thorough approach by the programmer.

By completing the analysis procedure and documentation process, you have the information you need for entry into the small business computer world on a very intelligent level.

## EXTENSIONS

In writing a paper of this nature I became aware of its limitations. It is impossible to cover all aspects of the subject. I suggest the following areas for continued research in the same field.

The areas are:

- 1) developing a criteria for selection,
- 2) preparing request for proposal,
- 3) developing a procedure for evaluating proposals and selecting equipment,
- 4) developing installation plans and budgeting, and
- 5) developing a study for economic feasibility.

I feel that research in these areas would compliment this paper and be beneficial to a small business considering computerization.

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APPENDIX A



### A Computer

A description of the basic operation of a computer system will be given. In the simplest terms data, called input, is entered into the computer; it is processed; and the resulting information is called output. (See Figure A-1.)

Of greatest importance is what happens inside the computer. By breaking the computer into two parts, main memory and the central processing unit, we can see how it works. (See Figure A-2.)

Input is transmitted to main memory and stored there until needed for processing by the central processing unit (CPU). However, for the CPU to perform the processing mentioned earlier, it must be programmed. Programs are the instructions the computer follows to process the input.

Programs may enter a computer as input or from a secondary storage source such as floppy disks or tape cartridge storage. (See Figure A-3.) Package programs may be sold to you on floppy disks or on tape cartridges. You may also develop your own original programs for the specific tasks your company requires. After you develop your own program and it has been debugged, the correct version should be stored for future use on some form of secondary storage.

Input can also be stored on secondary storage until needed for processing. Some types of data are constant, used numerous times, and considered as permanent files. Some data is entered, processed, and then no longer needed. Other data is entered, processed, stored briefly in a working file, used in processing again and then is no longer needed. These working files are stored temporarily on secondary storage and are referred to as temporary files.

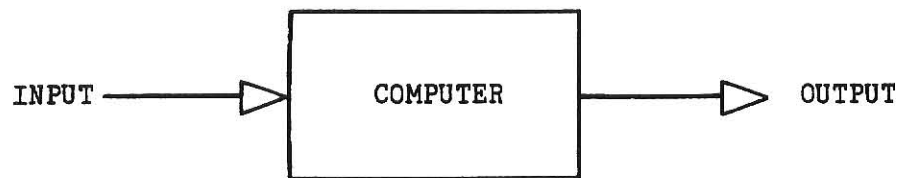


Figure A-1. The computer in simplest terms [DAT]

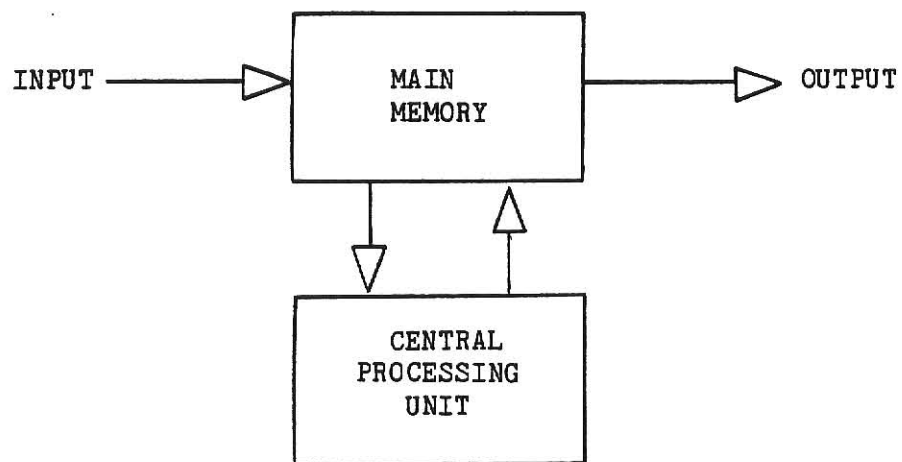


Figure A-2. The computer's two principal components [DAT]

