IBM Data Processing Techniques

Basic System Study Guide

This manual presents an organized approach to conducting a system study in a smaller organization. The reader need not have participated in any prior study. He should, however, understand the basic concepts of punched card and computer equipment. The material presented is based upon actual system studies that used the IBM Study Organization Plan approach.

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CHAPTER 1 - SYSTEMS STUDY AND DESIGN

In the dynamically changing environment of our economy, businessmen explore many alternatives to improve the competitive position of their firms. For example, new products are introduced, old products are redesigned, new services are made available to customers. The value of these products and services is heavily advertised to specific consumers, and also to the public at large.

There are, of course, other, less publicized ways to improve a firm's competitive position. Production and delivery cycles are reduced, operating costs are pared, paperwork is simplified, and more current and meaningful operating information is provided for the firm's management. All of these improvements require a study of some portion or all of the existing business system before designing a new system that incorporates them.

EVOLUTION OF BUSINESS SYSTEMS

A business system is an organization of manpower and equipment, operating under a set of procedures to accomplish definite business goals. Modern business systems are a product of the Industrial Revolution. Think back to when many of today's large corporate enterprises started. Most were built around the nucleus of a small production group that divided up the workload according to the capabilities (and limitations) of the individuals. As factory equipment was introduced, the more progressive firms quickly adopted it into their business systems, though without making major changes to their business structures.

The division of labor in the factory began to see its counterpart in the office (this of course happened even earlier in service-type organizations: banks, insurance companies, retailers). Clerical tasks were subdivided into ever smaller pieces to permit rapid human learning and efficient human execution.

Even with the introduction of punched card (unit record) equipment, the system often remained tied to human capacities and machine specializations. Jobs were still divided into steps, which were now matched to individual machine characteristics. As the volume grew, more equipment units were added, more people were hired and the work was further subdivided. Each report and each file called for a procedure (and a system) of its own.

Introduction of the first computers designed for business operations began to affect this piecemeal subdivision of clerical workloads. The computer's first impact was in the processing of vast amounts of paperwork: industrial payrolls, inventory records and customer billings. The next step in application centered around the idea of integrated data processing: a single transaction, such as a customer's order, created an automatic chain reaction through sales, production scheduling, material and parts purchasing, factory control, shipping and accounting. As a result of the use of computers, work was done faster at lower cost -- but the inherent business structure and relationships had not been changed.

As the concept of integrated data processing was implemented by business firms into their day-to-day operations, forward-thinking management began to realize that the decision-making capabilities of the computer could be put to far greater use. For example, quantity ranges could be incorporated in the computer; automatic decisions then could be made to determine customers who have exceeded credit limits, to approve credit authorization if within established bounds, to replenish inventories or discontinue low-usage stock items, and so on.

Beyond the level of simple decision-making lies the area of management science or operations research. Computers today assist in establishing optimal reorder quantities, correct safety stock levels, effective credit ranges, product mix for maximum profitability, production schedules based on efficient machine loading, balanced quality control procedures, optimum shipping and distribution patterns, and many other basic business decisions. The use of mathematical techniques can significantly improve the quality and timeliness of business decisions and increase the profitability of business plans and operations.

SYSTEMS DESIGN

From this evolution of the business system has come the idea of designing new business systems as a unified entity that contribute directly to business goals and take full advantage of equipment capabilities and management science techniques. It is extremely important to recognize that the introduction of a computer to a firm offers an unparalleled opportunity to (1) improve the business system, (2) display true operating conditions to management, and (3) guide the business in the direction intended by management.

If the existing business system is slavishly and electronically duplicated in the new system, then the opportunities described above are unlikely to be possible. They will not come about unless time

is taken to determine and analyze the primary goals and objectives of the business and to design a system that contributes to these goals. The goal-directed systems approach requires the re-examination and restatement of true business goals.

THE STUDY ORGANIZATION PLAN

The IBM Study Organization Plan (SOP) is an organized approach to conducting systems studies, studies in which true business goals are isolated, analyzed and satisfied in the new system. SOP has already been tested in widely divergent business fields:

- Wholesale distribution
- Banking
- Insurance
- Electronics manufacturing
- Aircraft manufacturing
- Public utilities

On the basis of detailed analysis and review, SOP can be readily applied in the fields of retail merchandising, transportation, communications, mining, construction, government, etc.

In almost any type or size of business, SOP may be used for a fast but comprehensive study of part of the business or it may be used as an organized approach to a long-term study in depth. Its documentation may be applied to either type of study. Hence SOP may be used to guide studies which convert from:

- A manual system to a unit record system.
- A manual system to a computer system.
- A unit record system to a computer system.
- A computer system to another computer system.

SOP was originally developed to guide more advanced systems studies involving teams of IBM and customer systems engineering personnel. As these studies progressed and results were analyzed, it became apparent that with some modifications, the basic concepts contained in SOP could be applied to both small and large studies.

This manual is written with smaller-study participants in mind, those who have not had the opportunity to conduct or be a part of previous systems studies, but who do understand the basic concepts of data processing equipment as well as applications. Emphasis is placed on the role of the systems planner in a smaller business that can assign only one (or perhaps two or three) methods personnel to conduct the study.

There are three stages in the life of a business system (Figure 1).

The purpose of Stage 1 is to design a new system (the subject of this manual). Stages 2 and 3 cover implementation and operation of the new system. Stage 1, study and design, may be divided into three phases:

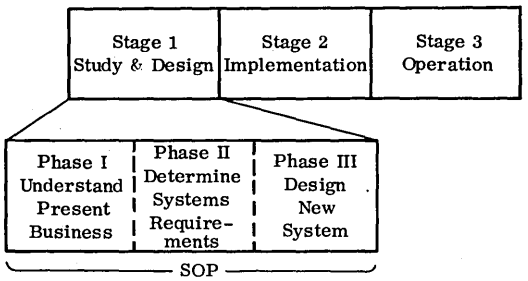


Figure 1.

- Phase I--Study the existing system to gain an insight into the business and its key relationships.
- Phase II-- Blend results of the Phase I study with forecasts of foreseeable needs to determine true systems requirements.
- Phase III--Design the new system and communicate it to management.

These three phases provide the framework of SOP and also the structure of this manual. Chapter 2, "Understanding the Present Business", is concerned with Phase I, the determination of what is done in the existing system, using what inputs, with what resources, to achieve what results. Information is collected and organized into a meaningful pattern to permit an accurate understanding of the business as it presently operates and reacts to its environment.

Chapter 3, "Determining Systems Requirements", reviews the impact of three basic questions about the new system. What must it do? How well must it do it? What resources has management specified be used? To answer these questions and to arrive at a valid set of systems requirements, Phase II blends known facts about the present system with projections concerning the future.

Chapter 4, "Designing the New System", reviews the nature of systems design from the initial specification of a set of alternative designs through equipment selection and the development of the one design that represents the best solution to the problem.

Chapter 5, "Economic Analysis", discusses the need for careful economic analysis of the proposed system as compared with the present system. It includes consideration of implementation costs and time schedules.

Chapter 6, "New System Plan", outlines a recommended structure for describing the new system and communicating the design and its advantages to management.

CHAPTER 2 - UNDERSTANDING THE PRESENT BUSINESS

Before designing a new system, the systems planner must identify the areas which present the greatest opportunity for better control, cost reduction, and profit improvement. In some studies, especially in smaller companies, these areas may be readily apparent to management and the planner before the study begins. In these instances, the planner is often tempted to postulate a type or class of data processing equipment for implementation and ignore the "getting acquainted" phase of the study entirely. While this is often justified in the interest of getting started, the fact remains that it often sets an extremely narrow scope to the new system and leads to a straight mechanization of the present system.

The present system study phase is important for two major reasons:

- The new system must, at the very least, perform as well as the present system. Therefore, an understanding of the present system becomes the logical foundation (and provides a benchmark) for design of the new system.
- An understanding of the present system is also needed to obtain a clear picture of elapsed times, sequences of operations, unit operation time, operating volumes, and operating costs.

If the ultimate aim of the study is to provide a complete, creative reconstruction of the information processing capabilities of all areas of the business, then the information must probe deeply into management goals and methods of accomplishment. Quite often, the development of new information processing procedures that are designed to incorporate a large computing system involves this type of study. If on the other hand, improvement of one operation or several operations is the objective, then overall business goals are of lesser importance and the specific operations themselves become logical targets for concentrated and more detailed study.

This basic systems study guide has been developed by IBM to assist the systems planner in his analysis. Its "predesign" framework provides him with a method of organizing his thinking, and recording and analyzing data. The framework is organized according to the level of detail obtained. Three major levels are specified: general, structural and operational.

The systems planner whose assignment is a major overhaul or reconstruction of the complete information processing activity of a business will spend proportionately more time in obtaining general and structural information. The systems planner involved in the improvement of one or more smaller operations will spend more time gathering operational information. Before the planner concentrates on gathering operational information, the operations themselves must be placed in the proper context in the business, and before this context can be recognized, the overall organization must be studied. In conducting this study the planner must be extremely selective, both as to the type of information gathered and also its general level of detail. His objective is understanding and not a vast collection of facts that defies any type of analysis.

GATHERING INFORMATION

Basically, there are three main methods of gathering information about the present business:

1. Interviewing personnel
2. Searching internal and external manuals and records
3. Sampling and estimating

Interviews

The interview is perhaps the most productive form of securing information if the planner has the interviewee's trust and confidence. Interviews start with top levels of management. Middle and first-line management are the main sources of information during the study, along with professional specialists. Later, individual clerical and factory workers may be interviewed concerning their particular job assignments. A few points to remember when planning an interview are:

- Prepare beforehand (and follow) an outline of the topics that will be covered. Don't become involved in day-to-day problems unless they have impact on the study.
- Don't prolong interviews by attempting a detailed analysis of the information during the interview.
- Avoid giving the appearance that the interview is really a thinly disguised time study.
- Learn to separate fact from opinion as soon as possible. Opinions, of course, may be extremely revealing and should not be ignored, but they should be labeled as such.
- Make sure to interview personnel representing both sides of significant topics. For instance, interview both the senders and receivers of important internal documents.

- Question all levels of personnel about the improvements they would recommend if they were in a higher position. Be sure to credit them when discussing these recommendations with others. Keep all interviews informal, yet businesslike.
- Request each manager to introduce you to people within his organization whom you will interview in the future.
- Arrange appointments as far in advance as possible.

Searching Records

Business information exists in many places, some external to the business, others internal. All data should be verified with personnel who are acquainted with the subject matter. The planner should secure a list of sources of material during his first interview with top management. One point to remember in gathering data from internal sources is that the most important information files to search are usually the ones that are most difficult to secure because of their constant use. External sources of material include trade publications, government statistics, brokerage reports and credit reports. More informal sources are vendors, customers, policyholders, depositors, etc.

Estimating and Sampling

In many growing businesses, little attention is paid to historical recordkeeping. Consequently, file searching rarely results in gathering adequate data. In these cases, estimating is an accepted method of developing data, as long as all estimates are checked and verified. If, for example, a department (with inadequate cost records) performs three major operations, the estimated individual costs of these operations, when totaled, should roughly agree with the department's total budget.

Sampling is a measuring technique which can be applied formally or informally. In its more formal usage (work sampling) it can be employed to analyze the actions of people and machines, or the occurrence of events. Sampling is particularly useful on more high-volume or complex situations where procedures have not been issued or data is not readily summarized.

Data should be sampled with a clear purpose in mind - that is, with a clear idea of the precise way in which it will be analyzed to yield the desired information. Bias creeps into data despite the most careful and refined attempts to eliminate it. All sampling investigations are subject to experimental error. Therefore, no sampling investigation can give an absolute result, only a probable value. In sampling, the planner is constantly weighing the problem of achieving the maximum economy of sampling effort compatible with the degree of uncertainty involved.

GENERAL INFORMATION

General information is collected in order to obtain a wider perspective of the company's operations. In doing this, the planner familiarizes himself with the framework upon which the new system will rest. This wider perspective will assist the planner in avoiding the pitfall of a straight mechanization of present clerical operations. It will also later assist him when he prepares his recommendations to management by enabling him to concentrate on the facts that are important to the managing of the business.

Much of the example material presented in this section has been recorded during actual studies. Names and locations have been changed to preserve the proprietary nature of the information. The material is presented as an illustration of the type of information that can be gathered. There is no intention to suggest that, during the study, the planner must collect, arrange, and type the information as presented. Indeed, for the one- or two-man system planning staff, having it typed would be an immense task to accomplish within the time usually allocated to a study. What is implied, however, is that the planner should begin his study by obtaining as broad a background as possible.

History and Framework

Even a rudimentary knowledge of the pattern of growth and major events of a business assists the planner in understanding its complexities. What is not needed, of course, is an understanding of the complete history of the business. Rather, the planner should concentrate on the major milestones. These milestones are often the results of management decisions which reflect the basic goals of the business. The planner will continually encounter this "basic goal" theme throughout the General section. It is embodied in the one-word questions, "What?" and "How?"

HISTORY AND FRAMEWORK - Industrial Concern

The Butodale Electronics Company was established in 1946, incorporated in the State of Massachusetts. It was founded by four engineers and scientists who had worked together for a number

of years in a large corporation on advanced government project work. Their main objective was to aid research laboratories and manufacturers in design and production of the latest radar, radio, and other electronic equipment.

It is significant that the corporation sales have increased in thirteen years from $170,000 in 1947 to 15.9 million in 1959. Some of the major milestones in the last five years were:

1. Established the Worcester Computation Center to develop new fields of application for the analog computer (e.g., heat transfer, nuclear engineering, management control engineering).
2. Established the Long Beach and Rio de Janeiro Computation Centers to extend what was started at Worcester and to educate prospective customers in the use of analog computer techniques.
3. Opened additional sales offices in Chicago and Fort Worth.
4. Greatly expanded and modernized the plant in Danvers.
5. Instituted a major drive to secure overseas business, particularly in South America.

Butodale's major product lines have expanded during this period to include small general-purpose analog computers, instruments, and data plotters. (None of these new lines have developed to more than 10% of the annual sales dollar.)

Important historical information includes reasons for starting the company, mergers, expansion or curtailment of product lines or services, growth of physical plant and number of employees, and a general identification of products and services. Some sources of information are:

- Interviews with top management.
- Annual reports (current and back issues).
- Copies of management speeches about the business.
- Employee orientation handbooks.
- Investment house reviews and registers.
- Biographical registers such as "Who's Who in Commerce and Industry".

Industry Background

In most businesses, management spends a good portion of its time dealing with facts about competition. Factual data on competition, gathered early in the study, therefore better prepares the planner to visualize ways in which the new system can help management improve the competitive position of the business. The planner will also use this material as background information when presenting his recommendations to management.

Industry background information includes material showing the total demand for the industry's goods and services, important technological developments, growth trends, comparable statistics and sales volume, territories served, profit margins, etc. Some sources of information are:

- Industry magazines
- Technical magazines
- Department of Commerce statistics
- Comparative sales reports
- Interviews with marketing management

INDUSTRY BACKGROUND -- Industrial Concern

Butodale finds itself in the electronics industry and specifically in the analog computer area. Analog computers, in the sense of their use today, are only ten to fifteen years old and fall into two categories, general-purpose and special-purpose computers. There is considerable competition in this industry; some of the biggest competitors are ABC Instrument, Jones Instrument and National Systems, Inc. The company feels there will be continued growth for the general-purpose computer but this growth may not be at the same rate as in the past. Naturally, arriving at these conclusions, there is considerable stress put on to find new markets and new products. In order to uncover these areas and products the company has set up a New Products Committee and Market Analysis Section. It is the specific purpose of these groups to plan future growth and to direct engineering effort towards this growth in order that the company may maintain a planned growth pattern of 20% per annum, or greater.

Some of the product areas under scrutiny are instruments, special-purpose computers, and process control. Likewise, industry statistical analyses by marketing areas are developed in order to concentrate effort in the proper industries. There has been no designed plan to integrate this company through component manufacture; however, it is not opposed to this type of growth if necessary to insure reliable source of supply, and if excess capacity can be sold profitably. Recently the company absorbed the Premium Capacitors Company and is now building high-quality capacitors.

Business Objectives and Goals

Most profit-making organizations would define their major objective as the expansion of sales and profits in order to guarantee a proper return to stockholders and offer continued opportunity to employees. However, more specific information is needed to assure that the performance of the new system conforms with overall business objectives.

Much valuable time and expense can be wasted in compiling information which later turns out to be obsolete because of planned changes in business objectives, as could have been anticipated by the planner at the start, had he first checked with management. It is the responsibility of the planner to determine with management what future major changes in business objectives will have a direct bearing on his procedures before he begins his study of detailed operations. Specific goals and objectives should be reviewed, such as planned amount of sales increase, changes in product lines or services, reductions or increases in inventories, branch office expansion, etc. The ultimate sources of information are personal interviews with owners or top-level management.

BUSINESS OBJECTIVES AND GOALS - Industrial Concern

1. Manufacture and sell standard computer models and accessories to satisfy individual specifications and requirements.
2. Design and manufacture special computer models and accessories to satisfy individual specifications and requirements.
3. Offer computation services and engineering consultation on a fee basis to industry, commerce, and schools, among others.
4. Manufacture spare parts and components for sale to the trade.
5. Repair and maintain installed equipment.
6. Conduct research on new products and services to support present lines and initiate new ones with Butodale's area of knowledge and proficiency.
7. Compensate employees and suppliers for services and provide a satisfactory return to investors.
8. Demonstrate competence and quality in every product to clearly show advantage over competitive equipment.

Major Policies and Practices

Information which summarizes the major policies and practices is gathered, especially if it has a direct effect on the operations of the activities studied. Policies and practices are the ways in which management carries out the objectives of the business. While not as basic to the business as objectives and goals, they have usually stood the test of time and should be recognized as important ground rules by the procedure planner. The planner will become aware of the implications of his new procedures only if he has first become acquainted with major policies and practices earlier in the study. Information about plans for expansion, approaches to advertising and publicity, internal education and promotion plans, wage and benefit plans, etc., are what is needed. Sources of information are the documented plans in the above areas, supplemented by interviews with management where the reasons or motivations for the plans are discussed.

