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IBM Data Processing Techniques

IBM Study Organization Plan

The Approach

This manual introduces the IBM Study Organization Plan (SOP) and describes its use in the study and design of business systems through three phases: Understanding the present business; Determining system requirements; Designing the new system. It also discusses formulating and analyzing goal-directed activities, and planning and performing a system study.

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In the continuing effort to be competitive and conduct profitable operations, businessmen explore many alternatives. The product or service can be redesigned to make it more attractive in the marketplace; advertising and sales promotion can be stepped up to reach a wider audience; internal cost reduction programs can be initiated to reduce expenses; the business system can be redesigned and updated to secure greater efficiencies. Of these alternatives, the search for new products and wider markets usually draws the most attention, while other areas with less direct appeal are considered secondary in importance. The business system, for example, despite clear warning signs of inefficiency and obsolescence, often continues to be operated in much the same old way, with only an occasional patchwork repair job to keep it in running condition. As a result, too many enterprises have the outward look of sleek, 20th-century creation, while internally still limping along with a 19th-century power plant.

With growth, a certain maturity evolves. With maturity, sound judgment and intelligent direction can be applied by those in control, whether they carry the title of owner, government bureau head, agency director, professional manager, or some other name, to detect and eliminate waste, duplication, and proliferating services. The business system, while it should be a sharp instrument of control and a vital generator of dynamic decision-making information, is often outdated in both concept and technology. Many existing business systems were designed around human capabilities — and, unfortunately, around human limitations. Think back to when the key business systems were designed. Some were built around the classic figure of a green-visored bookkeeper perched high on a stool, quill in hand, making entries to the ledger carefully and laboriously. Others were structured for a number of clerks busily performing manual calculations or punching the keyboards of desk calculators; each clerk usually had different, but limited, duties. The system was paced to human skills with the attendant shortcoming in fatigue, inaccuracy and limited span of attention. Errors were detected by assigning one person to audit another's work, or by the rather expensive method of cross-checking. Nevertheless, these systems worked — because individuals could compensate for many errors. Even with the introduction of unit record equipment, the system often remained tied to human capacities and machine specializations. Jobs were divided into steps which were matched to the machines. If the volume grew, or something went wrong, or bottlenecks occurred, more machines were added, or more people hired, or the work further subdivided.

Equipments with vastly increased versatility and speed appeared on the market — yet there was no immediate parallel improvement in systems control and methodology. Systems men and managers thought at first that the new machines could be superimposed directly on the system, and everything would be fine. And indeed, everything was fine. Work was processed faster, and reports did contain more detail. However, some forward-thinking people began to realize there must be greater advantages to machines than simply faster throughput speeds. Out of this "rethinking" has emerged a completely new idea: redesign each business system as a unified entity contributing directly to business goals and take full advantage of equipment capabilities as well as fast developing new management science techniques. This is the real breakthrough, the opportunity to tap the long-unrealized potential of an outstanding business system.

DEFINING BUSINESS GOALS

In a total systems concept, the system is designed to support the primary goals of the business, and consequently is closely identified with them; this is true whether the goals are formally stated or exist only in the minds of the management personnel. Profitmaking, while a common goal for nearly all enterprises (with the exception of special situations like government operations), is too general and vague for useful system consideration. Goals are the special contributions a business makes to its environment.

The primary goal of an appliance company, for instance, is to manufacture and sell appliances. Profitmaking, though vital for the company to stay in business, is only part of the governing framework within which it must operate. Starting with the single, specific goal of making appliances, the company from time to time may have seen and grasped other activities for adding to profit or for increasing profit margins on appliances. By expanding into such activities as manufacturing other products, mining basic metals, and financing purchases, the company added other goals. As the company grew, it added departments, divisions and other organizational subdivisions to meet requirements imposed by the more complex operations. The final result, if inspected at any moment in time, would of course be a total system of great complexity.