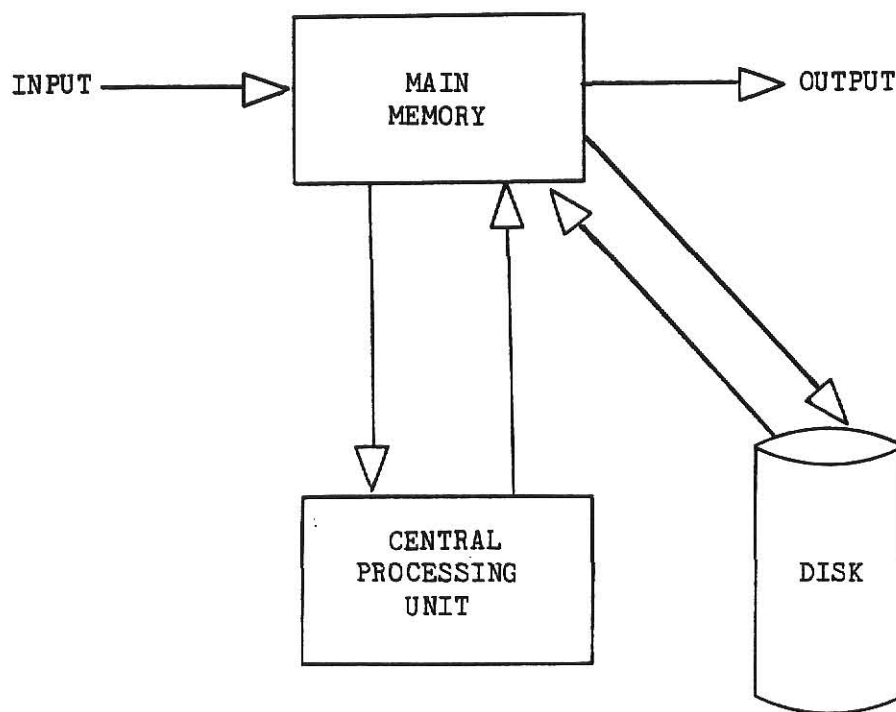


Figure A-3. Computer input from secondary storage

When the program finishes processing and has results, these results are called output. Output can be transferred to secondary storage disks, displayed on a CRT, or printed as hardcopy by a printer. If output is put on secondary storage it can be kept for future use. CRT displays are usually used when looking-up information such as inventory stock or a customer's credit rating. Printed matter allows a physical record of data.

#### Small Business Computer Systems

A minimal small business computer system requires the following peripherals: a CRT-computer unit, two disk drives to handle floppy disks for secondary storage, and a printer for hardcopy. As mentioned in Chapter 1 a typical business system processes large amounts of data. The CRT is often combined with the central processing unit as a CRT-computer unit. The CRT-computer unit provides a simple, fast method of entering data. Two disk drives can provide access to the files stored in secondary storage devices. A printer produces the physical record that is so necessary in business.

Most small businesses use the CRT for entering data. It is a versatile piece of equipment in that data may be entered with the keyboard or output may be displayed on the screen. A CRT also allows an operator to proofread data and make corrections before entering the data into main memory.

Secondary storage is also an important part of a small business system as most businesses have large files. Several types of suitable

storage devices are available. The specific type selected will probably depend on size of the files and access speed to the stored data.

Business functions are simplified by a printer to produce reports, bills, letters, address labels, etc. Printers are available with various qualities of print and various speeds, e.g., lines of print per minute.

The actual system hardware peripherals may vary because no two businesses are exactly alike. Each business has different secondary storage needs since file sizes differ. The larger the storage volume the higher the price. The time needed to access stored data, called access speed, is another system variable. The higher the access speed, the higher the equipment price. Printer requirements also vary among businesses. Some require simple, low-quality output while others require more complicated high-quality output for bills and letters.

Most business systems have a CRT-computer unit. Business systems differ most in the area of secondary storage and printer equipment. Common types of secondary storage are cassette tape cartridges, floppy disks, and hard disks. Cassette tape cartridges are at the low end of both cost and access speed. The equipment to run cassette tape drives is less expensive than the equipment needed for disks. However, access speed is considerably slower because tapes are accessed sequentially [FRE]. Thus if the desired data is stored toward the end of the tape, you must search most of the tape before the data is found. This can be time consuming. The volume stored is limited by your tape supply.

Floppy disks are the most popular storage devices for microcomputers and small business systems. Even though they are more expensive than cassette tapes, no other storage devices match the

combination of low price, direct access, and removable media [POR1]. Floppy disks have the ability to access data directly thus greatly increasing access speed over cassette tapes. This sole feature is a strong argument for the use of floppies. Continued development has increased the storage capacity from 70 K bytes in older, single-sided, single-density versions to more than 700 K bytes in the newer, double-sided, double-density versions [STI]. The increased cost of disk drives compared to tape drives is offset by speed and capacity. Although hard disks offer even larger storage capacity and faster access speed the relatively low cost of floppies is enough to offset these advantages for many applications.

Hard disks offer a much larger storage capacity and higher access speed than floppy disks. The access speed of floppies varies from about 180 to 800 msec average [STI]. Compare this to the hard disk average access speed of 25 to 234 msec [POR2]. The capacity comparison has an even larger gap. Compared to individual floppy capacities varying from 70 to 700 K bytes, hard disks have a range of 2 to over 300 M bytes.

The price differences between the types of secondary storage ranges from a high of .0010 cents/bit for hard disks over 300 M bytes to a low of .00017 cents/bit for cassette tapes, with floppy disk prices somewhere in the middle [THE]. Probably floppies offer the best combination of low price, high capacity, and high access speed.