MAJOR POLICIES AND PRACTICES - Financial Institution

For Individual and Commercial
(customers and prospects)

1. Accessible, flexible facilities for deposit and receipt of cash, checks, bonds, drafts, and other negotiable documents.
2. Interest paying system to encourage time deposits.
3. Safekeeping facilities for valuable records.
4. Personal, confidential, knowledgeable consultation on all financial matters.

For Correspondent Bank
(customers and prospects)

1. Direct sending service and fast collection of cash items.
2. Full draft collection service.
3. Fast currency and coin shipment service.
4. Valuable document safekeeping facilities.
5. Assistance on large loans and advice on trust matters.

For Loan
(customers and prospects)

1. Facilities and experienced personnel available for consultation and financial advice on all loan matters.
2. Readily accessible facilities for the closing of (and payment on) personal, commercial, or mortgage loans.
3. Extensive advertising program to attract loan prospects to the bank for consultation.
4. Specialist available with a broad knowledge of income-producing investments.
5. Specialists available having detailed financial status information on local individuals and businesses.
6. Analysts available who are well informed on relative valuations of all types of property.
7. Flexible interest charging structure to encourage large loans and rewards for those who pay when due.

Planned practices to meet goals are:

1. Expand advertising program to reach more potential customers.
2. Enlarge drive-up banking facilities.
3. Increase emphasis on "Installment" type loans.
4. Modernize and reorganize physical and manpower facilities as necessary for most efficient operation.
5. Establish an electronic data center using the latest data processing equipment for processing paperwork; offer such services to local industry at a minimum cost.

Government Regulations

Where government regulations significantly affect the operation of the company, the planner will want to recognize them. These regulations should be determined early in the study, as they are apt to impose severe constraints on the eventual system design. Enacted laws are not the only regulations which will eventually affect the new system: equally important are laws which are proposed at the time of the study, and which might well be in effect when the new system is in operation. While there are specific government regulations, of course, which apply to many areas of every business, such as zoning, safety, payroll reporting, etc. only the regulations which significantly restrict the objectives and goals of business need be identified at this point. Regulations which affect data processing operations rather than management of the business are gathered when gathering Operational information.

Sources of information include interviews with management and the company counsel, and trade journals and business magazines which feature news from local, state, and national capitals.

GOVERNMENT REGULATIONS - Financial Institution

National Bank of Commerce, organized in 1891, was chartered for business under the National Bank Act of 1864. The National Bank Act created a Bureau of Controller of Currency in the Treasury Department. The Controller, who is Director of the Bureau, has the power to charter National Banks and is responsible for the examination, supervision, and rules relating to the operation and powers of such banks. Where State banking regulations are in conflict with National regulations, the National Bank is normally required to comply with the state regulation.

National Bank of Commerce, like all member banks, must operate within the limits of the 22 regulations of the Federal Reserve System. Responsibility for Federal Reserve policy and decisions rest on the Board of Governors, who are appointed by the President and approved by the Senate for a term of 14 years, the twelve Federal Reserve Banks, and the Federal Open Market committee. All National Banks must be members of the Federal Reserve System, hold Federal Reserve Stock, and maintain legal reserve monies on deposit in their district Federal Reserve Bank. National Banks must furnish a financial report when requested by Federal Reserve and are members of Federal Deposit Insurance Corporation (FDIC) which guarantees each depositor against loss up to a maximum of $10,000.

National Bank of Commerce must constantly adjust policies and operational procedures to meet the requirements of new Federal Reserve Regulation interpretations.

The 22 Federal Regulations cover:

1. Advances and discounts by Federal Reserve Banks.
2. Open Market Purchases of bills of exchange, trade acceptances and bankers acceptances under Section 14.
3. Acceptance of drafts or bills of exchange by member banks.
4. Reserves of member banks.
5. Purchase of warrants.
6. Trust powers of National Banks.
7. Collection of non-cash items.
8. Membership of state banking institutions in the Federal Reserve System.
9. Increase or decrease of capital stock of Federal Reserve Banks and cancellation of old and issue of new stock certificates.
10. Check clearing and collection.
11. Corporations doing foreign banking or other foreign financing under the Federal Reserve Act.
12. Interlocking bank directorates under the Clayton Act.
13. Foreign branches of National Banks and of corporations organized under the provisions of Section 25 (a) of the Federal Reserve Act.
14. Relations with foreign banks and bankers.
15. Loans to executive officers of member banks.
16. Holding company affiliates - voting permits.
17. Payment of interest on deposits.
18. Relationships with dealers in securities under Section 32 of the Banking Act of 1933.
19. Credit by brokers, dealers, and members of National Securities Exchanges.
20. Loans by banks for purpose of purchasing or carrying registered stocks.
21. Loan guarantees for defense production.
22. Bank holding companies.

STRUCTURAL INFORMATION

Structural information describes the interaction between the external business environment (for example, customers and vendors) and the resources of the business. Structural information is gathered to prepare the planner for the operational analysis and systems design work ahead by developing a broader understanding of the business. It does not mean or imply the assembly of a vast collection of unanalyzed data.

Structural information is classified into three elements:

- Outputs (products and markets)
- Inputs (materials and suppliers)
- Resources (personnel, finances, facilities, inventories)

Main sources of structural information are the annual report, various internal reports, and

accounting documents. Information should be carefully checked with its originators.

Figure 2 is a simplified model of a business and illustrates the interaction of its various elements. Materials, services and information flow in from vendors outside the business. Resources (both physical and informational) are called upon by the business operations to produce products, services and information for the outside marketplace. Physical inputs and outputs predominate in a manufacturing business, while services predominate in a financial institution.

Outputs -- Products and Markets

The planner's understanding of the marketplace in which the business operates is strengthened by the gathering of customer information. The planner is interested in management perspective of the output of the business, not in detailed sales analysis. Structural information will assist the planner later in his systems design work. For example, it will enable him to see the scope and significance of the complete problem before he establishes coding structures for the new system. Selection of these coding structures must be based upon a clear understanding of the purpose they serve. Therefore, the time (and expense) needed to obtain this fundamental information should not be sacrificed to the always-present need of getting started with detailed procedures.

BUSINESS MODEL

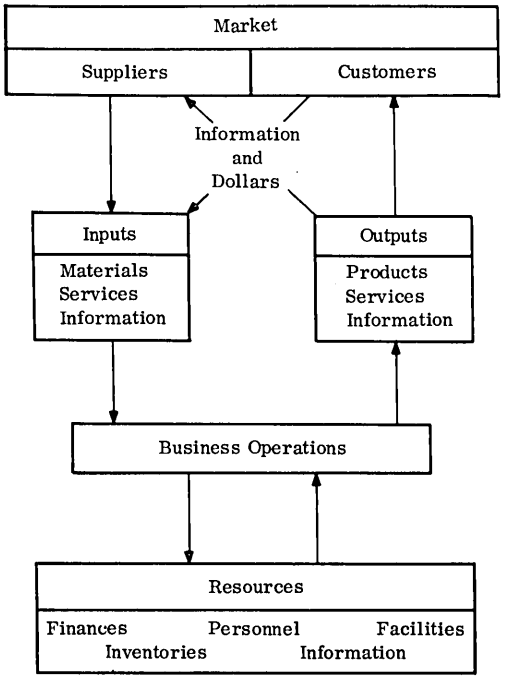


Figure 2. Business model

The type of information with which the planner is concerned here is that which describes the sales and distribution characteristics of the output of the firm.

Its sources may be:

- Sales tabulations by customer, industry, region, territory, salesman, product line
- Sales catalogs
- Sales forecasts
- Advertising budgets
- Sales quota reports
- Sales expense reports
- Percentage breakdown of income by product line

PRODUCTS AND MARKETS - Financial Institution

Output Products

The National Bank of Commerce furnishes loan money and banking services primarily in Shawnee and Wabaunsee Counties.

Amount of loan money available for output to customers is determined as follows:

Total Deposit money
Less outstanding Regular Loan money
Less Long-term outstanding Investment Loan money
Less Cash and Reserve
Equals Available loanable funds.

Output Services

1. Demand Deposit
   Check collection and payment service is offered in order to increase the percentage of demand deposits that can be loaned (or invested) to create interest and fee income. A small fee is charged to cover a portion of the handling costs.
2. Time Deposits
   Interest dividends are paid to savings depositors to encourage larger deposits and therefore increase loanable funds.
3. Loan
   Secured or unsecured loans for long or short terms are offered. Men experienced in all types of loan financing are available to the bank's customers and prospects.
4. Trust
   Trust service is offered to encourage new and retain existing trust deposit funds. A fee charged for administration of estate and pension trusts creates income for the bank.
5. Correspondent Check Clearing & Collection
   Correspondent check clearing and collection service primarily benefits local industry and surrounding banks. Rapid clearing and collection service encourages large deposits, which creates more loanable funds.
6. Safe Deposit
   Document safekeeping service is offered to provide a maximum security area for a customer's valuable documents. Fees for use of the Safe Deposit area create income for the bank.

Borrowing Customers (Receivers of output money)

Individuals
Commercial Businesses
Government
Local, state, national (includes bonds and securities)

Types of Loans

	PER CENT OF OUTSTANDING TOTAL
Real Estate	20%
Financial institution	4%
Purchase or carrying securities	3%
Farm loans	5%
Commercial and industrial	48%
Automobile installment	6%
Retail consumer installment	5%
Single-payment household and personal expenditures	9%

A general policy of the bank is to have outstanding loans equal about 40% of total deposits.

Depositing Customers (Receiving Output Services)

Individuals

At the present time the bank has 24,000 individual deposit customers. Records show a total of 36,500 accounts. However, studies show a 50% account duplication between saving and checking. About 95% of the customers are located in Topeka, which had a population of 103,000 persons in 1960.

Commercial

2200 community business establishments are customers of the National Bank of Commerce. The records actually show 2500 accounts, but some customers have multiple accounts. Both large and small businesses use the service offered. Statistics reveal 95% of the commercial customers are located in Shawnee County, and some 5% are in Wabaunsee County.

Banks

Out of 709 banks in Kansas, 277 have active correspondent agreements with The National Bank of Commerce. The records show 365 accounts; however, 88 are considered inactive. The primary market appears to be the area within an 80 mile radius of Topeka due to one-day check clearing desired by most banks. About eight banks in the primary market area offer correspondent bank service and are considered competitors.

Government

Local, state, and Federal government units are customers. The Federal government is the largest single depositor.

Inputs -- Materials and Suppliers

This information classifies the suppliers of input to the business. Supplier information is usually somewhat more difficult to gather than customer information. It is worthwhile, however, to obtain a broad perspective of the "raw material input" operations of the business at this stage in the study. Raw material may be exactly that in a manufacturing firm, but it is also money (in the form of deposits) in a bank, premiums in an insurance company, and a warehouse inventory in a wholesale grocery business. Suppliers may be classified according to annual dollar volume and kinds of products or services they offer. Comparative information that shows "make or buy" trends in a manufacturing business also provides insight.

Supplier information is obtained from the purchasing department or accounts payable unit in most businesses. In addition, quality control departments in manufacturing firms maintain records of vendor performance.

MATERIAL AND SUPPLIERS - Financial Institution

In order to perform primary banking services of (1) receive money for safekeeping (2) lend money and (3) transfer money from place to place and person to person by means of checks, National Bank of Commerce must receive large amounts of material (money) from community "suppliers". Suppliers to National Bank of Commerce can be classified as follows:

1. Individual Depositors

   Approximately 13,300 individuals deposit money in checking accounts for paying daily personal obligations by check. The check processing service provided is the inducement for the money deposit, as no interest is paid on the balances.

   About 21,000 individuals deposit money in savings accounts. They withdraw this money only when necessary, as the bank pays a semi-annual dividend of 3 1/2% for money left on deposit for a minimum of three months and an added 1/4% for deposits more than two years old. The interest dividend method induces community individuals to save and therefore to supply money to the bank.

2. Commercial Depositors

   The commercial group of 2,200 business establishments deposit money in checking accounts for paying business obligations by check. The amount of money supplied by this group is normally larger per account than that supplied by individual depositors. No interest is paid, but many services are offered to encourage commercial checking customers.

3. Correspondent Banks

   Some 277 smaller Kansas banks deposit money in accounts at National Bank of Commerce to establish a base for a correspondent relationship. The correspondent service primarily provides smaller banks in the surrounding area with a direct sending point for a rapid collection of cash items through a larger central bank.

Collection service, along with advisory and loan overlimit service, encourages the smaller banks to supply and retain large balances of money with the Topeka bank. Under Federal Reserve Regulations, interest cannot be paid to the smaller bank.

4. Government

Federal, state, and local government units deposit money in The National Bank of Commerce for checking purposes. This type of deposit is normally large and profitable. Most banks, like the National Bank of Commerce, continually seek more money from this type of supplier.

5. Stockholders

Money is supplied by stockholders in return for shares of stock. Profits are earned and dividends paid to stockholders for use of their money.

Resources - Personnel

An organization chart is usually available but should be carefully checked as it may not be up to date. If no organization chart exists, the planner can prepare a rough one from data provided by the personnel department and operating department managers.

Reports which classify employees by organizational component, by skill, by payroll class, and so forth often indicate important facts not readily apparent from inspection of organization charts. Other significant facts concerning personnel include the union contract and membership data, the local labor market, turnover statistics and fringe benefit data.

PERSONNEL - Financial Institution

Approximately 35% of the total operating expense of the bank consists of salaries and fringe benefits. Bank personnel are divided into major functional groups:

	QUANTITY	
Administrative		
Executive Officers	3	
Senior Officers	5	
Junior Officers and Adminstrative	15	
		23
Operations		
Tellers	32	
Working Leaders, Bookkeepers, Proof Operators Messengers and Clerical	135	
		167
Total Working Personnel		190
Bank Directors		16

Because of the many clerical and semiclerical tasks in bank operations, a large percentage of the working force falls into the operations group. Tellers, who deal directly with the public, are the most experienced of the operations group, and therefore receive higher than average compensation.

The 167 personnel in the operations group at National Bank of Commerce receive about 60% of the payroll dollars, while the 23 personnel in the administrative group receive about 40%. Wide variation in the training, education, and experience requirements of the two groups creates the unusual distribution.

Turnover in the operations group is over 40% per year, while in the administrative group, separations are practically nonexistent, indicating that a much greater incentive to remain with the bank exists for officers and other administrative personnel.

Management policies are normally reviewed by the following group of eight:

Chairman of the Board
President
Executive Vice President
Commercial Loan - Senior Officers (2)
Correspondent Bank - Senior Officer
Public Relations - Senior Officers
Trust Department - Senior Officer

In addition to acting as a sounding board for bank policy, the committee meets on a daily basis with the home loan officer, cashier, and two junior trust officers to review trust investments and approve or reject large or extra-risk loans.

All officers, including the Chairman of the Board, are active on a full-time basis in the bank. All are well versed in both the administrative requirements and the operational details of their respective departments.

Fringe benefits make up 18% of the total payroll. For this cost, the following benefit programs are offered to employees:

Cost fully paid by bank:

- Hospital, surgical, medical and major medical coverage.
  - Effective after completion of six months of service.
- Profit Sharing Plan.
  - Effective after completion of two years continuous service.
- Retirement Plan.
  - Effective when employed.
- Other Benefits:
  - Free coffee and soup for all employees.
  - Entry fees and dues paid for selected organizations.

Cost Shared with employee:

- Group Life Insurance.
  - Effective after one year of continuous service.

Paid vacations, holidays and sick leaves are all part of fringe benefits, but are not considered as extra benefits by employees since all are now standard practice in business today.

Resources - Financial

The planner, by acquainting himself with financial control data (in the form in which it is used by management) will better understand the complexities of the accounting procedures that are used to assemble the data. The foundation of financial information is the consolidated balance sheet, the statement of income and the overhead statement. At this point in the study, the planner is interested in management uses of financial data rather than in detailed accounting and bookkeeping procedures.

FINANCES - Financial Institution

Ownership

Ten thousand shares of stock are outstanding. Par value of stock is $100, market value (last sale) is $750, and book value is $1000.

Distribution of ownership is as follows:

Locally owned--individuals (Includes shares held in local trusts)	85%
Locally owned--companies	2%
Other Kansas owned	9%
Out-of-state owned	4%
	100%
Largest control block	26%

Dividends have been paid semiannually to the shareholders. A 5% dividend has been paid every year, and the book value has increased from $700 to $1000 in the past five years.

Liabilities

Resources-Liabilities, Chart I
Primary resource and liability categories for the past five years (1956 through 1960) reported to the public at the end of each calendar year. Examination indicates steady profitable growth.

Earnings, Chart II
Major earnings summary for past five years. Fairly constant growth rate indicated.

Expense, Chart III
Major expense account summary for past five years. Increase follows same pattern as earnings.

Loans Outstanding, Chart IV
Loan amounts summarized by major classification of loans. Installment loan growth rate above industry average.

Deposits, Chart V
Deposit categories for past five years charted in millions of dollars.

Investments, Chart VI
Amount invested in U.S. Government securities and municipal bonds over past five years. Indicates plan to reduce municipal holdings which are not as liquid as Government securities.

Net Earnings, Chart VII
Comparison of gross earnings vs. expense.

Resources - Facilities

The third area under Resources is concerned with physical facilities such as manufacturing plants, branch offices, warehouses, office and communication equipment, data processing equipment, transportation equipment, automatic stock-picking equipment, etc. Subsidiary fixed-asset ledgers, plant layouts, warehouse layouts, cost and capacity reports, and maps (showing locations and mileage between facilities) are reviewed where pertinent.

The new system may well incorporate transmission of data to and from the data processing system in conjunction with existing or new transmission facilities. The planner should therefore pay particular attention to communications — for it is in this area more than in any other that radical developments in data processing theory and equipment are occurring today.

Locations for the new data processing installation will be considered during the study, so information should be secured on office floor space, floor loading, air conditioning and electrical capacities.

FACILITIES - Industrial Concern

Bullding--130,000 square feet -- expandable to 250,000 square feet.

Office Area -- (55' x 80') ground floor, no floor loading problem, 20' x 40' area available for new system. Adequate 110 and 208 volt single and three-phase AC available near possible system site.

Fire protection -- Overhead sprinkler system with 100,000 gallon underground water tank.