However, this is a total system only in the sense that the whole is equal to the sum of its parts. Over the years, primary business goals may have been forgotten or new goals never formulated, while a number of secondary goals emerged to assume unwarranted importance and emphasis. Primary or true goals, for example, do not include the preparation of reports (unless the business produces reports for profit or legal reasons), or sending bills (unless the business is a bill collection agency). The goal-directed systems approach makes timely the re-examination and restatement of true business goals

UNIFIED SYSTEMS APPROACH

Though sometimes poorly designed or even mismanaged, most systems do work. Somehow, products are manufactured, records kept, orders filled, and employees paid. The system continues to grow or shrink as new products or services are added or obsolete ones phased out. Reorganizations occur, or perhaps a merger strengthens finances. All the while, the business maintains momentum without being fully conscious of waste, duplication or illogic.

The key to creating a business system is the unified systems approach. The business is treated as a unified whole; it is considered initially in broad, generalized terms. True goals are identified in terms of what the business contributes to its environment. From this vantage point, an approach can be defined and expanded into an operating system which fulfills the goals of the enterprise. Items not contributing directly to the satisfaction of a business goal may be considered either secondary in importance or entirely expendable.

The unified systems approach is oriented toward goals and toward activities which attain goals, rather than toward personnel, equipment, or organization structure. This may be explained more fully through the following example. An aircraft flies passengers and mail between Milwaukee and New Orleans. This is a primary goal. To achieve it, certain takeoff and landing procedures are used, the aircraft is propelled, navigated, and controlled in space, and it is prepared for the next flight. It is not necessary to mention in the goal statement that a 707 type aircraft with tricycle landing gear was involved, piloted by a man named John Wilson, and landing on ramp #23. The goal is stated simply as "fly passengers and freight between designated points," regardless of equipment or personnel. The concern in a goal statement is to express the results the system must achieve while ignoring the specifics of the systems solution.

Under the unified systems approach, the business system is viewed as a whole, as a single entity for which a systematic program of problem solution can be proposed, instead of as an organizational structure composed of individual elements. While the latter position has solved problems, to be sure, it has not provided the opportunity for truly significant breakthroughs and solutions.

STUDY ORGANIZATION PLAN

The Study Organization Plan (SOP) is a program for applying the unified systems approach to business systems. As a comprehensive plan, it presents an approach and methodology to achieve better systems designs when used by imaginative systems people working in a suitable management and business climate.

This SOP approach manual describes a philosophy and approach to systems design. Companion volumes (Figure 1) deal with the methodology and documentation of a system study through three phases:

(I) studying an existing system
(II) determining true systems requirements
(III) designing a new system

SOP, as discussed in the following pages, is a plan for total systems study. The question might well be asked at this point: Is this the complete usefulness of the plan, or does it have application over a wider range of business situations?

STUDY ORGANIZATION PLAN
MANUALS

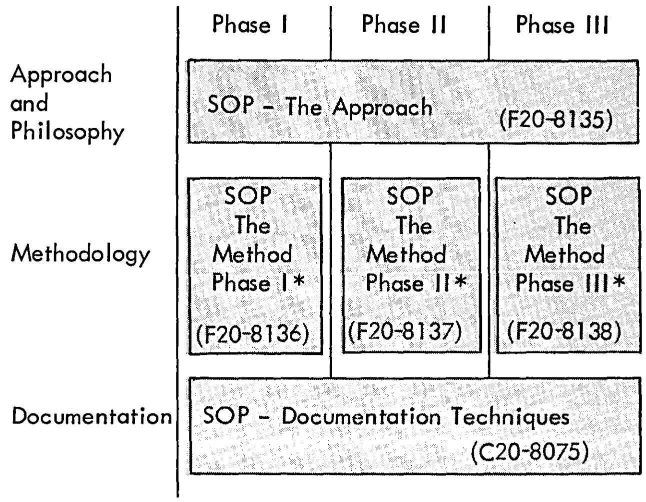

Figure 1

SOP — A FLEXIBLE TOOL

The Study Organization Plan is an instrument of variable magnifying power. This flexibility extends in many directions:

(1) type of business
(2) size and length of the study
(3) size of business
(4) depth of penetration
(5) level of refinement

Types of Business

Too frequently in the past, the framework of systems reference has either been over-generalized or else held within too rigid limits. In searching for the great middle ground as a point of orientation to relate philosophy and detailed explanation, most approaches have used the example of the "medium-size manufacturing concern," whatever that is. It is personified in the size 38 Regular suit for men, and the depiction of a smiling, well groomed, 5'10" male for advertising. The reference is fine for 38R people, but hardly suitable for the 42 extra large. By the same token, in systems work, what does the banker or school executive think about when the classic example too often turns out to be a medium-size manufacturing concern?

SOP is flexible enough in design to avoid the twin traps of rigidity and overgeneralization; as evidence, the text of the supporting manuals is profusely illustrated with examples taken from many kinds and types of business. SOP has already been tested in widely divergent business fields:

- wholesale distribution
- banking

- insurance
- electronics manufacture
- aircraft manufacture
- public utilities

On the basis of detailed analysis and review, SOP seems readily extensible to include credit, merchandising, transportation, communications, mining, construction, government, etc.

Size and Length of Study

In any type of business, it is possible to use SOP for a fast but comprehensive pass at part of the business, determining its goals and operating methods, sketching its structure, and arriving at a significantly improved business application. On the other hand, it can be used for probing a business in considerable depth to portray its detailed structure and operating dynamics for creative redesign. Of course, any level between these extremes may be chosen, depending on time allowed, team size and quality, and study objectives.

Size of Business

Experience has demonstrated that size of business has no effect on the applicability of the Study Organization Plan. Both a small retailer and a giant multi-division corporation can be studied within this framework. In one case, a selectively compressed version would be used; in another, the full plan would be required.

Depth of Penetration

SOP can be applied in varying depths of penetration. Certain activities within a company may require more detailed study than others, depending on cost of data gathering and potential for improvement; various forms permit everything from an overview treatment to fine detail. The SOP Documentation Techniques manual (C20-8075) discusses these recording forms and describes how data is introduced and displayed.

Level of Refinement

SOP is further useful over a range of levels in study refinement. Where an enterprise is interested in moderate systems improvement or direct mechanization of an existing system, the plan provides a ready-made structure by which these objectives can be quickly accomplished. In the other direction, it can be employed to its full extent to support the creative study which will set in place an entirely new system design to carry a business many years into the future.

The Study Organization Plan is a total plan of action, a set of guidelines for many types of system studies, in companies large and small, for almost any type of endeavor, for simple studies or complex ones; it can be applied in a fully expanded version or in an abridged form.

THE SYSTEMS PLANNER

The interest in updating operating systems in enterprises throughout the business world has opened up a remarkable opportunity for the individual who will perform the study, whether he is referred to as systems planner, methods analyst, or procedures specialist. He is, in fact, the key to systems growth and development. He carries the responsibility for creating, designing and implementing the new systems within a business. If he is to fulfill this promise, he must demonstrate insight, understanding, imagination and determination in this work. With the Study Organization Plan, the systems planner has a programmed approach, methodology and set of documentation techniques to guide him in his work.

CHAPTER 2 — STRUCTURE OF THE STUDY ORGANIZATION PLAN

There are three stages in the life of a business system (Figure 2):

Stage 1 — Study and Design
Stage 2 — Implementation
Stage 3 — Operation

The purpose of Stage 1 is to design a new system. Before design can begin, however, an understanding of the present business is required. From this understanding, and from information on the future direction of the business, true systems requirements are defined and specified: "What must the system do?" and "How well must the system perform?" Answers to these questions provide design objectives. Then alternative solutions are created, and the new system is selected from among them through careful evaluation.

Stage 2 covers implementation: converting the design from Stage 1 into an operating system. It includes detailed systems design, programming, equipment installation, system conversion and testing, and personnel training.