APPENDIX B

TermsAudit trail:

An audit trail is a record of the value changes made in a data element using a before and after picture.

Bit:

A bit is a binary digit, a zero or a one, used to represent a number in the binary system.

Byte:

A byte is a group of eight bits representing one alphabetic character, one symbol or binary number. Data Processing personnel measure the size of records by bytes instead of number of characters.

CPU-Central Processing Unit:

CPU is another name used for a computer. It is where the processing of data takes place and includes the memory and machinery to process data.

CRT screen:

A CRT is a cathode ray tube, another name for a terminal with a screen similar to that of a television. In this paper CRT screen is used to represent the formatting of the original source document that will appear on the screen and the formatting used to prompt the operator to enter the needed data.



Data base:

A set of data usually separate and apart from programs. It can be shared by a number of applications.

Data element:

Data elements make up records. Each item within a record such as name is a data element. A record is made of one or more data elements. See also data item.

Data field:

A coded description of the size and layout of an element or data item. In Common Business Oriented Language, COBOL, it is the picture.

Data flow:

It is the sequential ordering of the data from its origin into the system until it leaves the system. See also flowchart.

Data item:

A data item is the smallest logical unit of data. Another name for a data element.

Direct access:

A technique for determining the storage locations of records stored on direct access devices. An address generation algorithm is used to convert a key into a storage location. Contrasts with sequential access.

File:

A file is similar to a file cabinet. It is a group of records containing all data pertinent to a particular topic (e.g., accounts receivable file, accounts payable file and inventory file). There are two kinds of files, one referred to as a permanent or master file and the other as a temporary or working file. See also permanent file. See also temporary file.

Flowchart:

A flowchart is a graphic presentation to show a way to solve a problem. It can also be used to show the flow of data and procedures and the type of equipment used. A flowchart can help explain the flow of data from point of acquisition to the finished report.

Input:

Input is concerned with the information entered into the computer and how it is entered. Accounts receivable needs input facts in order to produce reports. Information needed varies with the file being used. In an accounts receivable file, matters concerning dates, credits, and debits are paramount. Decisions you will be making in this are generally deal with type, amount, and frequency of information input to the computer. The computer can receive data in several forms, such as cathode ray tube (CRT), cards, or disks. Intelligent selection of input forms requires study. Each form has limitations and advantages. Presently most small businesses find the CRT suitable.

Keyboard stroke:

See stroke.

Msec (millisecond):

One-thousandth of a second.

Output:

Output is information leaving the computer. It may be stored or printed.

Permanent file:

A permanent file is a file whose structure and data rarely change. An accounts receivable file belongs in a permanent file because the customer name and address are constants as they would be in a ledger in a file cabinet. Of course information, such as amount due, may change on a periodic basis without altering the structure of the file.

Record:

A record is a specific individual part of a file, for example it may be one customer's account within an accounts receivable file. All data needed to work with that customer should be included in the record. A file is made up of all the records of a particular type. Thus all accounts receivable records make up the accounts receivable file.

Reports:

Reports are the same in both business and computer language. They contain information in list form necessary for decision making. An example would be a list of overdue accounts. The computer uses the data in the files to produce the reports. Reports may be produced at specific times or on request. They may be as specific and detailed or as general as you like.

Sequential access:

The storing and retrieval of records in an order determined by the records in an order determined by the records keys. It is used with magnetic tape. Contrasts with direct access.

Strokes:

A keyboard stroke is the process of entering data into a computer system by an individual. Each time the individual types a key this is a stroke. Also referred to as keystroke or keyboard stroke.

Temporary file:

A temporary file resembles a worksheet. The structure is constant but the data varies. The variables in an accounts receivable working file, when correlated, are utilized to update the permanent file and keep it current.

Terminal:

A device from which data is either entered or received by a person.

A PROCEDURE FOR ANALYZING THE COMPUTER  
REQUIREMENTS OF SMALL BUSINESSES

by

FAYE LAVONNE KENNEDY

B.S., Kansas State University, 1969

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AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Computer Science

KANSAS STATE UNIVERSITY  
Manhattan, Kansas

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## ABSTRACT

This paper is written to help a small businessman prepare his business for computerization. Steps for analyzing the business policies and procedures are outlined. The paper includes a detailed step-by-step procedure for determining the written specifications needed for hardware procurement. An owner or manager of a business who follows the guidelines presented in this paper should be able to enter the marketplace with the specifications for a suitable computer system. The paper also includes two appendices. The first discusses a minimal small business computer system and the capabilities and shortcomings of such a system. The second defines computer terms used in this paper.

This paper does not pretend to educate the reader to a level of full understanding of all there is to know about computers. To gain that competence, an individual would need to complete several courses or read many books about computers. Instead, the paper is designed to orient and familiarize a prospective computer user with concepts useful to one who is considering computerization.