Air-conditioning -- Two systems; front office area (55' x 80') has central compressor and chiller. Plant area has 50 individual units, each rated at 7 1/2 tons. Water is circulated through a water tower to exchange the heat before it is returned to individual systems. Each unit is individually controlled to maintain a temperature of 10° below outside air, with 50%-60% relative humidity.

Communication -- Teletypewriter Exchange (TWX) service between plant (office area) to Chicago and Fort Worth sales office.

Equipment -- Printer and keyboard in each location; circuits rated at 60 wmp, half duplex.

Other Office Equipment

	Owned	Rented	Total
Typewriters	47	57	104
Adding Machine and Calculators	23	10	33
Bookkeeping machines	3	--	3
Dictating machine	5	--	3
Cars	10	7	17
Trucks	5	--	5

IBM Equipment

	Owned	Rented	Total
Card punches	3	3	6
Verifier	2	2	4

	Owned	Rented	Total
Collator	1	1	2
Sorter	1	1	2
Accounting Machine	2	2	4
Reproducer	1	1	2
Calculating punch	1	1	2
Interpreter	1	1	2

Resources - Inventories

Inventories are vital to the administration of a business. Inventory control is a familiar requirement in every business and data is usually available.

Physical inventories (stocks of raw material, parts, subassemblies, or finished products in a manufacturing enterprise; supplies of available cash in a financial enterprise) can be classified by type, inventory level, value of the stock, and the cost of maintaining the inventory. Facts about inventories of data (information files) can also be obtained. These are true resources of a business too, and should receive the same amount of attention as physical inventory information. They appear under various names (customer name and address file, back order file, master product file, catalog, general voucher file, order file, bills of material, open orders, perpetual inventory, etc.). Of course, the planner does not attempt to familiarize himself with every information file in the business; he concentrates on files affecting the areas which are to be improved.

There is a difference between structural and operational inventory information. In obtaining structural information, the planner may be satisfied to identify the files and the reasons for their existence. He should not try to depict the dynamic way in which they are maintained and used at this point. Later, in analyzing operational information, he may examine them for such characteristics as source, users and usage, number of inquiries during peak periods, file sequence(s), methods and time of updating, retention period, etc.

Inventory information is secured from two main sources:

1. Accounting records show inventory liquidations through shipments, classifications by type (raw, in-process, etc.), consignment and warehouse balances, and material budgets.

2. Manufacturing maintains files in stockrooms, accumulation areas, and production and inventory control sections. Reports of inventory statistics by units, age, manufacturing losses, amount of surplus, special budgets, etc., contain useful information.

INVENTORIES - Industrial Concern

Since a major portion of the end product is customized, it is not desirable to manufacture to inventory. However, because there are a large number of standard components used, Butodale endeavors to forecast sales and stock a number of them for immediate support to production schedules. This means that work-in-process inventory is made up of both this preplanned stock and project stock where a system is being assembled and tested for a specific customer's order. It should be noted that general and administrative expense is applied to the work-in-process inventory.

The inventory is divided into the following major categories:

Shop Stores

Purchased parts and some fabricated mechanical parts used to support preplanned and project stock.

Work-In-process Inventory

Material and labor already expended against preplanned and project stock (including components completed except for final quality control).

Finished Goods Inventory

End products and components ready for sale or on customers' orders.

Direct Material

Includes materials purchased directly for preplanned or project stock but not placed in shop Stores inventory; it goes directly to work-in-process.

NOTE - Indirect Material includes low cost purchased parts and fabricated mechanical parts commonly used in components, and end products not carried as inventory.

Inventory Breakdown

	Parts	Value
Shop Stores	3120	$1,675,381
Finished Goods	850	1,526,334
Work-in-Process		6,743,617
Preplanned Stock		2,750,000
Project Stock		3,182,894
In-Process Stores	350	810,723
*Indirect Material	5000	410,385

*Not included in inventory; includes 3000 purchased parts and 2000 fabricated parts.

Shop Stores Inventory Annual Usage

This is divided into these classes:

Class A	$10,000 or more annual use
Class B	Less than $10,000 annual use, including terms with long lead time and new items that may develop into Class A
Class C	Items of low unit cost with common usage

Total items in Shop Stores	3470
Total annual use (issues from Shop Stores)	$5,645,250

Class A	90 items	$3,671,870	65% of $
Class B	240 items	673,840	11% of $
Class C	2790 items	1,299,540	24% of $

Inventory Annual Usage Other Than Shop Stores

	(Estimated)
Direct Material	$3,152,750
Indirect Material	827,645
Shop Supplies	253,890
Office Supplies	70,050
Maintenance Supplies	203,420
Drafting Supplies	56,725
Photo Supplies	15,860
Freight-In	68,290
TOTAL	$4,648,630

Analysis of Shop Stores Inventory
December 1959

Number of Items	Price Category	Total
1830	Under $2.00	$ 463,319
717	$2.00 to $5.00	285,008
238	$5.00 to $10.00	178,916
156	$10.00 to $25.00	265,312
97	$25.00 to $50.00	182,694
33	$50.00 to $100.00	64,371
49	$100.00 and over	235,761
3120		$1,675,381

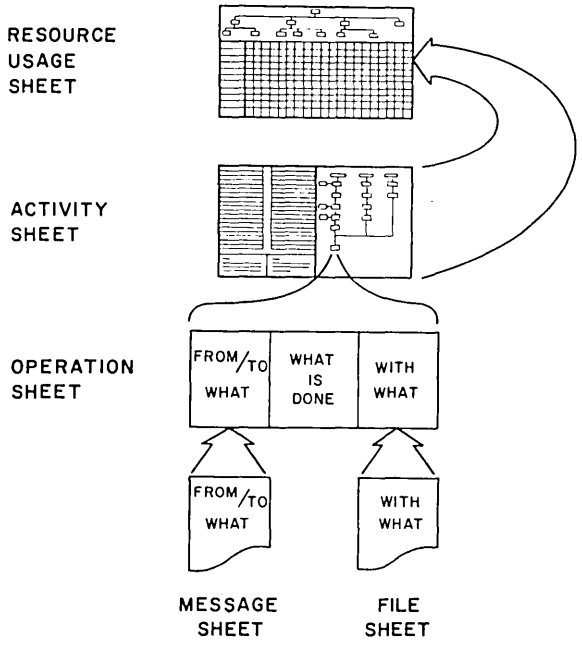


Figure 3.

OPERATIONAL INFORMATION

Having obtained general and structural information, the systems planner now examines the business in motion. The existing operations themselves are analyzed and recorded--not for the purpose of faithfully reproducing them electronically, but for the purpose of understanding them in terms of the true data processing requirements of the future system.

To assist the planner in recording and also in analyzing existing operations, IBM has developed five basic descriptive documents. Their relationship is illustrated in Figure 3. They are easily used and logically organized. They also clearly segregate and identify the key information needed, and therefore simplify the portraying of dynamic procedures on static documents.

The organizational structure and cost analysis of a business appear on the Resource Usage Sheet. The flow of each activity within the business appears on an Activity Sheet. Operations within an activity appear on the Operation Sheet. Message and File Sheets support the Operation Sheet and Activity Sheet with additional information about inputs, outputs and files used. The reader who desires a detailed explanation and method of completing these forms may refer to the IBM Reference Manual "Study Organization Plan - Documentation Techniques" (C20-8075).

Activity Formulation

An activity is a group of related tasks which are typically directed toward fulfilling one or more basic goals of the business. It usually represents a significant portion of the operating costs of one or more major departments.

An activity normally crosses the lines of traditional accounting applications. For instance, the usual definition of a payroll application includes the reporting to the employee, to government agencies, and to the owners of a business the amount of money paid for services rendered the employer by the employee. However, an "activity" definition of payroll might also include the preparation of cost and production reports. Cost and production reports, in turn, provide a basis for:

- Establishing selling prices.
- Pricing inventories.
- Deciding whether to build or purchase parts.
- Formulating broad policies relating to wages, employee welfare retirement plans, and inventory and machine tool requirements.

Billing procedures may also be narrowly or broadly defined. Billing may be thought of as the preparation of a document or series of documents which describe the goods or services sold to a customer, goods which have been ordered but not

shipped, and goods or merchandise contained in a given package or shipment. However, when developing procedures for billing, the planner may well acquaint himself with related activities such as:

- Accounts receivable
- Sales analysis
- Cost of sales
- Commission reporting
- Inventory control
- Finished stock reporting

In recognizing multiple uses for information the planner will often modify the original scope of the study. He must decide for himself the "payoff" between a limited procedure, which at first perhaps represents the minimum cost to the business, and a more flexible interpretation which incorporates elements of control rather than mere mechanization of additional accounting applications. The more flexible interpretation might contain management control elements which, when implemented in a long range data processing program, will ultimately prove of far more significance and benefit to the management of the business.

Documentation

For the planner, the activity will be everything encompassed from the logical beginning to the logical ending of the goal-directed and related tasks which he is studying. Moreover, the exact scope of a given activity is defined and redefined by the planner as he uncovers more information. For example, when preparing the Resource Usage Sheet (Figure 4), the planner called "Provide Product Demand" an activity, after a careful review of the general and structural view information he previously developed. To him it represented a major area of his business, with well-defined goals such as preparation of quotations and preparation and transmission of order acknowledgments. As his survey progressed, his definition of "Provide Demand" became more and more precise as he analyzed the operations in each department which went to make up that activity.

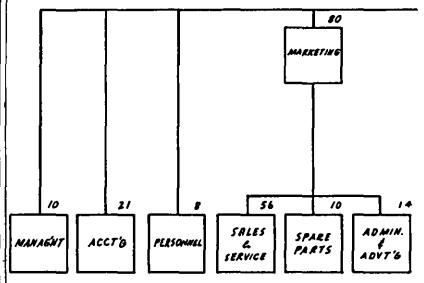
The Resource Usage Sheet is the most important descriptive document the study team uses. The form is a guide to obtaining operational information; when completed, it is a source of vital cost information.

The system planner, having first made an educated guess at a preliminary definition of activities, from general and structural information, next decides at what organizational level he will

NOTES

1. ORGANIZATION CHART DOES NOT INCLUDE COMPUTER CENTERS OR FOREIGN OPERATIONS, A TOTAL OF 97 PERSONS.
2. DIRECT MATERIAL IS INCLUDED AS A MEMO FIGURE.

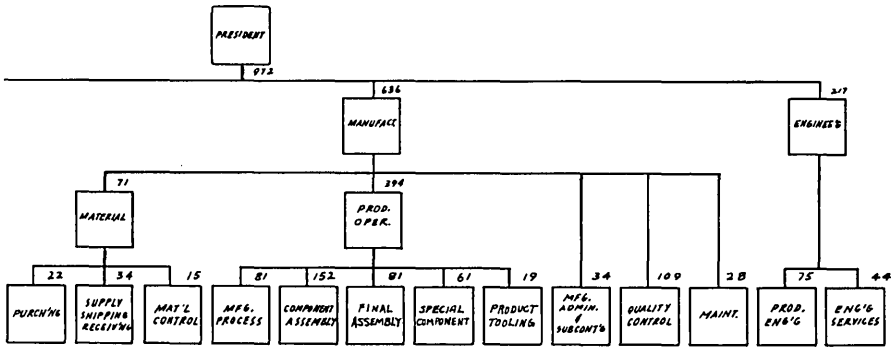
ORGANIZATION CHART



		MANAGMT	ACCT'G	PERSONNEL	SALES & SERVICE	SPARE PARTS	ADMIN. & ADVT'G
PERSONNEL		•230,000	•115,500	• 48,800	•448,000	•41,000	• 84,000
MACHINE & EQUIPMENT		•	•22,000	• 1,000	• 10,100	• 2,000	• 3,000
MATERIAL		•	•14,000	• 6,000	•342,00	• 7,000	• 11,000
MISCELLANEOUS		•515,400	•	•	•251,600	•	•167,300
		•303,700	•	•	•	•	•
TOTAL		1,049,100	151,500	55,800	1,051,700	50,000	265,300
ACTIVITY NAME	PERS.	•	•	•	•	•	•
PROVIDE	EQUIP.	•	•	•	•	•	•
PRODUCT	MAT'L.	•	•	•	•	•	•
DEMAND	MISC.	•	•	•	•	•	•
(001)	TOT.	24,000	32,160		1,051,700		265,300
ACTIVITY NAME	PERS.	•	•	•	•	•	•
PROVIDE	EQUIP.	•	•	•	•	•	•
MATERIAL	MAT'L.	•	•	•	•	•	•
	MISC.	•	•	•	•	•	•
(002)	TOT.		28,160				
ACTIVITY NAME	PERS.	•	•	•	•	•	•
PROVIDE	EQUIP.	•	•	•	•	•	•
COMPONENTS	MAT'L.	•	•	•	•	•	•
	MISC.	•	•	•	•	•	•
(003)	TOT.		9,010				
ACTIVITY NAME	PERS.	•	•	•	•	•	•
PROVIDE	EQUIP.	•	•	•	•	•	•
END	MAT'L.	•	•	•	•	•	•
PRODUCT	MISC.	•	•	•	•	•	•
(004)	TOT.		9,010				
ACTIVITY NAME	PERS.	•	•	•	•	•	•
PROVIDE	EQUIP.	•	•	•	•	•	•
ENGINEERED PRODUCTS	MAT'L.	•	•	•	•	•	•
AND SPARE PARTS	MISC.	•	•	•	•	•	•
(005)	TOT.		9,010			50,000	
ACTIVITY NAME	PERS.	•	•	•	•	•	•
PROVIDE	EQUIP.	•	•	•	•	•	•
MANAGEMENT,	MAT'L.	•	•	•	•	•	•
PERSONNEL, AND	MISC.	•	•	•	•	•	•
FACILITIES (006)	TOT.	1,023,700	64,750	55,800			

Figure 4. Resource Usage Sheet

secure and present cost information. That level should be the one which, when summarized, will provide the planner with the most useful cost information. Some planners will summarize costs at the departmental level; others will record them at a lower level, such as work section within department. In determining level, the planner must



Resource Usage Sheet
IBM

Study BUTTONALE ELECTRONICS
Analyst R. L. CASEY
Date

NOTES:

•149,600	•183,600	•61,500	•421,200	•638,400	•356,400	•268,400	•134,900	•326,400	•632,200	•142,800	•642,400	•964,800	•
• 3,000	• 10,100	•24,300	•	•	•	•	•	• 5,000	•	•	•	•	•
•12,000	•21,000	•	•46,000	•75,000	•46,000	•32,000	•10,000	•20,000	•58,400	•162,900	•116,600	•72,600	•
•695,800	•	•	•18,000	• 6,000	•	•	•	•	•31,000	•15,000	•	• 6,000	•
176,400 (2)													
•6,384,000	•	•	•	•	•	•	•	•	•	•	•	•	•
1,036,800	214,700	85,800	485,200	719,400	402,400	300,400	144,900	351,400	721,600	320,700	759,000	1,043,400	
•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•
											26,400	51,200	
•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•
838,000	83,000	41,000	485,200				36,400	91,300	130,600			47,800	
•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•
95,000	20,800	7,100		719,400		300,400	72,000	123,500	314,500			47,800	
•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•
36,800	58,000	5,000			402,400		36,500	136,600	276,500			108,000	
•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•
67,000	52,900	32,700									732,600	788,600	
•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•	•	•	•	•	•	•
										320,700			

(FROM BALANCE SHEET)

TOTALS	ASSETS	LIABILITIES
•5889,900	CASH & RECEIV. 6,804,560	CURRENT NOTES 7,710,000
• 80,500	INVENTORIES	OTHER
• 1,052,600	9,338,012	2,051,506
• 2,186,200	FIXED ASSETS 2,265,208	LONG TERM 567,249
• 6384,000		OWNERSHIP 7,813,246
15,593,200	18,207,780	18,142,001
1,450,760		
3,925,860		
2,661,010		
2,058,010		
4,031,810		
1,465,750		

MO8-4607-2

weigh the time (and expense) necessary to go into greater detail against the value of the information obtained. In Figure 4 the planner summarized costs one level below that of department manager.

The planner completes the upper portion of the form, the organization chart, down to the level he has selected. Directly underneath, he summarizes yearly operational costs, historical or budgeted, for each department. These costs are total departmental costs. Activity costs are included in them and must still be presented. Activity costs are calculated by determining what specific operations in each department are chargeable to the activity, then costing them out.

Activity Name 001 PROVIDE DEMAND

FUNCTION: QUOTATIONS

INPUTS: 2000, 2010

KEYS	AVG	PEAK	NOTE
1-2	1H	1D	
3-4	2H	6D	1200
4-6	1D	2D	
7-8	1H	4H	
8-11	1D	6D	1200
12-13	2D	5D	
13-14	1D	2D	
14-15	1D	2D	
15-16	12D	30D	1210
16-17	3D	10D	1200
17-18	2D	5D	
20-23	2D	5D	
7-11	2D	5D	
14-16	14D	30D	
23-25	14D	90D-MAX	
		20D-MIN	

FUNCTION: ORDERS

INPUTS: 2020

KEYS	AVG	PEAK	NOTE
25-28	4D	10D	
28-29	2D	4D	
29-31	1D	3D	
25-31	7D	20D	1220

INPUTS

KEY	NAME	SOURCE	AVG VOLUME	PEAK VOLUME	NOTE
2000	QUOTE REQUEST	CUST	50/W	70/W	1020
		FREQUENCY	46 W/YR	4 W/YR	1030
2010	BID REQUEST	CUST	10/W	12/W	
		FREQUENCY	42 W/YR	10 W/YR	1040
2020	ORDER	CUST	16/W	20/W	1030
		FREQUENCY	44 W/YR	6 W/YR	

OUTPUTS

KEY	NAME	DEST	AVG VOLUME	PEAK VOLUME	NOTE
3000	QUOTATN	CUST	15/W	20/W	1030
		FREQUENCY	40 W/YR	10 W/YR	
3050	ACKNOW	CUST	16/W	—	1050

FILE USAGE

KEY	NAME	MSGS AVG	MSGS PEAK	ACCESS	USAGE TIME	NOTE
4000	PRICING	240K	300K	RANDM	8H/D	1100
4010	COST	1,000K	—	RANDM	—	1110
4020	RATE	2500	2800	RANDM	8H/D	
4030	INSTALLED SYSTEMS	400K	—	RANDM	4H/D	1120
4050	CONTRACT REGISTER	1500	2100	SEQ	8H/D	1130
4060	CUSTOMER INDEX	4000	5500	SEQ	2H/D	
4070	PROJECT INDEX	1500	2100	SEQ	1H/D	
4080	ASSIGN'T SHEET	20	80	RANDM	10H/D	1140

IBM Activity Sheet

NOTES
1100 - PRICING FILE IS USED IN BOTH END ITEM AND SYSTEMS QUOTATIONS.
1110 - COST FILE IS PRESENTLY MAINTAINED IN 3 DIFFERENT AREAS. NO CARDS HAVE YET BEEN DISCARDED.
1120 - INSTALLED SYSTEMS FILE HAS NOT YET BEEN PURGED.
1130 - CONTRACT REGISTER IS MASTER OPEN CUSTOMER ORDER FILE. WHEN ORDERS ARE COMPLETED, THE RECORDS ARE MOVED TO THE INSTALLED SYSTEMS FILE.
1140 - MUST BE AVAILABLE FOR SECOND SHIFT.
1200 - WIDE VARIATION DUE TO SYSTEM VARIATION. THERE IS NO SUCH THING, STRICTLY, AS "STD SYSTEM"
1210 - MULTIPLE DESIGN "PASSES" (SEE NOTE 1000)
1220 - TIME ALLOWED BY CUSTOMERS TO ACKNOWLEDGE ORDER VARIES FROM 1D TO MAX. OF 30D.