Stage 3 involves the long-term task of operating the system from day to day, and introducing modifications, improvements and expanded coverage to meet new or revised requirements as they occur.

SYSTEM DEVELOPMENT

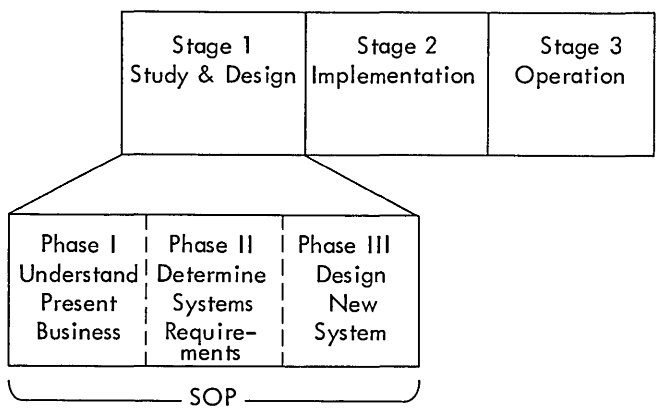

Figure 2.

STAGE 1 — STUDY AND DESIGN

Implementation and operation, Stages 2 and 3, have often been described, but there has been little effective material describing the vital first stage of study and design. Many authors and analysts have assumed that the major task of system design was to "fit" new equipment to an existing system. They have completely overlooked the facts mentioned earlier: that these systems grew up around the characteristics and limitations of humans; that these systems reflected typical patterns of organization and the division of labor into special classes; that information was handled sequentially, with all inputs recorded before any processing was initiated; that the systems were generally dedicated to after-the-fact recording of historical information.

With this attitude toward study and design, systems were too often just mechanized; only infrequently were reconceived solutions developed from an understanding of the present and a true grasp of the future requirements of the business. Yet only with a complete reconception of the task during the stage of study and design can a strikingly advanced system be devised. The approach and methodology of SOP is directed toward changing the pattern, toward providing advanced, substantially more "profitable" business systems.

Study and design is itself separated into three phases:

Phase I — The existing system is studied to gain an insight into the business and its key relationships.

Phase II — Results of the Phase I study are blended with forecasts of foreseeable needs to develop an accurate specification of true system requirements.

Phase III — The new system is designed from specifications of its basic requirements, and communicated to management in the form of a new system plan.

PHASE I — UNDERSTANDING THE PRESENT SYSTEM

During Phase I, work is directed to the determination of what is done, using what inputs, with what resources, to achieve what results. This would hold true in a mechanization study where a manual system is being converted directly to machines, in a study aimed at partial improvement or modification of an existing system, or in a completely creative study leading to a new design. 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.

A document entitled the Present Business Description is the formal output from Phase I. It contains three major sections:

The General section includes a history of the enterprise, industry background, goals and objectives, major policies and practices and government regulations.

The Structural section contains a simplified model of the business (Figure 3), and then describes the business in terms of products and markets, materials and suppliers, finances, personnel, facilities, inventories and information.

The Operational section employs flow diagrams and a distribution of total resources to present the operating dynamics of the business. These charts demonstrate how the resources of a business respond to inputs, perform operations and produce outputs.

An Appendix is usually added to cover more detailed working documents such as Operation, Message, and File Sheets.

Mechanization studies frequently change only the physical method of performing a job, and improvement studies usually consider nominal improvements to the systems framework. In these studies, the general and structural sections can be compiled quite rapidly, and more time allocated to the compilation of data for the operations section. Note, though, that application of SOP methodology often leads to extending the scope and potential benefit of mechanization and improvement studies beyond management's initial objectives. Even in the creative study, where the objective is to be consciously and deliberately free from past limitations, understanding of the present system is still necessary before present and future system requirements can be defined and established.