NOTES
1020 - BREAKDOWN OF REQUESTS FOR QUOTATION:

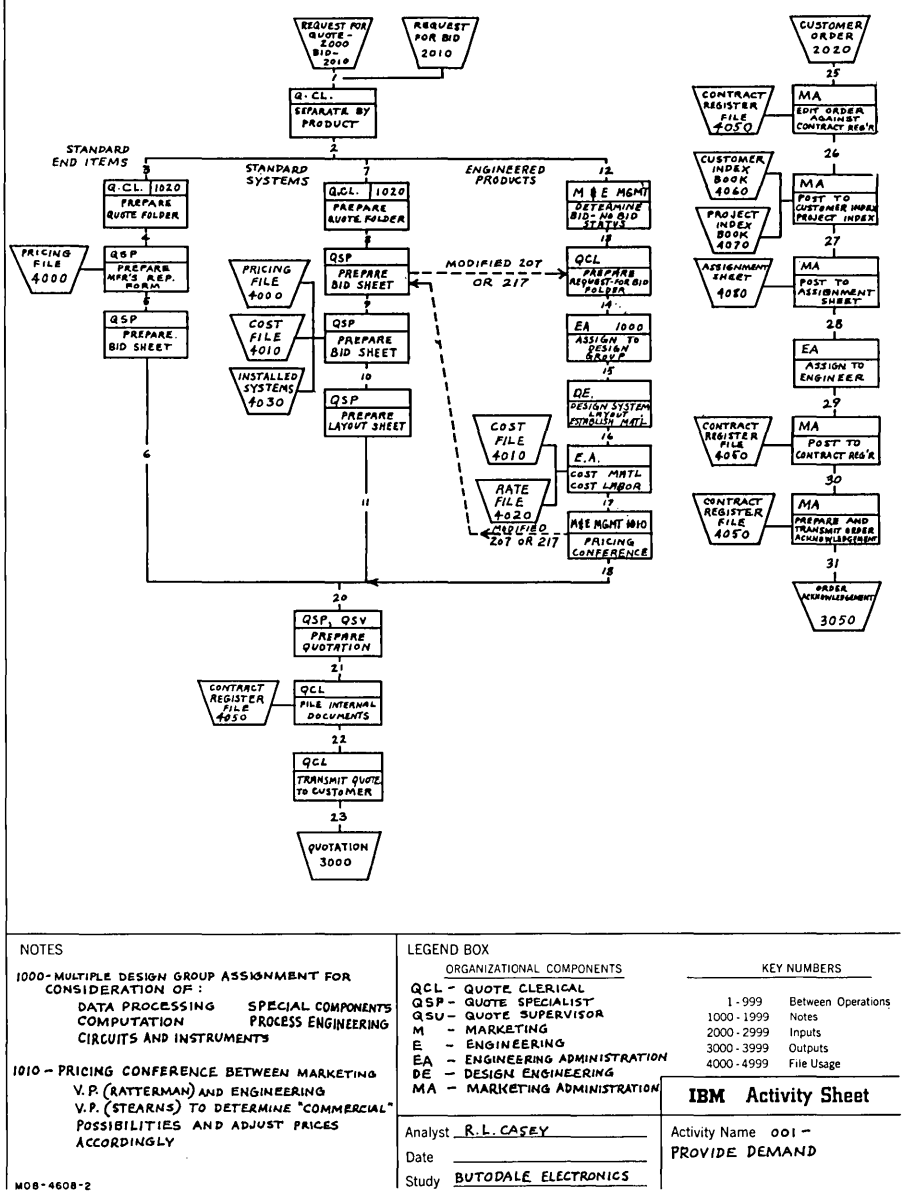
	STD SYSTEMS	207-217	OTHER	STD END ITM	PLOTTER	OTHER
AVG	36/W	32/W	4/W	14/W	10/W	4/W
PEAK	51/W	40/W	11/W	19/W	14/W	5/W

1030 - PLANT CLOSES DOWN FOR 2 WEEKS EACH YEAR, SO THERE ARE 50 WEEKS/YR FOR THIS INPUT. PEAKS OCCUR JUST BEFORE AND JUST AFTER THE 2-WEEK CLOSED PERIOD.
1040 - ENGINEERING DOES NOT CLOSE DOWN ALONG WITH THE PLANT, SO THIS INPUT OCCURS 52 WEEKS PER YEAR. PEAKS OCCUR AT BEGINNING OF EACH FISCAL QUARTER.
1050 - ESSENTIALLY NO PEAKS IN THIS OUTPUT.

Figure 5. Activity Sheet

Two documents are helpful to the planner as he determines activity costs within the departments. The first, the Activity Sheet (Figure 5), contains a flow diagram of the entire activity. It provides room (in the tabular section on the left) for recording key information about inputs, outputs and files. The second, the Operation Sheet (Figure 6), can be used to record significant operations in more detail. The Activity Sheet and Operation Sheet can be prepared, department by department, as the operations are determined.

The Activity Sheet presents a total picture (the flow diagram) of the activity to which the planner can refer as he relates one department's contributions



to the activity with those of other departments. Operations appear in the form of rectangular boxes on the flow diagram. The "flowerpot" symbol represents inputs, outputs and files.

In order to develop total activity costs, expenses and overhead must be allocated. The Operation Sheet is helpful in recording this information. As other activities may also share in a department's total expense, the planner first determines what operations are directly chargeable to the activity he is studying. Operations can be broken down into further subdivisions. These are called processes and appear on the right-center side of the form. Finally, the personnel and equipment (re-

IBM **Operation Sheet**

OPERATION		TRIGGERS, INPUTS AND OUTPUTS						PROCESSES			RESOURCES				
NO	PERFORMED BY	ID NO	NAME AND QUALIFICATIONS	RECEIVED FROM OR SENT TO	VOLUME AVG	VOLUME PER	ELAPSED TIME	ID NO	DESCRIPTION AND QUALIFICATIONS	FRFQ	ID NO	TYPE	UNIT TIME	TOTAL TIME AVG	TOTAL TIME PER
001-580	QUOTE SECTION	T1	RECEIPT OF I1					P1	SELECT STANDARD RACK DIAGRAMS FOR COMPONENTS	1/I1	X1	QUOTE SPECIALIST(3)	11½ OP		
		I1	QUOTE FOLDER (F-4050.1)	QUOTE SPECIALIST	10	D	0				X2	OPERATIONAL DATA REFERENCE MANUALS		8H	D
		I2	QUOTE FOLDER (F-4050.1)	QUOTATION SUPVR.	10	D	1D	P2	ENTER APPROPRIATE ASSEMBLY NUMBER IN EACH RACK POSITION USED	16/I1					
								P3	SELECT FLOOR LAYOUT SHEET (207-217 ONLY. OTHER STD. SYSTEMS DO NOT REQUIRE FLOOR LAYOUT)	7/BI1					
								P4	ENTER COMPONENT AND/OR END ITEM DESCRIPTION IN FLOOR LAYOUT DIAGRAM	7/BI1					
								P5	PLACE LAYOUT SHEETS IN QUOTE FOLDER	1/I1					
001-650	QUOTE SECTION	T1	RECEIPT OF I1 OR I2 (F 4050.1)					P1	REVIEW OF QUOTE OR BID BY QUOTE SECTION SUPERVISOR	1/I1	X1	QUOTE SECTION SUPVR.			
		I1	QUOTE FOLDER (COMPLETED)	QUOTE SPECIALIST	12	D	0				X2	QUOTE CLERK			
		I2	BID FOLDER (F-4050.2) (COMPLETED)	MARKETING V.P.	2	D	0	P2	TYPE QUOTATION FROM BID SHEET	1/I1	X3	TYPE WRITER			
		R1	QUOTATION (5 PARTS)	QUOTE CLERK	14	D	1-2D	P3	PREPARE IDENTIFICATION CARDS (3)	1/I1					
		R2	IDENTIFICATION CARDS (3)	" "	14	D	1-2D	P4	SELECT ADVERTISING LITERATURE	1/I1					
		R3	QUOTE/BID FOLDER	" "	14	D	1-2D	P5	ASSEMBLE QUOTATION AND INTERNAL DOCUMENTS	1/I1					
		R4	DRAWINGS, PRINTS, ETC.	" "	10	D	1-2D								
		R5	ADVERTISING LITERATURE	" "	14	D	1-2D								

DATE R.L. CASEY ANALYST A.R. HOLMES SOURCE BUTODALE STUDY 001-PROVIDE DEMAND ACTIVITY 1 OF 1 PAGE

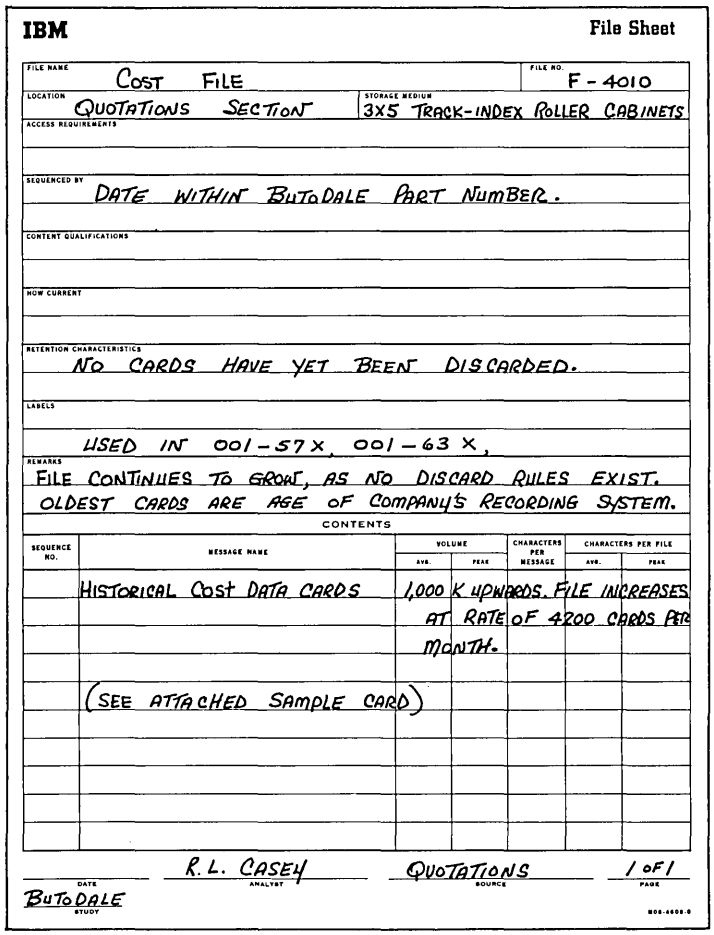
Figure 6. Operation Sheet

sources) used in the operation and their time per unit (or total time per operation) are recorded on the extreme right side of the form and costed out. These costs can be transferred to the Resource Usage Sheet.

Expenses of personnel and resources (files, communication equipment, etc.) shared with other activities are more difficult to allocate. Under allocation or burden cost systems, this can sometimes be done indirectly during interviews with department heads and supervisors. One way to arrive at an estimate is to suggest that the interviewee think of the activity under study as suddenly being set up as an independent operation. Questions such as "How much money and facilities would it take to start it? How much to keep it in operation?" are helpful in arriving at approximate figures. After these costs are obtained (and checked with management), they are also transferred to the Resource Usage Sheet.

A situation often encountered in a systems study is that documents are batched before an operation begins. An operation may begin because a certain day of the month is reached, as in payroll accounting or cycle billing; often it begins as a result of a combination of time and availability of input items, as when ten documents are available and the time of the day is after 3 p. m. Whatever the conditions, and whatever the combination of conditions, the Operation Sheet identifies these operation starters as "triggers".

An understanding and appreciation of information files which are referenced or changed during the operations is vital. Files are represented by a flowerpot symbol on the Activity Sheet; a File Sheet (Figure 7) shows more detail on file characteristics. In recording file characteristics, the planner attempts to capture on paper the dynamic way in which the file is used in the operation. File name, location, access requirements, sequence, content qualifications, how current the file is maintained, retention characteristics, labels and purposes can be recorded. Also noted is the number of documents which make up the file, the number of characters per document and the



IBM — File Sheet

FILE NAME: COST FILE — FILE NO.: F-4010
LOCATION: QUOTATIONS SECTION — STORAGE MEDIUM: 3X5 TRACK-INDEX ROLLER CABINETS
ACCESS REQUIREMENTS:
SEQUENCED BY: DATE WITHIN BUTODALE PART NUMBER.
CONTENT QUALIFICATIONS:
HOW CURRENT:
RETENTION CHARACTERISTICS: NO CARDS HAVE YET BEEN DISCARDED.
LABELS: USED IN 001-57X, 001-63X,
REMARKS: FILE CONTINUES TO GROW, AS NO DISCARD RULES EXIST. OLDEST CARDS ARE AGE OF COMPANY'S RECORDING SYSTEM.

CONTENTS

SEQUENCE NO.	MESSAGE NAME	VOLUME AVG.	VOLUME PEAK	CHARACTERS PER MESSAGE	CHARACTERS PER FILE AVG.	CHARACTERS PER FILE PEAK
	HISTORICAL COST DATA CARDS	1,000 K UPWARDS. FILE INCREASES AT RATE OF 4200 CARDS PER MONTH.				
	(SEE ATTACHED SAMPLE CARD)					

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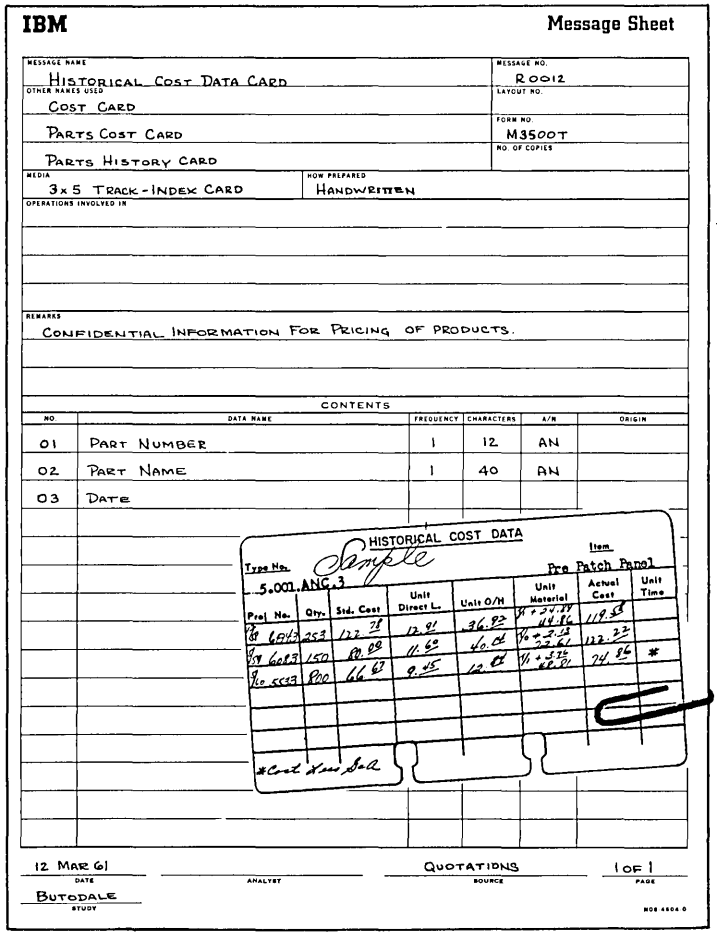

IBM — Message Sheet

MESSAGE NAME: HISTORICAL COST DATA CARD — MESSAGE NO.: R0012
OTHER NAMES USED: COST CARD; PARTS COST CARD; PARTS HISTORY CARD — LAYOUT NO.: — FORM NO.: M3500T — NO. OF COPIES:
MEDIA: 3x5 TRACK-INDEX CARD — HOW PREPARED: HANDWRITTEN
OPERATIONS INVOLVED IN:
REMARKS: CONFIDENTIAL INFORMATION FOR PRICING OF PRODUCTS.

CONTENTS

NO.	DATA NAME	FREQUENCY	CHARACTERS	A/N	ORIGIN
01	PART NUMBER	1	12	AN	
02	PART NAME	1	40	AN	
03	DATE				

HISTORICAL COST DATA — Sample — Item: Pre Patch Panel
Type No. 5.001.ANC.3

Proj. No.	Qty.	Std. Cost	Unit Direct L.	Unit O/H	Unit Material	Actual Cost	Unit Time
6443	253	122.78	12.91	36.92		118.58	
6483	150	80.09	11.50	40.04		112.22	
5593	800	66.67	9.45	12.84		74.86	*

*Cost Has Sold

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Figure 7. File Sheet

Figure 8. Message Sheet

total number of characters in all the documents in the file.

The other use of the flowerpot symbol on the Activity Sheet flow diagram is to show an input or output message. In general, a message is any notice or communication entering or leaving an operation, regardless of the medium of transmission. Messages may be classified as recorded or unrecorded. Formal input and output documents are recorded messages. Their contents are fixed in nature, order and relative length, and are recorded in some permanent medium. Telephone requests for information are a type of unrecorded message. Their characteristics also can be noted on a Message Sheet. In Figure 8, a Message Sheet for an historical cost data card is illustrated. Name, method of preparation, uses and contents are all noted in the top half of the form. The bottom half is used to display data elements which constitute the message. The planner records their name, frequency of appearance, numerical and alphabetical characteristics and origin. Completed samples of the message documents are attached to their respective Message Sheets. The versatility of the File Sheet is illustrated by Figure 7, which identifies a collection (file) of historical cost data cards rather than a single record. Instead of treating the document singly (as he did when he prepared the Message Sheet), the planner analyzed the characteristics of the group of filed documents or messages. In other words, the individual messages assumed new purposes and uses once they were filed with others. Here again, the descriptive documents enabled the planner to illustrate two critical aspects of the same basic information, the Message Sheet illustrating the characteristics of a single document, the File Sheet illustrating the "group" impact of the same basic document.

As he encounters messages, files, operations, processes, etc., the planner not only records their characteristics, but also attempts to determine exactly what internal or external contributions they make to the activity. His documentation assists him by providing either the broad perspective of the Activity and Resource Usage Sheets, or the magni-

fication which is characteristic of the Operation, File and Message Sheets. In many studies, Phase I documentation will consist mainly of Activity and Resource Usage Sheets; the use of Operation, File and Message Sheets will be confined to the brief recording of the present system's most important characteristics.

Although this manual must necessarily describe each document and its use separately, in actual practice the five descriptive forms are used concurrently.

From the Resource Usage Sheet to the Message and File Sheets, there can be a steady progression of finer and finer detail, all of which becomes the planner's operational view of an activity.

Recall the document structure (Figure 3). How are these interrelated documents used? First, the Resource Usage Sheet is filled out to the point where costs of the traditional departments are recorded. Next, an activity is traced through each applicable department to determine its operating costs. The Operation Sheet can be used to expand the information in each operations box on the Activity Sheet. As costs per operation are determined, the totals are transferred to the Resource Usage Sheet. Significant operational characteristics such as volume and frequency of inputs, outputs and files are recorded in the tabular section of the Activity Sheet. Inputs, outputs and files can be further analyzed on Message and File Sheets. As the full impact of the activity gradually takes shape in the planner's mind (as he proceeds through each department) he begins to prepare the lower section of the Resource Usage Sheet. Sometimes the planner uncovers new operations which disclose errors in previously completed Operation Sheets, making alterations necessary.

When he finishes, operations are recorded on Operation Sheets; their inputs, outputs and files are recorded on Message and File Sheets; the operations are flowcharted on the Activity Sheet; finally, activity costs are totaled on the Resource Usage Sheet. When the operational view is completed, the planner has developed a deeper understanding of the impact of the activity on the business. His next task is the development of the overall processing requirements of the new system.

CHAPTER 3 - DETERMINING SYSTEMS REQUIREMENTS

The planner asks himself two vital questions in Phase II as he determines true system requirements. The questions encompass:

- System functions - What must the system do?
- System performance - How well must the system perform?

In Phase I, the planner concentrates on gaining understanding and insight into the business as it presently exists and reacts to its environment. In Phase II, the planner determines what the new system must do to meet future business objectives. As he acquaints himself with future objectives, he also develops an understanding of the future requirements on the new system in terms of the basic systems elements of inputs, outputs, operations and resources. Requirements and performance measurements are defined at the problem level in terms of these elements. Once this is done, Phase III design work may start. Early in Phase III, the planner will determine the amount of automatic processing of data that is feasible. From this, it will be possible to specify a range or class of equipment (IBM 1440, 1401, etc.) that will serve as the chief means of processing data in the new system.

Phase II work, then, covers the transitional period from the study of the present system in Phase I to design of the new system in Phase III. Between these points, the planner:

- Analyzes and defines future objectives.
- Modifies existing activities to better serve future objectives.
- Analyzes activity requirements in terms of inputs, outputs, operations and resources.
- Determines measures of effectiveness for each of these elements.

SOURCES OF INFORMATION

The documentary sources for Phase II analysis are the Resource Usage and Activity Sheets prepared in Phase I plus information about the future contained in:

Market research department reports.
Production department forecasts.
Sales department or advertising agency surveys.
Departmental budget justifications.
Long-range financial requirements reports.
New product, plant, branch office, etc., proposals.
Future manpower estimates.

After gathering available information, the planner examines it for indications of both short- and long-range impact. Even minor changes or additions in such things as products, manufacturing processes, sales territories, and services will affect input and output volumes and existing coding structures as well as the operations themselves.

In many cases, information about the future exists partially (or only as thoughts) in the minds of managers. The planner must draw these thoughts out in interviews. From these diverse sources, the planner determines what main objectives the new system must fulfill. The more clearly and precisely he can express these objectives as he reviews them with management, the more valid the specification of systems requirements will be.

SYSTEM FUNCTIONS

System functions are expressed in terms of:

- Outputs it must produce.
- Inputs it must accept.
- Operations it must perform.
- Resources it must use.

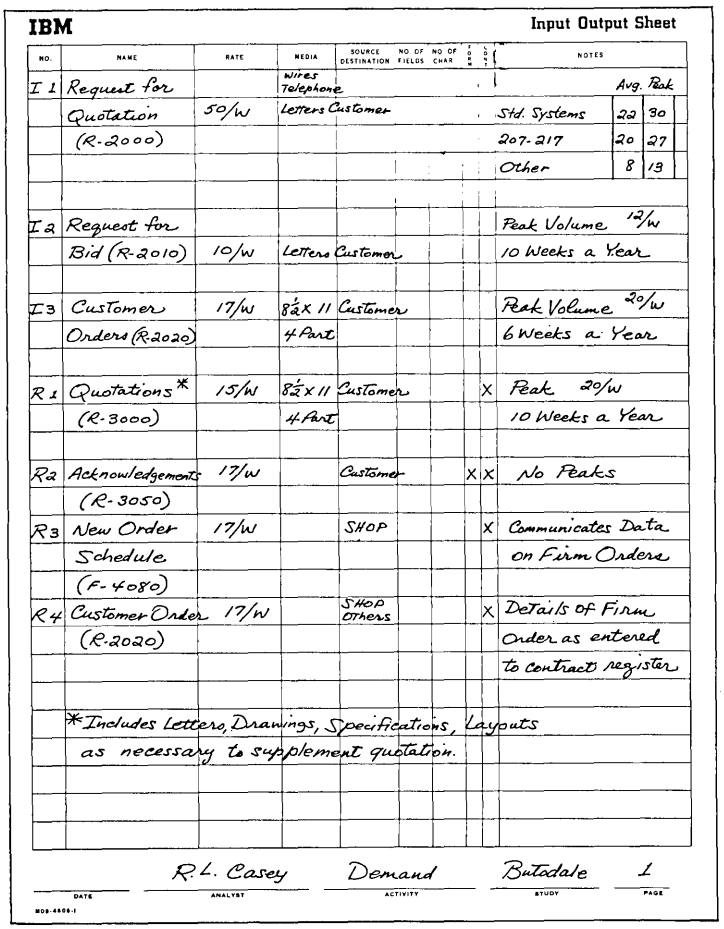
The planner first develops descriptive requirements for inputs, outputs, operations and resources; in other words, he merely names and describes them in narrative form. Then quantitative data (such as time, volume, cost) are added to this description. Techniques such as trend projection, forecasting, estimating, sampling, etc., are applied where necessary to increase precision of specifications.

Inputs and Outputs

Activity inputs or outputs are stated first since they are normally more closely associated with the goals and objectives of the activity than are operations and resources. Sources of information are the planner's Phase I descriptive documents supplemented by information about the future gathered early in Phase II.

Because many outputs are subject to constraints (for example, the format of invoice, purchase order, paycheck, etc.), most planners state them before inputs. Customer acceptance, industry practice, legal or audit requirements, or management preference are some constraints governing the preparation of outputs.

After naming required outputs, the planner turns to inputs where fewer constraints may be present. Exceptions to this are special types of input such as MICR checks, credit plates, documents required



IBM — Input Output Sheet

NO.	NAME	RATE	MEDIA	SOURCE DESTINATION	NO. OF FIELDS	NO. OF CHAR	DUPL	NOTES	Avg.	Peak
I 1	Request for		Wires Telephone							
	Quotation	50/W	Letters	Customer				Std. Systems	22	30
	(R-2000)							207-217	20	27
								Other	8	19
I 2	Request for							Peak Volume 12/W		
	Bid (R-2010)	10/W	Letters	Customer				10 Weeks a Year		
I 3	Customer	17/W	8½ X 11	Customer				Peak Volume 20/W		
	Orders (R-2020)		4 Part					6 Weeks a Year		
R 1	Quotations*	15/W	8½ X 11	Customer			X	Peak 20/W		
	(R-3000)		4 Part					10 Weeks a Year		
R 2	Acknowledgements	17/W		Customer			X X	No Peaks		
	(R-3050)									
R 3	New Order	17/W		SHOP			X	Communicates Data		
	Schedule							on Firm Orders		
	(F-4080)									
R 4	Customer Order	17/W		SHOP Others			X	Details of Firm		
	(R-2020)							Order as entered		
								to contract register		
	*Includes Letters, Drawings, Specifications, Layouts									
	as necessary to supplement quotation.									

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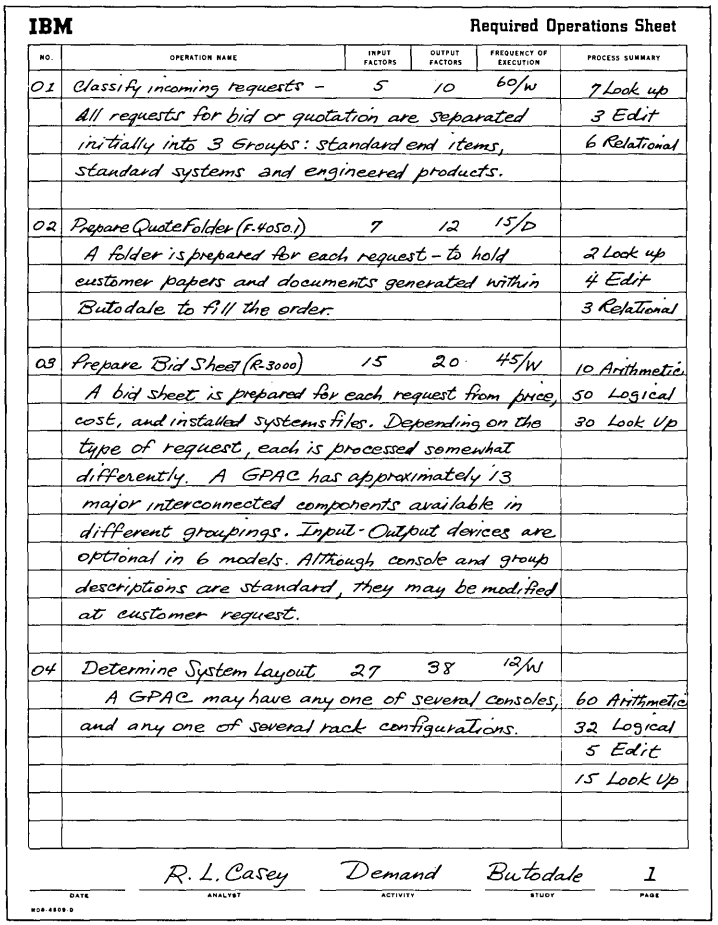
Figure 9. Input Output Sheet



IBM — Required Operations Sheet

NO.	OPERATION NAME	INPUT FACTORS	OUTPUT FACTORS	FREQUENCY OF EXECUTION	PROCESS SUMMARY
01	Classify incoming requests -	5	10	60/W	7 Look up
	All requests for bid or quotation are separated				3 Edit
	initially into 3 Groups: standard end items,				6 Relational
	standard systems and engineered products.				
02	Prepare Quote Folder (F-4050.1)	7	12	15/D	
	A folder is prepared for each request - to hold				2 Look up
	customer papers and documents generated within				4 Edit
	Butodale to fill the order.				3 Relational
03	Prepare Bid Sheet (R-3000)	15	20	45/W	10 Arithmetic
	A bid sheet is prepared for each request from price,				50 Logical
	cost, and installed systems files. Depending on the				30 Look Up
	type of request, each is processed somewhat				
	differently. A GPAC has approximately 13				
	major interconnected components available in				
	different groupings. Input-Output devices are				
	optional in 6 models. Although console and group				
	descriptions are standard, they may be modified				
	at customer request.				
04	Determine System Layout	27	38	12/W	
	A GPAC may have any one of several consoles,				60 Arithmetic
	and any one of several rack configurations.				32 Logical
					5 Edit
					15 Look Up

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Figure 10. Required Operations Sheet

to be read optically, special order forms, etc. In most cases, however, constraints govern the content of input rather than its format.

Once inputs and outputs are named, quantitative data such as peak and average volumes and rates, cyclic and periodic properties, trends and patterns (to the degree of detail that is significant) is added. Phase I data contained in Activity and Message Sheets, supplemented by data about the future, are sources of information. Figure 9 illustrates an Input Output Sheet* that may be used to show input and output information. It summarizes pertinent characteristics of messages that must be accepted or produced by the system. Details concerning each message may be recorded on a Message Sheet.

Operations

Operations are identified by kind and number of inputs they must accept, by kind and number of outputs they must produce, and by how often they must be performed. If the nature and number of the processes involved in the execution of the operation can be estimated, they too are recorded. For example:

- How many arithmetic and logical processes must be performed?
- What comparisons must be made, and how many?
- How many times must files be consulted to transform input information into output?
- How many edit or audit functions must be performed?

Operations are first sketched out on rough flowcharts. A Required Operations Sheet (Figure 10) may then be used to record initial details of operation elements within the flowchart.

It is unlikely that operations will be performed by the new system in exactly the same way or sequence as present operations, except in out-and-out mechanization studies. In most cases, the planner uses his information about present operations merely to identify them and to serve as a guide in regard to complexity.

*A detailed description of this and other forms mentioned in this section is given in "Study Organization Plan — Documentation Techniques" (C20-8075).

Resources

Resources may be classified into two general categories: those which management has specified to be used in the new system, and those which are unspecified but logically necessary.

Management often states or implies that certain resources must be used. For example, restrictions often exist as to the number and type of personnel available to implement and operate the new system. New systems may also be restricted as to their total operating costs, rental costs, physical installation costs and total implementation investment, to name only a few. Sometimes these constraints are imposed by management without a true knowledge of their impact. Quite often the planner will want to reduce them or eliminate them entirely. Merely finding reasons why they should not be imposed is not enough; management will want sound, positive and profitable alternatives. The development of these alternatives will be possible only if the planner recognizes imposed constraints early in the design work.

All resources, those imposed and those also logically necessary, are first described by name – the present name for those that already exist, and a name that indicates content for those that do not. After resources have been named, quantitative data is determined for each. Resource Sheets (Figures 11 and 12) may be used. Required personnel are grouped by occupation, equipment is grouped by classification, and approximate costs are applied.

Information resources (files) are described in terms of characteristics such as:

- Total size of file – number of messages, number of characters
- Retention rules
- Age of data
- Peak and average message volume
- Access requirements
- Growth rate of file
- Change rate of file
- Distribution of file activity (for example, normal or skew)
- Digit distribution of control field characters

Detailed characteristics of each information file may be recorded on File Sheets.

For studies involving communication facilities, the network diagram is modified to show planned addition or deletion of trunk lines, terminals, message centers, etc.

IBM Resource Sheet

NO	NAME AND DESCRIPTION	AMOUNT	COST	NOTES
P1	Manager	1	$12,000/YR	
P2	Secretary	1	4,200/YR	MAIN OFFICE
P3	Underwriters	5	42,000/YR	
P4	Typists	2	7,600/YR	
P5	Agents	2	commission	SALES OFFICE
P6	Receptionists & Typists	27	92,600/YR	
P7	Doctor (uses his own office)	1	10,000/YR	
E1	Typewriters - Electric, 115 Volt	30	600/MO	
E2	Teletype - 10 LPM	(1)	175/MO	(1) 5 UNITS
				1 Sending
				4 Receiving
				Each is 3' X 3'
F1	Main Office - 161 Front St.	44' x 37'	200/MO	
F2	Sales Offices -	4 Offices;	880/MO	
	73 Clover St.	each is 24' x 58'		
	7476 Jones Ave.			
	35 Myrtle St.			
	1 River St.			
V1	Sales Records, monthly.	1200	15/YR	Monthly sales report
	Last 10 years			includes 8 fields
				repeated 120 times
				Plus totals.
V2	Stock Certificates	850	.25/UNIT	Each certificate is
				registered & insured.

T.B. Flanagan (ANALYST) | Life Policy (ACTIVITY) | Life Insurance (STUDY) | 1 (PAGE)

Figure 11. Resource Sheet

IBM Resource Sheet

NO	NAME AND DESCRIPTION	AMOUNT	COST	NOTES
V1	Inventory			
	Shop Stores	3120	$1,450,000	All levels
	Finished Goods	850	1,210,000	caculated at
	Work in Process	350	3,370,000	Sales Volume of
	Indirect	5000	275,000	$22,700,000
				using decision
V2	Decision Rules			rules tested
				in simulation
	1. Forecast Review - 2 mos.			
	2. Order Points for			
	Shop Stores:			
	A. Items - 2 weeks			65% of total
	B. Items - 7 weeks			11% of total
	C. Items - 26 weeks			24% of total
	3. Service Level - 95%			
			*	
V3	Vendor Name File	850		
V4	Purchase Order File			13,500/year
V5	Project File (F-4070)	225		
V6	Back Order (Shortage) File	150		
V7	Eng'g. Release Notice File	550		
V8	Work Order File	8500		use 300/wk.
	(Order Records)			
V9	Requisition File			variable
V10	Operation Planning File	3750		
V11	Eng'g. Print File	4000		
V12	Receiving File			34,000/year
	* costs not identifiable			

R.L. Casey (ANALYST) | Materials (ACTIVITY) | Butodale (STUDY) | 1 (PAGE)

Figure 12. Resource Sheet

SYSTEM PERFORMANCE

In determing input, output, operations and resource requirements for the new system, the planner attempts to analyze the problem without constantly considering the equipment that will eventually process much of the workload. This is only possible to a degree; the means of solving a problem can never be completely divorced from the problem itself. In every study, equipment solutions will suggest themselves at all points in requirements analysis. This is especially true in analyzing system performance where many measurement factors present themselves.