BUSINESS MODEL

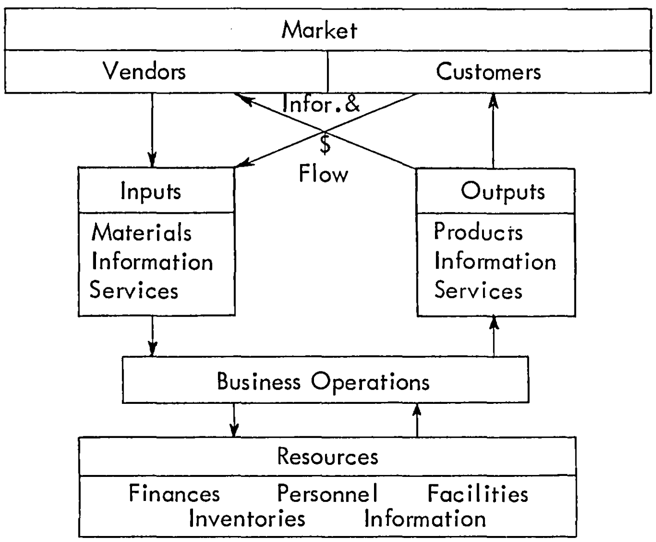

Figure 3.

PHASE II — DETERMINING SYSTEMS REQUIREMENTS

Phase II answers the questions: "What is the system required to do, now and in the future?" and "How well must it perform in satisfying these requirements?" To find out, known facts about the existing system are blended with information concerning the future. Advanced information is generated through forecasts and predictions on future markets, new services, product volumes, design changes, business trends, advanced processes, regulatory law, and revisions in product mix. Any changes in policy or objectives contemplated by management along lines of increased specialization or diversification would be considered in future requirements. A proposed system would have to react and correct for seasonal patterns in labor and costs, as well as market penetration by competitors. Phase II work is a mixture of analysis, synthesis, forecasting, construction of models, and even operations research.

Collection and review of information does not in itself produce a requirements specification. The study team must combine competence and creative talents with precise scientific techniques to generate true requirements. Management sciences have become much more available to systems engineers in the last few years. Operations research, for instance, started out by applying known statistical and mathematical techniques to operational problems. For example, during World War II, the use of a long-known sampling technique revealed that aircraft aiming bombs from a pattern obtained much better results than aircraft individually aiming at a target. This technique was referred to as "dispersion bombing." The application of powerful, generally mathematical and scientific techniques to business problems (management science) is producing worthwhile and sometimes startling solutions.

The approach in Phase II is much like that of the architect as he designs a new home. First, he listens to his client describe family desires, plans and ideas. He notes income, sizes and ages within the family group, and what their present dwelling looks like in terms of taste and preference. Pointed inquiry is made into the arrangement and sizes of play areas, studies and the kitchen. With a knowledge of the family's preferences in design, the architect next has to help bring desire into line with pocketbook. Would they give up a screened porch and an extra bathroom to get a fourth bedroom? Is there a chance to postpone some landscaping to keep the air-conditioning system? From all this, he is able to formulate a full picture of requirements within the boundaries of available funds, and to establish definitive specifications leading to an individual design completely satisfactory to the family. His specification is of prime importance; its precision and accuracy controls the eventual effectiveness of solution design.

The output document from Phase II is the Systems Requirements Specification (SRS). The SRS is a series of information packets (Figure 4) each of which describes requirements for one activity within the business (an activity, to be explained more fully later, is a combination of operations which satisfies one or more business goals).

OUTLINE OF SRS DOCUMENT

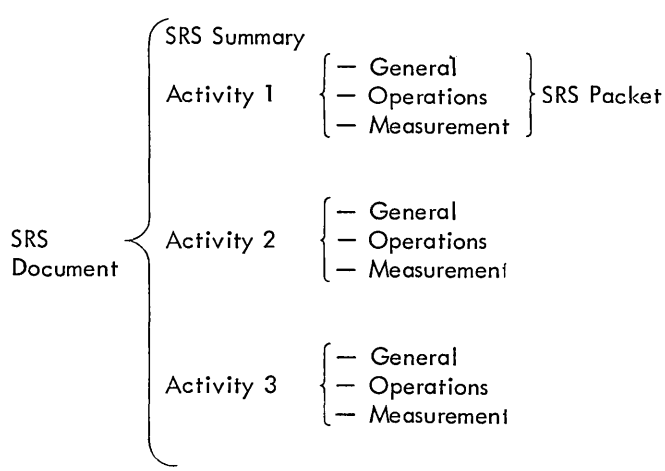

Figure 4.