The planner's first step, in determing measures of effectiveness for a new system, is to select a set of significant factors for measuring new system performance. These factors are closely related to the present and future business objectives as expressed in management plans and in Phase I business goals.

Some major measurement categories and factors within them are:

1. Cost -- operating and implementation.
2. Time -- response (to an input; within operations), access, elapsed, turnaround, cycle, process.
3. Accuracy -- roundoff, frequency and significance of errors on input and output documents.
4. Reliability -- duplexed components, backup equipment.
5. Flexibility -- type and number of exceptions handled.
6. Security -- legal, safety, secrecy.
7. Capacity -- average and peak load.
8. Quality -- appearance, tolerance.
9. Acceptance -- employee, management, customer, stockholder.
10. Efficiency -- performance ratios.

The next step is to determine the present system operating points (or ranges) in each factor: average performance, best or worst performance when significant. This data provides a benchmark for the new system design: as noted earlier, a new system must perform at least as well as the present system. Operational information which the planner gathered in Phase I may be directly usable, or it may be necessary for him to develop data from the present system's files.

Setting performance targets for the new system is the planner's final step. Here again he must consider present and future objectives-- and again must use his knowledge of business goals and management policy. Targets should whenever possible be expressed quantitatively: two-day cycle time from receipt of an order to shipment, $75,000 annual cost saving over the present system, less than 1% error on customer-order inputs, and the like.

Measurement of performance is rarely an absolute process. Many factors must be arrived at by hypothesizing certain system solutions and then working back to the means of measuring their eventual performance. The planner must interview management frequently during this work to make sure that he is adequately measuring the significant factors-- so that he can design the new system to accomplish management objectives.

CONCLUSION

At this point, the planner is ready to begin his systems design work where he will incorporate the problem's functional requirements of inputs, outputs, operations and resources into one or perhaps two alternative system configurations of manpower, procedures and equipment. He will also have developed insight into just how their performance must be measured. The application of these measurements to each alternative approach will result in the selection of the one that will best perform the problem stated in his Phase II analysis.

CHAPTER 4 - DESIGNING THE NEW SYSTEM

New system design is the development of an effective solution to the problem defined during Phase II of the study. Without the fundamental understanding of the present system and a good grasp of the requirements of the future system, the probability of designing a good new system drops significantly.

The detail of design should be as limited as possible and only go far enough to demonstrate feasibility, to provide a base for reasonable cost and benefit estimates and to enable a good equipment selection. The systems planner should design only to the depth needed to satisfy himself and management that the new system is practical and will produce results. The actual level of detail will vary with the scope and complexity of the new system. When it is time to implement the system, full detail and documentation will be required; until then, the detail should be minimized.

Fundamental to practical system design is knowledge: knowledge of the business (present and planned), knowledge of the equipment and programming systems available, knowledge of how these applications or activities have been solved elsewhere, and knowledge of how to perform the design process efficiently.

IBM provides many vehicles to increase the planner's knowledge of applications and equipment — then helps him prepare himself to develop good problem solutions, good system design. Some of the information sources are:

- Customer education courses
- General information manuals - techniques, system concepts
- Reference manuals - equipment, programming systems
- Application briefs
- Application program bulletins

In attending classes, the planner gains information not just from the class presentation but also from discussions with others, many of whom have similar interests and problems. The manuals and bulletins discuss a wide range of topics in data processing: procedures, equipment concepts and operation, programming language concepts and uses, specifications of IBM application programs, and the application of management science techniques by users of data processing systems.

Information about available equipment and the approaches of others may also be obtained by visits to installations, attendance at business shows, reading of data processing trade publications, and participation in business or data processing associations and societies.

System design is still very much of an art, though certain detailed aspects are subject to automatic analysis or calculation. No particular solution, therefore, is best for all problems. Some systems are best when based on a random access, one-transaction-at-a-time approach; others are more efficient with batched transactions updating a consolidated file; still others need to be built around sequential processing of split files, with emphasis on efficient sorting of intermediate results.

There is, however, a pattern of designing which most good systems designers follow: this procedure provides careful consideration of the key factors in an efficient, logical order. The result of this procedure is generally a practical, economic solution to the business systems problems identified and defined in Phase II.

SYSTEMS APPROACH

The first job is to examine different general systems approaches to solving the problem. Usually an approach can be developed by successively examining inputs, outputs, files and operations.

There are many alternative ways in which inputs can be handled: preparing punched cards or punched paper tapes; mark-sensing cards or scoring them with an IBM PORT-A-PUNCH® using a magnetic ink character recognition or optical character recognition device; keying input directly; or working with remote terminal input through IBM TELE-PROCESSING® equipment channels.

Similarly, output alternatives are reviewed: magnetic tape, printed reports, punched cards, punched paper tape, direct display, and transmission to remote terminals. File possibilities are analyzed: magnetic tape, disks, disk packs, punched cards and drums.

The examination of operations is more complex. Here alternative ways of developing the solution must be studied. These relate to the procedures used: table lookup, decision logic, or calculation. Can minor operations be combined? Can oversized operations be split? With what frequency do the operations need to be performed: instantaneously? hourly? daily? weekly? monthly? quarterly? yearly? What degree of audit and control should be introduced? How? Can parts explosion be done on a "where-used" basis, or are calculation, sorting, and summarizing needed?

The purpose of this review of alternative ways to handle inputs, outputs, files and operations is to ensure not being bound by the limitations of the past, not being hamstrung by the rules of manual or even unit record systems.

With the possibilities analyzed, the systems planner must put these pieces together to form one or more sensible systems approaches. A system approach is simply an overall plan which relates inputs, outputs, files and operations into a system which will accomplish the stated business objectives. It is usually based on some concept of how the system should function. Real-time response is a concept; so is automated decision making; mathematical optimization is a third; integrated data processing is a concept; online physical control is another. Systems can be designed as information retrieval, report preparation, input response, or file maintenance.

The systems approach usually will sharply narrow the available alternatives for inputs, outputs, etc. The definition of the systems approach can often best be expressed as a flowchart or "balloon-and-box" diagram showing the principal inputs and outputs, the major operations to be performed by the central processing unit and the type and class of files. This activity definition is usually expressed in runs for batch processing or transaction classes for online systems. The Activity Sheet is useful in displaying the design solution; key volumes and or time relationships can be shown in the grid area.

In selecting systems approaches, special consideration should be given to available application programs or to solutions described in application briefs. Taking a predesigned approach like this may significantly reduce planning and installing time and provide more predictable results.

If more than one application or activity is involved, the interaction among them should be examined to see whether common inputs, outputs and files can be used, whether there are any special problems in using a common central processing unit, or whether peak loads may be a disturbing factor. Interaction of multiple activities may further limit the alternative systems approaches which are worth careful evaluation.

In summary, the planner makes his initial choice of a systems approach on the basis of his knowledge of the specific problem, various equipment capabilities, and the approaches of others who have already solved similar problems. After one, or possibly two or three, overall approaches have been defined, they are analyzed in more detail.

SYSTEM SELECTION

The first step in system selection is to segment the problem into a series of computer runs. These runs are usually associated with:

- Conversion of input
- Sorting of input into correct order (serial processes)
- Answering of inquiries (random processes)
- Updating of information files
- Preparation of reports and other forms of output

The basic objective of run design is to determine the organization of runs that will provide optimum performance at a minimum cost. Run design includes the preparation of a general flowchart of the procedure, the design of key input and output formats, and the definition, flowcharting and rough timing of critical segments of the procedure.

The planner designs runs and selects equipment within definite restrictions. Some of them may be:

- Operational time limits (one shift, two shifts per day, five days per week, 176 hours per month, etc.)
- Application program minimum-configuration requirements
- Programming system minimum-configuration requirements
- Deadline time (daily, weekly, monthly accounting period or report deadlines)
- Turnaround time (transactions must be processed within a stated time limit)
- Cost of objectives (total cost or system rental limits)
- Special systems requirements (MICR, optical or stub card reading, online special devices, compatibility with other systems, etc.)
- Necessary sequence of operations (some operations must precede others because of dependence on information produced by the others)

An initial configuration is selected on the basis of volume and frequency information, with suitable input, output and file devices and an adequate central processing unit. This configuration is selected for a particular systems approach after completion of run design.

Next, volume figures from Activity Sheets (associated with each input, output and file) are translated into rough timing estimates. Data arrangement within each input, output and file is put off until later; for now, it is sufficient to estimate total amount of data each will contain. Card input files are translated into card read time by dividing volume by card reader speed.

Reasonable assumptions are made for blocking of tape files, and total tape passing time is calculated for each file. Files contained on disks are judged for total disk file capacity required, and for access time and character transfer time on the basis of the estimated percentage of activity.

With this information available, the iterative, or repeated, process of run design and system selection begins. Runs are usually defined in descending order of importance: priority is given to the run that has the greatest impact on total running time. Adding the input/output times together for each run and weighting them by monthly frequency, then accumulating time across all runs provides an approximation of performance on a buffered single-channel system. Measuring this time against requirements gives a good indication of the buffering that may be required. A two-channel system will take roughly half as long, an unbuffered system at least twice as long. Intermediate results can be achieved through use of different-speed components and by adjusting the order of merge used in programs.

The first step in selecting a processing unit is to calculate internal processing and program storage requirements. One easily isolated element of each is the Input Output Control System (IOCS) requirement. Both the processing time and the core storage needed are defined in published manuals as functions of the number of files (and data channels, in larger systems) used by the run.

Calculating the balance of internal processing time is usually the most difficult task in run design. There are several reasonable approaches to estimating transaction processing time. "Benchmark" programming is certainly the most accurate, and is especially useful if the overwhelming majority of transactions are of a single type. Exception routines that should be programmed are the compares (to find an active master record), the record moves (if any), and the actual master testing and updating routines. Another method for calculating internal processing time is to estimate the instruction mix required: the number of adds, subtracts, compares, and moves, for example, required in the program. Multiplying each by published instruction execution times, then adding together, produces total program execution time. Finally, it may be possible to estimate processing time by making a time study of the same type of run on the same type of computer at another installation, then adjusting for differences in master record and transaction record volumes.

Another consideration in determining internal processing time is interlocking of the core storage unit as data is transferred between core storage and input/output devices. Time lost because of interlock depends on both the particular computer and the number of words read or written during the run.

If the logic of the run indicates that tables of significant size are used, the format of each table should be established and storage areas set aside.

Storage requirements for instructions and constants are then added. Additional storage is set aside for error checkpoint (on larger runs), restart and other miscellaneous routines. When all of the storage requirements so far defined have been added, and the result subtracted from the block of storage available in the class of system chosen (4K, 8K, 12K, 16K, etc.), the result is the storage available for input/output areas. Number of input/output areas required for each file is based upon the system's buffering (larger systems), the relationship between files (master file or transaction file), and the options in the computer's IOCS system. Blocking factors are then established for each file. If the number of input/output areas is severely limited (or if optimum blocking factors cannot be used because of input/output area limitations) then moving up to the next-higher block of storage available or adding additional components or special features (such as print storage, high-low-equal compare, process overlap) should be considered. If design objectives have been met, each run is then timed, and a preliminary total cost figure determined.

RUN IMPROVEMENT

After the number of input and output units have been defined for each run and the processing unit has been determined (along with preliminary time and cost information), each run is reviewed to determine where it can be improved to reduce operating costs. There may be opportunities to combine short runs, as long as such combination does not result in additional equipment requirements. Using one or more common files in combined runs or combining a process-limited run and an input/output-limited run (on a buffered system) usually will reduce operating costs. If system rental cost objectives are met and operating time remains available, partitioning of files may reduce equipment requirements (but increase operating time).

If both operating time and system rental limits are exceeded, the entire scope of the activity must be re-examined and a decision made either to reduce requirements or begin run design again on a larger system. Less extensive revisions may often be made before this step is taken. Processing operations such as zero-balancing fields in an

input transaction, and editing fields of an output transaction for printing can be moved from process-limited runs to input/output-limited runs without any effect on system logic. If the run to be improved is input/output-limited, essentially opposite approaches can be used to improve it. By using processing operations to construct fields as needed, rather than carrying the fields, input/output time may be reduced. For example, gross pay minus deductions equals net pay. Only two of these three fields need appear in an input or output master file. Special compacting and coding/decoding operations may also be used to decrease file size. When master files contribute excessively to input/output-limited runs, the effect of additional internal storage on master file blocking and input/output time should be considered. Alternatively, an extraction or change-tape technique may reduce total job time.

After the means of automatically processing data is selected and analyzed with respect to time, cost and accuracy, another important design aspect remains. Since a system, by definition, comprises both an equipment and a human element, all aspects of the system must be reviewed in terms of the people who will implement and operate it. Many of these considerations are discussed in the next section; at this point, however, the human element must enter into future operating costs. Salaries and clerical support costs are calculated from actual payroll or industry averages (for new job positions) and projected over the useful life of the system. Combined with timing and cost data for the equipment, this produces a total operating cost for the new system.

EQUIPMENT SELECTION

The specific equipment configuration is selected on the basis of individual run design, various systems approaches, and total company needs. Questions to be answered include:

- Will the equipment provide for efficient growth without substantial reprogramming?
- Is the equipment flexible enough to provide an efficient operating system even if the business changes significantly in product mix, type of customer, volume of orders, etc. ?
- Can other applications be performed on the equipment readily — commercial and scientific work, large and small assignments?

Also considered are machine backup, programming systems and application programming support, availability of trained personnel, and delivery schedules.

The choice of an equipment configuration is not a mechanical procedure requiring the mere addition of numbers where the configuration with the lowest cost is the victor. The many intangibles often dominate a decision, yet this does not in any way lessen the importance of careful system comparison.

SYSTEM DESIGN DOCUMENTATION

The system which has been designed must now be appropriately documented.

1. Prepare an Activity Sheet for the whole system.
2. Prepare an Activity Sheet for each run.
3. Write Operation Sheets (or equivalent flowcharts) for critical areas.
4. Describe key inputs, outputs and files adequately on Message and File Sheets.
5. Prepare an equipment list showing specific features and prices. This should list both data processing equipment and other machines or services required.
6. Prepare a list of personnel for system operation, showing title, number and salary.
7. If the system is unique or departs radically from present practices, an operating demonstration of an initial portion of the job may be a necessary "documentation" step.

CHAPTER 5 - ECONOMIC ANALYSIS

Before the planner submits recommendations to management, he must analyze the new system's economic impact. Throughout this analysis he must maintain a management viewpoint. The ultimate measure of management is the ability to protect and increase a company's profitability — earning the largest, safest return on stockholder investment over an extended period of time. The decision to rent or buy a data processing system represents a major investment — in implementation, site preparation, training, equipment, commitments, etc. Capital investment decisions are extremely complex, requiring the advice and counsel of a skilled financial man. Assistance from financial accounting personnel should therefore be sought — not only in the development of the capital investment and return information, but also in organization and presentation of the economic evaluation. This should include specific data on whether to rent or purchase the equipment.

Measurement information gathered in Phase II is another substantial input to the economic analysis. Measurement factors should be reviewed at this point in order to ensure that the new system meets costs and savings objectives that management has already expressed.

MAJOR AREAS OF MEASUREMENT

Economic analysis centers around three major areas:

1. The present system's direct costs are projected into the future and compared with the new system's predicted direct costs.
2. Other savings (or costs) in business operations caused by the new system are analyzed.
3. Implementation costs of the new system are determined.

Present System vs. New System Direct Costs

Present system cost information has been gathered in Phase I and appears on Resource Usage and Operation Sheets. Information gathered in Phase II on future volumes, planned expansion of product lines and services, etc., is applied to arrive at estimates of the costs of the present system that would be incurred if the present system were allowed to continue. Costs should be projected sufficiently into the future to allow for fair comparison; typically, at least three years is used. This is often extended to five or even ten years for large-scale or integrated systems.

Major direct cost categories are:

- Personnel
- Data processing equipment
- Data processing supplies

Data processing costs related to activities that will be taken over (or superseded) by the new system should be included. Since the compilation may cut across the present cost accounting structure, the costing process may be complex, but only in this way can present and new system costs be meaningfully compared. Direct costs of the new system are estimated for the same categories as those for future direct costs of the present system.

Where there is a question as to the expected level of future input or output volume, the planner should project present and new system costs at two or three different levels: an average or expected volume level and a maximum (and possibly a minimum) expected volume. The ability of automatic data processing systems to handle large changes in volume at relatively minor changes in cost is often best illustrated in this way.

Direct costs should be determined on a comparable basis for the level (or levels) of volume selected, and take into account previous cost improvement trends, salary (and fringe benefit) differentials between personnel required by both systems, and the fixed and variable cost aspects of growth. In planning and displaying cost information, recognition should be given to the "step function" characteristic of costs that are projected for data processing systems. The curve will show sudden cost jumps at certain volume levels (depending upon the initial workload of the system) as the system is expanded or another shift started, then level off for an extended period of additional volume, and so on.

Economic Value Beyond Direct Cost Savings

In addition to savings generated from reduced direct costs in processing data, the planner should show other benefits (and cost savings) derived from the new system. Benefits are often of an intangible nature, but an attempt should be made to express them quantitively in terms of the net value to the business. For example, in one study an analysis of customer sales statistics showed that the business was losing 4% of its gross sales annually,

due to out-of-stock situations. The present system had a 90% service factor for customer orders; the new system could achieve a 97% service factor. "Out-of-stock" lost sales that were prevented by the new system would, in effect, increase gross sales.