The activity specification packets are introduced by a Summary section stating overall goals and objectives of the business, defining the scope of the study, and summarizing the reports to follow.

Each SRS packet has three main sections:

The General section describes the goals and objectives of the activity, its scope and boundaries, and lists general considerations such as policies and costs not mentioned in more specialized sections. An Activity Requirements Model (Figure 5) shows the relationships among logically required and imposed inputs, operations, resources and outputs.

The Operations section specifies what the system designed for the activity must do: what operations it must perform, what inputs it must accept, what outputs it must produce, and what resources — people, equipment, facilities and inventories — will be required.

The Measurement section states in what terms the design of the system is to be evaluated in performing the stated tasks of the activity. Measurements are identified, and acceptable limits and present performance levels determined in terms of time, cost, accuracy, and volumes.

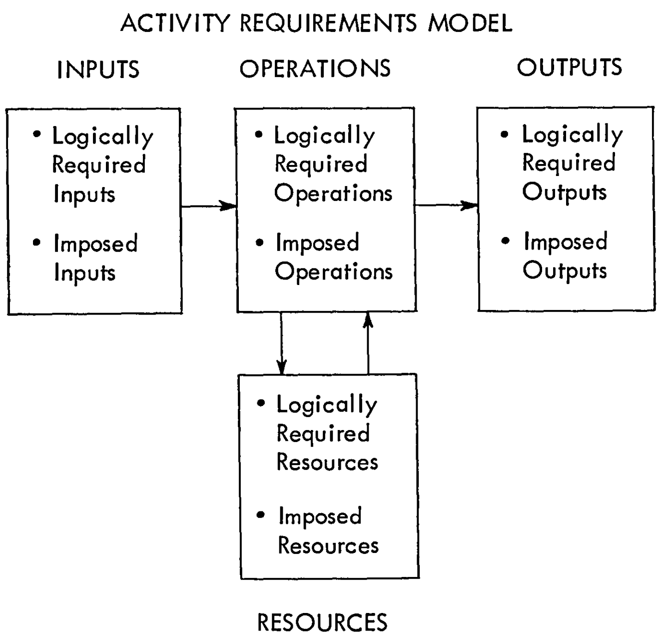

Figure 5.

An Appendix contains material which supports and amplifies statements of essential operations. This may include Message and File Sheets, Resource Lists, decision tables for operations logic, and definitions of measurement factors.

Mechanization and improvement studies have been carried out without extensive investigation into present and future requirements. One danger in this course, though, is that existing operations are often merely speeded up or made more automatic, whether or not they are truly necessary or even useful. Another danger is that future change may make the newly designed system inefficient.

PHASE III — DESIGNING THE NEW SYSTEM

In Phase III, the new system is designed and described. Throughout this period, a high level of creative contribution is desirable from the design team if the system is to successfully support the enterprise over a span of years.

First, reports from the first two phases are reviewed and the design objectives specified. Then, design alternatives are formulated and described — to see how effectively they meet requirements. When more than one activity is included, input, output, file, operation, and equipment characteristics must be examined and activities integrated wherever desirable.

Activity description is then expanded and specific equipment selected for various alternative solutions. Through careful evaluation, the best system is chosen. An implementation plan is then devised to show the cost and schedule for detailed systems design, programming, installation, conversion, testing, and personnel training. Finally, the expected performance of the new system is evaluated for its impact on revenue, investment and expense.