The same type of reasoning applies to many areas of new system impact. The importance of translating narrative statements of benefits (such as those below) to quantitative statements must be decided by the planner; each planner's situation is unique. Benefits that often may be expressed in terms of dollar savings or revenue increase are:

- Decrease in the length of production cycles.
- Improvement in product quality.
- Shortened response time to prospect and customer inquiries.
- Increase in employment stability.
- Decrease in accounts receivable.
- Reduced inventories.
- Elimination of spoilage, waste and obsolete materials.
- Fewer stockouts.
- Reduction in bad debts and bad debt claims.
- Improved vendor measurement.
- Better sales coverage.
- Better product design.
- Better operational planning.
- Higher degree of standardization.

All of these statements, when reduced to numerical data, relate in some way to the sales/cost relationships of a profit-making organization in terms of increased sales, or decreased fixed or variable costs:

Company sales-total costs = company net profits before taxes

This equation shows that if a new system can either assist in increasing sales or decrease costs, or both, net profits before taxes will increase. If the new system increases costs, the planner must be able to demonstrate sufficient increase in sales to produce a profit--over and above the expected profit if the business had continued to operate under the present system.

There is usually less need to develop information on sales-increase potential if the new system will reduce direct costs significantly. However, before the planner can complete his analysis he must add in another cost factor: the total cost of implementing the new system.

IMPLEMENTATION COST PLANNING

Implementation itself takes place after the New System Plan is approved. Planning for implementation, though, must occur before recommendations are submitted, in order to include the implementation schedule and cost.

Implementation cost planning is based on five major elements:

- Detailed system design
- Programming
- Physical planning
- Conversion and system testing
- Personnel

These elements are also the framework of the implementation schedule.

This manual concentrates on planning for implementation rather than the implementation itself. Before actual implementation is begun, the planner should obtain a general background from such IBM General Information Manuals as "Planing for an IBM Data Processing System" (F20-6088) and "Physical Planning" (F24-1052). After a system is selected, manuals pertaining to the specific equipment are useful, such as the IBM General Information Manual "Planning for an IBM 1401 Data Processing System" (F20-0228) and its companion, the IBM Installation Manual "Physical Planning — IBM 1401 Data Processing System" (C-1404-1).

In developing the overall implementation schedule, personnel requirements are critical. If the number of personnel available is too limited (or if they are not experienced enough to handle the workload), then either their number, their training, or the original schedule must be adjusted. Other adjustments may be necessary to agree with system and accessory delivery and physical site preparation plans.

The planner has a twofold responsibility in his preparation of implementation costs. The first, of course, is to prepare a realistic estimate; the second is to communicate this information to management. The five major elements of implementation cost planning are discussed in the following pages. Accompanying each subject is a cost planning chart that shows one way of displaying cost information. The next chapter, the "New System Plan", has an exhibit that summarizes cost information shown in each of these separate charts. These exhibits are intended as examples of how to display estimates. They are not intended as IBM's prediction of what a complete implementation program or a portion of one should cost. Large-scale, multiple-plant or multiple-office systems could run substantially higher in total cost of implementation illustrated in the exhibits; smaller systems could run lower.

Detailed System Design

Detailed system design takes place after management has approved the recommendations contained

in the New System Plan. It includes design of input and output, selection of a method (or methods) of organizing and addressing files, and the program flowcharting of each computer run.

In implementation planning, runs represent strings of related instructions prepared by programming personnel whose salaries represent a significant portion of implementation expense. A logical method of estimating (and reporting) these costs is to first estimate the time necessary to define the runs, then determine the time necessary to program them.

Some variables which influence the time it takes to complete detailed run design are the number, state of training and skill of personnel, the applicability of IBM "packaged" application programs (which assist in reducing problem definition and coding costs), the complexity of operations, and the accuracy of data in existing files.

Once estimates are prepared, the planner may use a cost summary planning chart (Figure 13) to show costs and time for detailed run design over his selected time span. This illustration shows that design of the MICR conversion run is planned for completion in time period one. Design of the posting run will require two time periods, and so on.

Minimum, average and maximum design costs for each run and for the entire job can also be developed. Alternative plans illustrating the cost differences between a stepped-up or crash program implementation schedule and a normal schedule may be pertinent in some cases.

TASKS						Total Cost by Task
MICR Conversion Run	500					500
SORT Run	500					500
Stop-Pay and Short List Runs	500					500
Posting Run	500	500				1,000
Statement Run	500	500				1,000
Exception Reports Run	500					500
Total Cost by Time Period	3,000 1	1,000 2	3	4	5	4,000 Total

Figure 13. Detail run design cost summary (by task and time period)

Programming

After the time requirements for detailed run design are determined, the planner can estimate the time and expense to prepare each run's computer program. IBM sales representatives and systems engineers should be consulted frequently as improvements in programming languages (and other means of generating machine instructions) are being made almost daily. IBM assistance is available as well on such topics as skill, background and experience needed of programming personnel, technical information manuals and programming material, and packaged programs pertaining to specific data processing tasks within the planner's specific industry.

Despite the number and variety of instruction-generating routines available today, an estimate of the time to fully program individual runs will necessarily have to be approximate. Adequate time safety factors must be allowed for solution of unforeseen problems. When preparing and presenting cost and time estimates (however approximate they may be), the planner should indicate any special ground rules under which the estimate is prepared, and indicate that the estimate is just that: an estimate. Estimates must be revised whenever the conditions on which they are based are markedly changed, or do not occur.

Figure 14 shows a cost summary planning chart prepared for programming of the same runs illustrated in Figure 13.

Physical Planning

Although necessarily discussed in the implementation planning section of this manual, planning

TASKS						Total Cost by Task
MICR Conversion Run	500	500				1,000
SORT Run	500	500				1,000
Stop-Pay and Short List Runs		500				500
Posting Run	500	2,000	1,000	500		4,000
Statement Run	500	1,500	500			2,500
Exception Reports Run	500	500	500	500		2,000
Total Cost by Time Period	2,500 1	5,500 2	2,000 3	1,000 4	5	11,000 Total

Figure 14. Programming cost summary (by task and time period)

for physical installation of the new system often begins as soon as the need for the system is recognized. The planner should consult company management, building engineers and IBM representatives early in the study concerning possible sites for the system; such factors as site selection, floor planning, structural problems, air conditioning, electrical requirements, safety and human factors should be reviewed.

Because installation is usually a one-time task, it sometimes receives less attention than continuing tasks such as personnel education and training. The planner should nevertheless be concerned with the scheduling and cost of installation; poor planning has its price here just as it does in other steps of the study.

The planner must consider environmental safety factors as he prepares his installation plans. Although IBM can advise in this aspect, the planner himself must assume the major responsibility here. Limitations of time, money and personnel may make necessary some compromises in the new systems procedures, but no compromise should be made in guaranteeing maximum environmental safety to operating personnel and important business records.

Physical installation plans will be included in the New System Plan. A cost summary planning chart similar to that shown in Figure 15 can be used to describe the start and completion dates of steps involved in physical installation of the system, and the cost of doing each step.

Conversion

After estimating programming time and costs, the planner turns to conversion. Some of the steps in conversion are:

1. Establish schedules for cutover to new system.
2. Establish an orientation program for all administrative and clerical employees of the company.
3. Plan for "pilot" operation.
4. Gather data for master files.
5. Edit files for completeness, accuracy and proper format.
6. Consolidate files, create new files, and determine procedures to maintain files.
7. Provide for training of machine operators and instruction of personnel in departments that will supply source data and receive processed data from the data processing system.
8. Coordinate the actual conversion process.
9. Compare results of the two systems.
10. Retrain and reassign personnel.

If preparation is done well, the conversion itself proceeds with a minimum of difficulty and confusion.

One of two general approaches can be followed at the time of conversion:

Parallel operation. Both the old and new system are operated simultaneously on current data; such parallel operation is usually continued through at least one or two complete processing cycles (say, accounting months). When one part is operating successfully, another is put into parallel operation.

Pilot operation. The new data processing system is put into test operation as soon as it is ready, using data from a previous period. Results are compared with those of the old method for the same period. Output is checked for accuracy, completeness, and proper handling. Any necessary adjustment to the new system is made before it takes over the processing of current data.

Both methods test the new system by verifying that each individual program is performing as intended. Each also provides valuable training for personnel in the operation of the entire system.

Figure 16 shows a cost summary planning chart for conversion and testing of the runs illustrated in Figures 13 and 14. It shows that the entire task of conversion will take two time periods beginning in the fourth and running through the fifth period. Testing of the conversion run, the posting run and the statement run will begin at the fourth period and continue until the end of the fifth period. At the beginning of the fifth period, testing of the sort run, the stop-pay run and the exception report run begins and lasts for one time period.

Personnel

Installation of a new data processing system often affects existing departmental relationships and responsibilities to a considerable degree. External

TASKS						Total Cost by Task
Site Construction	500					500
Air Conditioning	500	1,000				1,500
Power Supply				1,000		1,000
Office Layout				500		500
Equipment Installation				500	1,000	1,500
Total Cost by Time Period	1	1,000 2	1,000 3	2,000 4	1,000 5	5,000 Total

Figure 15. Physical installation cost summary (by task and time period)

departments are affected either through their contribution of information to the system or their receipt of information from it. The planner must effectively portray these responsibilities and relationships in the New System Plan so that no operating department affected by the changes is in doubt as to its new role. It is equally important to show the structure of the new data processing department.

If the planner were to compare internal structures of various data processing departments, it would be quite unlikely that he would find any two identical. However, no matter how they are organized, the more successful departments have two major characteristics in common:

1. Responsibility for the data processing department is specifically directed upward to one individual in top management who will give it his full and active support.

2. Responsibility is also clearly directed downward through the data processing supervisor(s) to each individual in the department. No individual concerned with data processing should be unaware of his responsibilities nor denied the authority necessary to fulfill them.

To ensure that management is aware of the special skills necessary in the data processing department, the planner should prepare a short description of each job function; this also serves as a guide for selection and training of personnel. Assuming that the planner prepared a rough outline of a master implementation plan as he estimated systems design, programming and conversion costs, he can then estimate the number of people required, their jobs, and when they will be needed. A further refinement would be to specify whether each position should be filled by an experienced person or a trainee.

From this information, training requirements can be developed, and costs calculated for each time period and in total. A cost summary planning chart (Figure 17) may then be developed. Depending on the circumstances, it may be simple, as in Figure 17, or elaborate - a simple cost-per-time-period chart, for instance, can be expanded through breaking personnel costs down by the activity being implemented. In preparing the training schedule, personnel affected by the data processing system but not directly involved in it must also be considered.

ECONOMIC ANALYSIS SUMMARY

In summary, economic analysis is carried out in three major steps:

1. Present and new system direct costs are projected, then compared to establish net operating improvements over a period of years.

TASKS						Total Cost by Task
MICR Conversion Run				500 ▲	500	1,000
SORT Run					500	500
Stop-Pay Run					500	500
Posting Run				250 ▲	1,000	1,250
Statement Run				250 ▲	1,000	1,250
Exception Reports Run					500	500
Total Cost by Time Period	1	2	3	1,000 4	4,000 5	5,000 Total

Figure 16. Conversion and testing cost summary (by task and time period)

TASKS						Total Cost by Task
Training Supplies	100 ▲	100				200
Advertising and Employment Agency Fees	750					750
Personnel Expenses (Salary, Living, Travel and Misc.)	550 ▲	500 ▲	500 ▲	300 ▲	100	1,950
Total Cost by Time Period	1,400 1	600 2	500 3	300 4	100 5	2,900 Total

Figure 17. Personnel selection and training cost summary (by task and time period)

2. Benefits other than those involved in the direct processing of data are translated into quantitative data.

3. Implementation costs are projected.

In many studies, the planner will produce sufficient savings in the first step to justify the system and can merely indicate additional benefits by name rather than estimate their dollar value. However, when the new system will cost more to operate or when it "breaks even" with the present system, additional benefits must be shown in terms of their net effect on profits. After revenue, expense, and investment totals are determined, the planner can produce information about profit per sales dollar, profit per investment dollar, rate of return on investment, cash flow forecasts, etc., and other regularly accepted measurements of the value of an investment.

CHAPTER 6. NEW SYSTEM PLAN

The prime objective of the New System Plan* is to show management that the business can profit more by investing time and money in the new system than in other investment opportunities. While style, length, and amount of detail vary appreciably from plan to plan, each should relate how the new system will operate, and indicate how much time and money is needed to install it. The New System Plan should also effectively show the system's value in terms of business operation and performance.

Another objective is to provide appropriate technical information and supporting detail to enable personnel not on the management level to review, understand and implement the new system. For this reason, selected information on inputs, outputs, files, decision logic, run timing, and at times even sample problem material is incorporated in the plan as an Appendix.

To carry out these objectives, the New System Plan has five sections:

- Management Abstract
- The New System in Operation
- Implementation Plans
- Appraisal of System Value
- Appendix

The New System Plan should be easy to read, attractive, and well organized. A title page and table of contents are useful. Exhibits and charts should be numbered and referenced directly by the text.

MANAGEMENT ABSTRACT

The Management Abstract may well be the most critical section of the New System Plan. Since management, when reading it, expects to find the precise and factual information on which to make long-range decisions, the Abstract must reflect management's viewpoint. It is tailored for the executive who wants to see the results of the study quickly, in capsule form. There may be some flexibility of approach, depending on the depth and scope of the study, but the abstract must be thorough and yet only contain significant data, much like a lawyer's initial brief. It should serve as an extended table of contents for the remainder of the report. Although usually prepared after the other sections are completed, it is located at the front to aid the reader. However brief, it should:

- State the planner's recommendations and justify the new system objectively.
- Review the results of Phase I and II.
- Highlight the operation of the new system.
- Review the implementation schedule and cost.

New System Recommendations and Advantages

The Management abstract begins by briefly reviewing the aims of the study, as in this example from a life insurance company:

> A detailed systems study has been carried out to determine the best system for our requirements. The following applications were specified for study: group billing, group reconciliation, premium and claim statistics, subscriber history, and claim approval and payments.

Another example:

> The goal of the study team was to design a data processing system and recommend equipment for preparing load analysis reports, payroll, maintenance expense accounting, and claim reports.

Both examples define the study scope; all key activities within the scope should be mentioned. After a concise statement of the scope and reasons for the study, basic recommendations and advantages are presented, as in this example from a manufacturing study:

> On the basis of this systems study, we recommend that an IBM 1401 system be installed for management reporting and production control. This solid-state data processing system will

* In studies where IBM representatives are requested to prepare a formal proposal for data processing eqiupment and services, the IBM proposal will cover much of the subject matter discussed in this chapter. There is no intention to suggest that the planner duplicate their efforts by preparing a separate New System Plan. In these studies, the New System Plan as presented here may instead serve as an outline for an oral presentation to management. At this presentation, the IBM proposal could be submitted, along with the planner's recommendations for equipment and services not covered by the IBM proposal (additional common-carrier services, physical site construction bids and estimates, accessories, etc.). If, however, a formal IBM proposal is not required, the New System Plan as discussed here may be used as the basis of a formal document submitted to management.

provide an efficient and economical processing system designed to meet present and future requirements.

The following general advantages should be realized:

1. Reduced finished goods inventory dollar value with no increase in stockouts.
2. Preparation of exception data for management decision.
3. Higher utilization of production machines through increased scheduling capabilities.

Significant results from economic analysis (Chapter 5) are summarized here, with the management viewpoint in mind. For example, reduction of clerical staff may be less important than the way in which a new system can release critically needed skills for other areas. Such a minor difference in emphasis may be critical in convincing management that the recommended system will really accomplish what they, as managers, are seeking. Another effective way of characterizing the solution is by means of a brief list of key statements such as:

1. Up-to-date parts purchasing history, by vendor is immediately available on the system's magnetic disk storage.
2. Weekly cost variance reports are issued on shop orders for which accumulated cost is 5% (or more) above or below standard.
3. Weekly work center performance reports are prepared showing center utilization and efficiency.

A list of this nature allows even the busiest executive to see features and advantages of the new system at a glance.

Phase I and II Review

The next topic in the Management Abstract is a short, concise description of the activities under study. This topic acts as a transition from the review of overall new system advantages to discussion of new system operations. It briefly answers the questions: "What is being done now?" and "What are the future requirements of the new system?" A brief description of present products (or services performed), rate of growth, present volume of business and major goals of the new activity are included. For example:

This activity is directed to the new business functions of our insurance company. Its purpose is to handle the details of new business, from receipt of the application at the home office to the completion of the policy (and related records) ready for transmission to the customer. In the last three years, customer applications processed have grown from 8,565 to 9,811. This is expected to increase gradually over the next five years. No sudden jump in volume, however, is expected.

New business is the vital force of our company. If the organization is to prosper, there must be an ever growing flow of new customer applications into the home office. Quick and efficient processing of these applications will greatly assist in stimulating even more new business. To maintain company profits, this objective must be attained without a commensurate increase in operating costs.

Activity requirements should logically flow from the activity description. Requirements are defined in terms of what the activity must do--and, equally important, what it does not do. For example:

The new system must:

1. Review application and related forms.
2. Request medical and policyholder history.
3. Prepare processing documents.
4. Assemble application data.
5. Underwrite applications
6. Prepare declination letter.
7. Calculate premiums.
8. Prepare policy.
9. Prepare internal records.
10. Prepare external records.
11. Provide new business statistics on a current basis.

The new system does not:

1. Determine outside underwriting services.
2. Determine underwriting standards.
3. Set limits for policy size.
4. Initiate new plans of insurance.
5. Determine medical standards.
6. Determine premium rates or dividend schedules.

Restraints or other limiting considerations are also mentioned. A brief statement such as this is sufficient:

Total cost of the new business function (as defined in this activity last year) was $100,000; this includes personnel, equipment, and facilities used to perform the functions associated with new business processing. The new system has this figure as a maximum cost limit.

Major ground rules such as cost limitations, policy restraints, location preferences, and controls on activities should be identified here.