The output document from Phase III is the New System Plan, organized into five sections:

The Management Abstract section briefly reviews the work of the first two phases, outlines the proposed system as it will operate, surveys the implementation plan, and emphasizes the system's values for profit improvement, reduction of costs, and associated benefits. Since this is a synopsis of the entire Stage 1 study for management evaluation, it describes the main points of the proposal concisely but completely.

The New System in Operation section relates how the system will work, what equipment will be needed, what the responsibilities will be for operating personnel, and what the expected operating costs will be.

The Implementation Plans section describes the various steps of putting in the new system, showing costs and time schedules.

The Appraisal of Systems Value section accentuates benefits to be derived from the new system, relates why alternative designs were rejected, and projects the advantages over the life-span of the system.

The Appendix includes a selection of supporting data not shown in other sections. This supplies the technical reinforcement of the proposal, making it more thoroughly comprehensible.

The New System Plan is the culmination of the entire systems study in Stage 1, and provides a well documented, thoroughly analyzed framework from which Stages 2 and 3 may be inaugurated.

Of the many words and phrases used in business vocabularies, some convey very definite and meaningful images, while others, through use and abuse, have become vague and inexpressive. Each key word used in the Study Organization Plan has a precise definition; these terms will recur throughout the related texts, always carrying the same meaning. Many have already been used, but a discussion of their exact meaning will fix them for all applications in the manuals.

The business system is made up of a number of individual systems. Whenever the enterprise or the business is referred to in this text, it always means the entire business system. A business is an assembly of persons and resources organized into a complex whole, for the purpose of fulfilling some specific set of objectives or goals. Thus, a business may be all or part of a company, an agency, a field office, or a government bureau, depending on how the business is defined.

Goals are those contributions a business wishes to make to its environment. In their usage here, goals are precisely spelled out to represent concrete objectives of the business, and state definitely what the business system must accomplish.

The environment of a business is everything outside the scope of the study that influences the business. If a company is considered to be the business under study, then everything not in the company is in the environment. If one division of a company is selected as the business, then the other divisions of the same company become part of the environment. The environment also includes the external pressures influencing the system: competitors and competitive products or services, geographical considerations, market status, customer goodwill, and so forth.

A business may be described in terms of its organization, its goals and its activities. An activity is a related set of operations. It has few ties with its surrounding environment. It is usually self-contained, and directed toward satisfying one or more of the goals fundamental to the business. An activity generally starts with an input from the environment external to the business, and ends with an output to that environment. However, some activities are concerned with the maintenance of resources and thus have no significant ties with the environment.

Each activity or combination of activities is performed by means of a system. The system includes combinations of personnel, equipment and facilities working to produce outputs. By extension, the system includes its methods and procedures.

Activities are made up of operations. An operation is a related set of processes which, when initiated by a trigger, converts inputs to outputs, and uses resources to effect this transformation (Figure 6). The relationships of an operation are frequently internal; its inputs may come from another operation within the activity, and its outputs may be delivered to another such operation.

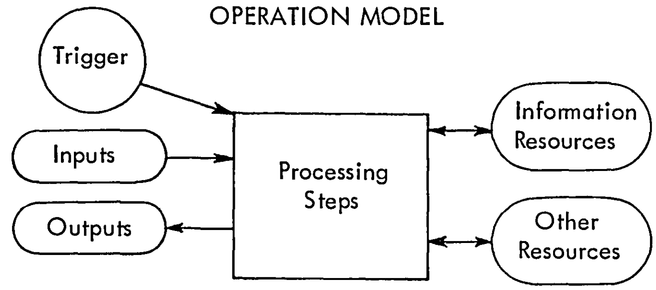

Figure 6.

The trigger that starts an operation works in much the same way as a catalyst in chemistry: the presence of certain conditions causes something to happen. The first working day in the month, 10:00 a.m. daily, and the arrival of a batch of 100 invoices are three examples of triggers. Only one trigger is specified for each operation.