New System Operation

The new system in operation is then described at the management level. Managerial uses of information are stressed rather than data processing equipment, operations or procedure. Major operations or groups of operations, not detailed processing steps, are illustrated. A system flowchart (Figure 18) is a concise way to show the major operations performed. Narrative description

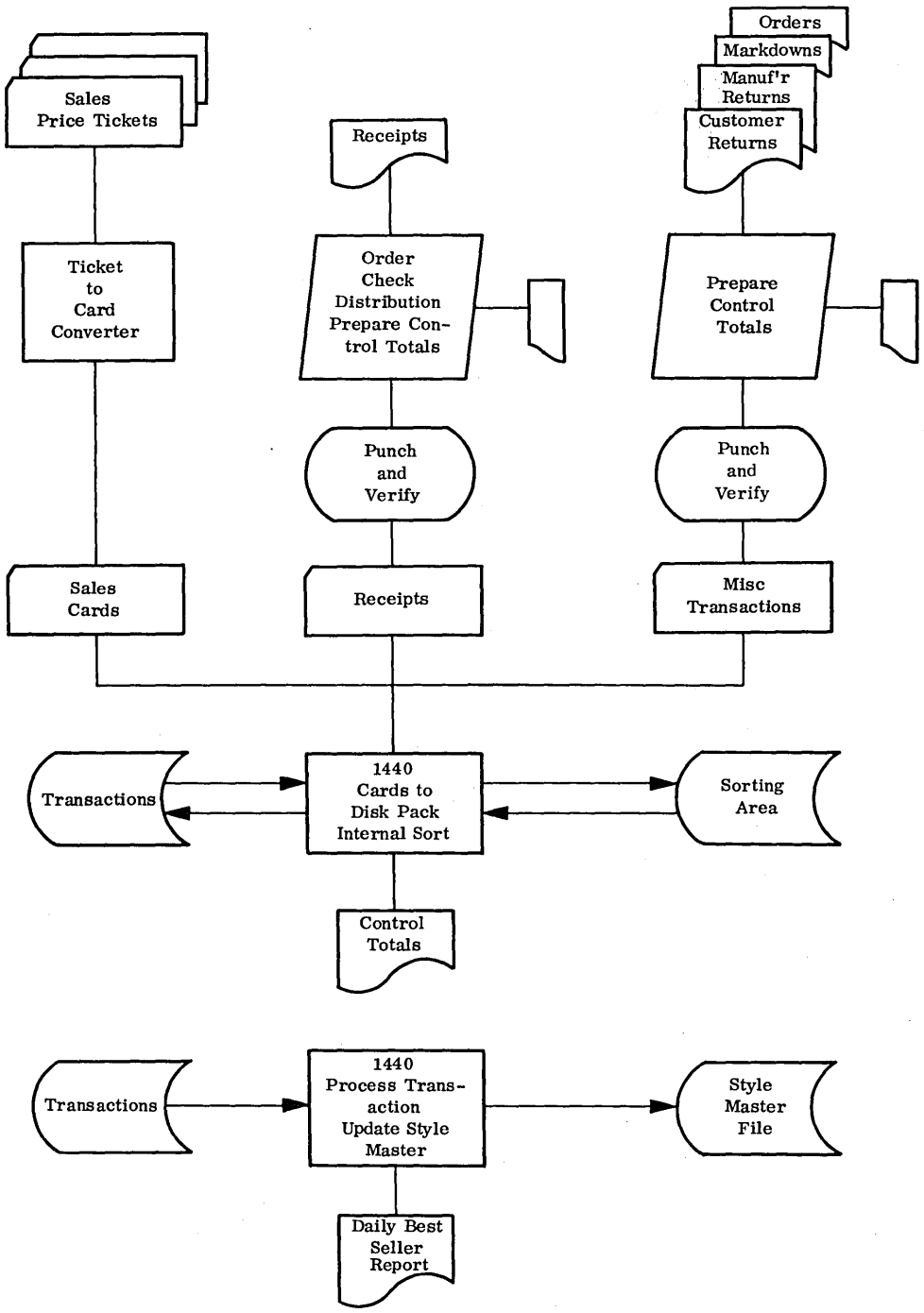

Figure 18. System flowchart

of major inputs, outputs and mainline operations may be included -- for example:

Sales cards, produced by the ticket converter, and miscellaneous transaction cards are read by the 1440 and placed in disk pack storage. All transactions are then sorted internally into the sequence of the style master: department, manufacturer, class, price and style.

The unit totals of orders, receipts, and vendor returns, and the dollar sales by department are accumulated and printed, for checking to the controls previously established.

The 1440 next processes the day's transactions against the style master file, reflecting the results of all transactions upon the master file as the daily best seller report is prepared. As a by-product of this processing, the 1440 reviews the stock-to-sales ratio of each style. This review considers the relationship of the day's sales to the quantity on hand, in order to spot an item that has sudden movement, and may, for instance, report all items

with greater than 15% movement. The 1440 also reviews the movement of the week and reports items of, say, 25% movement. A third test considers the last two periods and reports movement of 40%. These percentages may be varied to correspond to the type of merchandise and length of period.

Personnel requirements are also discussed since personnel are the most important part of any organization and proper emphasis of their role is essential. Job descriptions for new skills to implement and operate the system are summarized, as in this example:

> The full-time personnel required for this effort may be divided into three major categories:
>
> 1. Systems analyst — responsible primarily for designing the systems and acting as advisor to the programmers in system problems. He may also serve as a programmer.
> 2. Programmer — responsible for translating the basic procedural flowchart material into working computer programs. He does machine coding and program testing.
> 3. Operators
>   a. Console operator -- in charge of operations in the machine room during actual running of the equipment.
>   b. Machine operator -- responsible for operating the card and tape equipment of the data processing system.

Changes in the organizational structure, if any are required, are also outlined. Brevity is again essential, as in all sections of the Abstract.

Review of Implementation Schedule and Cost

The overall cost and time schedule of converting the new system is discussed here. The planner previously prepared separate cost summary planning charts for the three major elements in implementation: procedures, personnel and physical planning (procedures were subdivided into detailed run design, programming and conversion). These elements are now summarized into one overall cost summary, as in the planning chart in Figure 19 (separate charts are included in the more detailed Implementation Plans section). Narrative explains major elements of the exhibit. For example, the personnel selection and training entry (left side of Figure 19) was explained

TASKS						Total Cost by Task
Detail System Design	3,000	1,000				4,000
Programming	2,500	5,500	2,000	1,000		11,000
Installation		1,000	1,000	2,000	1,000	5,000
Conversion and Test				1,000	4,000	5,000
Personnel Selection and Training	1,400	600	500	300	100	2,900
Total Cost by Time Period	6,900 1	8,100 2	3,500 3	4,300 4	5,100 5	27,900 Total

Figure 19. Implementation plan cost summary (by task and time period)

as follows:

> This task involves the selection and education of personnel capable of effectively performing functions such as systems analysis, programming conversion, documentation and console operation. The selection procedures include aptitude tests, educational qualifications, and past experience reviews. Training will involve both classroom and on-the-job programs. A detailed cost breakdown of this task is included in the Implementation Plans section.

THE NEW SYSTEM IN OPERATION

This section expands topics from the concise presentation in the Abstract, using diagrams, charts, and narrative to provide different levels of detail necessary for different readers. Subjects that are covered are:

- How the new system will work.
- How personnel will be organized.
- What equipment will be needed.
- What the operating costs will be.

How the New System Will Work

In arranging his presentation, the planner always must consider the data processing background of his audience. If they are familiar with basic functions of the various units, an activity may be immediately described with a flowchart showing how the data processing system fits into the activity's operations. However, in many cases it is better to outline the activity from a more general standpoint, where the data processing system is considered to be just one of the many necessary resources to

perform the job. When this is done, an Activity Requirements Model (Figure 20) shows the interacting elements of inputs, operations, resources and outputs. Once the reader has a firm understanding of the basis upon which the new configuration of personnel, equipment and facilities rests, he is in a good position to see concepts and relationships of the activity flowchart—in which the principal elements of the activity are related directly to the new data processing equipment.

The activity flowchart describes the same elements as the activity model, but emphasizes the overall role of one resource, the data processing equipment. Symbols represent the equipment itself and the form in which data appears at various stages in the work process; the idea of step-by-step sequence is also introduced. Thus the main difference between the activity model and the activity flowchart is the arrangement of the principal elements, the emphasis of the role of the data processing equipment, and the flowchart's emphasis on the sequential nature of performing the job.

Just as system design problems were clarified by thinking in terms of computer runs, new system description is clarified by illustration of the system's operation in terms of these runs. This requires a deeper level of detail than the activity flowchart. Computer runs are documented in program flowcharts. Here the work process is related directly to each component of the data processing system. Where even greater detail is needed, flowcharts showing sequence of key logical and arithmetic processing steps are used.

The inclusion of program flowcharts in this section is usually not vital to an understanding of how the new system will work. Whether the flowcharts are placed here or in the Appendix is determined by the general level of detail of the complete New System Plan.

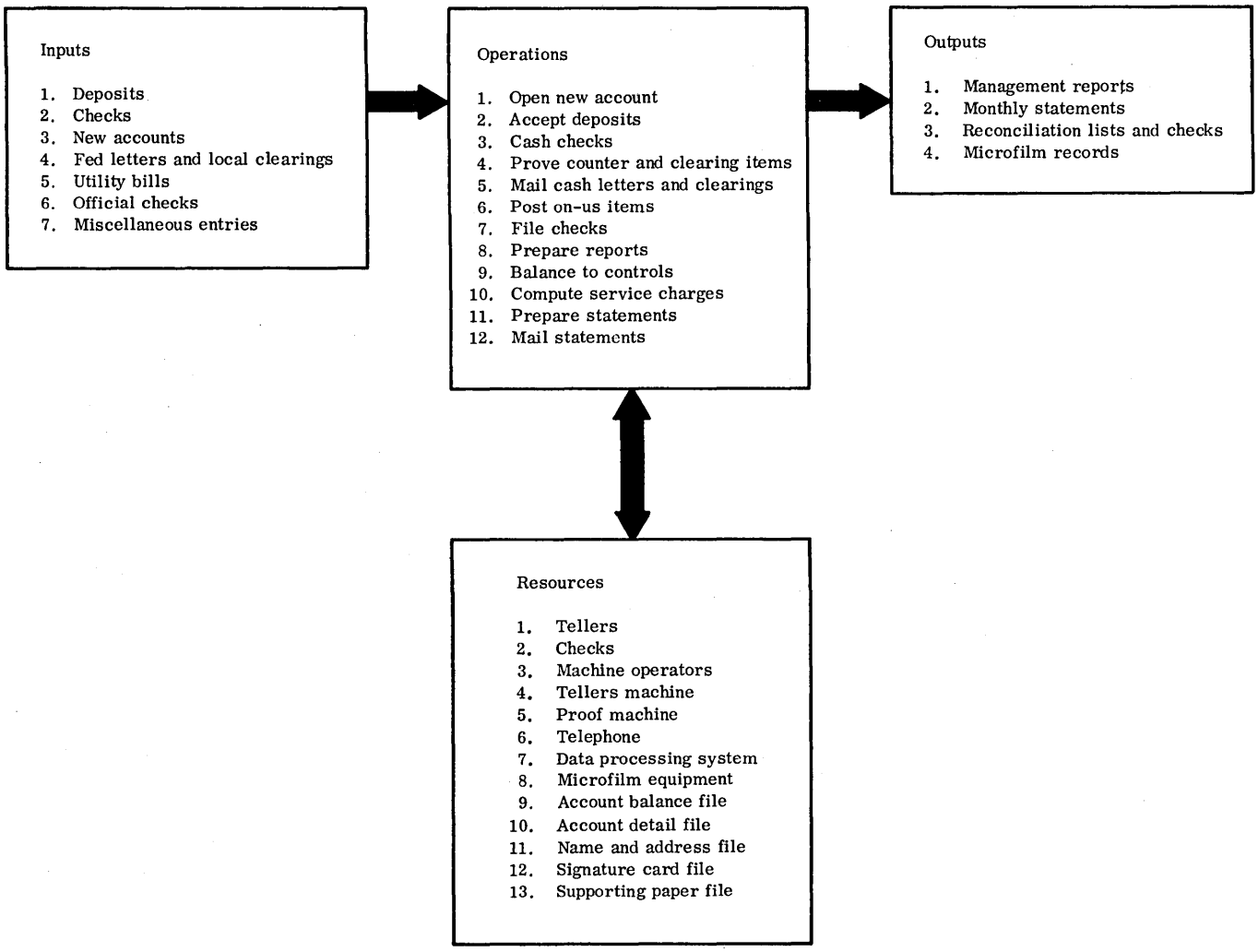

Figure 20. Activity Requirements Model - Demand Deposit Accounting

Before completing this section, the planner should carefully review all material to once more check applicability and accuracy of each item. Does it serve its purpose of communicating ideas and knowledge? Does the exhibit (model, activity flowchart, program flowchart, etc.) need additional explanation? If so, is the explanation near the exhibit (or properly keyed to it if placed further away)?

In general, this section must serve as convincing proof that the New System Plan's recommendations of personnel, equipment and facilities to implement the new system are soundly based on knowledge of the activity's data processing requirements.

How Personnel Will Be Organized

Having shown how the system will work, the planner now describes who will make it work. Organizational changes necessary have been outlined in the Abstract section and are presented in more detail here. Cost summary planning charts (similar to those prepared for implementation planning) are a good way to illustrate the type of personnel needed, the time when they will be required, and the expense they will represent.

This section will receive management's close scrutiny, so the planner must put himself in management's position as much as possible when he prepares it. As he prepares this section, he might ask himself such questions as:

1. Has a voluntary recruitment program for the new department been established which will be open to all personnel?
2. Does the new data processing department provide proper incentives to new personnel without unbalancing the company's existing wage and benefit structure?
3. Will a thorough plan to retrain, if necessary, and reassign employees be established? Will it stress individual needs? How will it be communicated to employees?
4. Are education and training plans commensurate with job descriptions? In other words, will the new data processing department employee be properly prepared to assume the job responsibilities outlined for him in the New System Plan?
5. Are all sales personnel and others who have contact with the public (such as advertising and public relations) been informed of the ways that customer service will be improved under the new system?
6. In summary—will the manager of each department affected be able to frankly answer the one question invariably asked by their employees, "How will this affect me?"

What Equipment Will Be Needed

Here the major contributions of each unit of equipment to the system as a whole are described. Physical characteristics (such as reading, punching, printing and arithmetic rates) are translated into specific operating performance. A statement such as "The high-speed printing capability will mean a two-day improvement in our order-confirmation schedule" is much more meaningful than one such as "The printer operates at speeds up to 600 lines per minute". Exact performance capabilities may not be available because detailed timing estimates have not yet been made. However, it is far more meaningful to present equipment in terms of what it can do rather than resort to pure physical description, even if the estimates are labeled "approximate". Detailed description of such things as dimensions, weight, and electrical requirements may be of importance to some readers and may be placed in the Appendix. Photographs of the equipment and charts which illustrate components are helpful, especially if supported by a narrative description. A blueprint or artist's rendering of the data processing area showing the proposed location of major equipment also provides the reader with useful information.

What the Operating Costs Will Be

The new system must be defined in terms of its operating costs. A comparison of these costs with estimated savings and other benefits is presented in subsequent System Appraisal section and summarized in the Abstract section. Since new system costs were developed in economic analysis (Chapter 5), the description of operating costs is mostly a question of display.

Financial data is usually illustrated in tabular or graphic form. Even a cursory inspection of today's business newspapers and periodicals shows the importance of graphic presentation. Descriptions of types of graphs and their preparation are available in most basic accounting, statistical or business arithmetic books.

In the day-to-day operation of the business, management often finds that expressing total cost in terms of dollars only is misleading. This is also true in the New System Plan. The planner should present cost information in terms of significant percentages, ratios, net differences and other analytical relationships to provide true insight into the meaning of his figures.

IMPLEMENTATION PLANS

Much of the data for this section was developed during analysis of implementation costs, so the planner need only extract and condense this material to present it. Here he should emphasize duties and responsibilities of each department (and, if applicable, each individual) involved in implementing the system. The interlocking nature of their duties should be stressed so that management is well aware that delays in specific assignments will usually result in delays of other assignments. If not corrected, these delays cause still other delays, and so forth, and the installation date of the system may be missed.

Useful exhibit material includes a preinstallation schedule, separate cost summary planning charts for personnel, programming procedure design etc. (which are the basis of the implementation cost planning chart presented in the Abstract section), and school schedules for training of personnel. The IBM General Information Manual "Planning for an IBM 1401 Data Processing System" (F20-0228) shows one type of preinstallation schedule that can be used as a guide in preparing exhibits for this section.

Another exhibit which can usefully be included is a proposed periodic (weekly, monthly, etc.) progress report to management. Such a report not only assists the planner in organizing his progress-reporting facts, but also emphasizes the need for another very important part of a good preinstallation schedule: the periodic staff meeting, in which the balance of the implementation plan is reviewed with management in the light of progress to date.

APPRAISAL OF SYSTEM VALUE

This section provides the facts and figures developed during economic analysis. It should be organized to facilitate reference to and from its highlighted version in the Abstract section.

Often the benefits obtained in the early stages of the new system depend heavily on its on-time installation. This fact should be illustrated wherever possible, especially if the installation date will be affected by particular deadlines; approximate cost of not meeting these deadlines is an effective display.

APPENDIX

The content of this section is largely determined by the overall degree of detail necessary in the New System Plan. The Appendix consists primarily of supporting details for technical personnel, both in the data processing department and in other departments affected. The documentation of such details should be concentrated on critical or advanced areas: the Appendix should add knowledge, not weight, to the New System Plan.

Forms used in the operational study are selected for description at whatever depth necessary. Some systems descriptions need only include Resource Usage and Activity Sheets; other studies require Message, File and Operation Sheets. Other documents and forms may also be required for a description of internal procedures; among them are:

- Descriptions of new equipment
- Detailed physical planning information
- Run timing estimates
- Card, disk or magnetic tape requirements
- Descriptions of school courses
- Sample programs
- Rationale behind formulas and calculations
- Programming systems support

SUMMARY

While this manual presents an organized, documented approach for conducting systems studies, its use is no substitute for creativity on the part of the planner. Creative work demands devotion, concentration, study and hard labor. No study disciplines or technique can do more than assist the planner in organizing his efforts and facts. It will always be up to him to provide the creativeness that will result in a profitable and practical design of far-reaching benefit to the business.

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