A process (or processing step) is one of the actions taking place within an operation, and can usually be described by a single verb whose object is the input, output or resource acted upon, and whose modifiers (as needed) specify the conditions under which the process takes place. Examples of processes are:

- Machine shaft to tolerance
- Compute monthly withholding tax
- Locate information in personnel file
- Compile manufacturing report on scrap losses

Each step in a business mechanism is a process. Related sets of these processes, started by some trigger, accepting some input, and ending with some definable output, form operations. Related groups of operations, preferably reaching to the external environment, compose activities. Each activity or combination of activities is performed by a system.

Resources are the means for performing an operation. They may be imposed by the user or made necessary by the nature of the inputs or outputs. Resources include personnel, equipment and facilities, inventories and finances. Inventories may include either information (files) or materials (stock). Inventories serve several functions: stocks of parts or materials provide a buffer between operations; files keep historical information for later use, or store operation rules for transforming inputs into outputs.

The customer, customer management or user is the person (or persons) for whom a study is undertaken. If a systems planner is studying some phase of a business which employs him, the customer is all or part of his own company management. If he studies another business, the customer is the management of that business. In the former case, working as an advisor for another part of his own business, a systems planner would do well to practice the finesse of the customer-consultant relationship, since many times he will, in fact, be required to educate himself in the specifics of the business exactly as if he were an outsider.

The terms system planner, analyst and study team are used variously, and in their generally accepted meanings. Whether working alone or as part of a team, the responsibilities of a systems planner remain the same in regard to searching out facts, organizing them into coherent descriptions, analyzing requirements, and synthesizing new systems.

Other terms such as activity requirements model, business model, overview, systems view, detail view, and synthesis are explained when they are first mentioned or are illustrated by example. Those not specifically defined here will be understood in the context of their common usage.

Two major concepts of the Study Organization Plan have already been introduced: (1) the orientation of a systems study toward business goals, and (2) the consideration of the business system as a unified entity. A third concept, activity formulation, is another important central idea of the entire plan.

An activity has been defined earlier as a logically related group of operations. Performance of these operations directly results in the achievement of one or more business goals. Some typical activities are:

- Design product line (manufacturing)
- Provide checking account service (bank)
- Estimate cost of performing services (agency)

Operations, as the principal element of an activity, transform inputs to outputs. Examples of operations are:

- Prepare market analysis from estimates and forecasts.
- Compile master production schedule from orders and propositions.

As a logically related group of tasks or operations cutting across functional lines, an activity is usually self-contained; that is, it stands alone, having few informational ties or little interaction with other activities in the business, and is directed toward satisfying one or more business goals. Note that there is no implied restriction or recommendation that business organization follow activity lines.

FORMULATION APPROACHES

During Phase I, the study team documents operations from many internal and external information sources. In doing so, several approaches may be used to arrive at goal-directed activities.

One approach is deductive in emphasis. From a statement of business goals supplied by management, activities are defined more or less intuitively. Then depth interviews are conducted in the several departments or functions of the business to verify the accuracy of this approximation. Once there is verification (to the degree validity can be established this early), activities are documented in detail.

Then there is the inductive approach, which works almost in reverse. Initially, the team looks at the total resources (dollars) of the business to secure a broad overview of costs and allocations. Then a detailed documentation is performed on operations. After the recording is finished, operations are sorted into logical groups of implied activities. Frequently, this requires a number of successive sorts to achieve more precise arrangements among operations.

Finally, there is the composite approach. A goal statement is obtained from management, and one major activity identified and selected out for documentation. Implied goals are formulated from the documentation and matched against the stated goals of management to see if they agree.

Since identification of activities and assignment of operations to activities presumes a completely new look at a business, an acceptable result may require several approximations on the part of the analyst. This is expected if the business is to be properly sectionalized into areas which are just large enough to be grasped thoroughly by the study team, or of a size to "get one's mind around." The number and scope of the activities is left completely to the judgment of the analyst. In a small business there might be only one activity, but in a large multi-plant facility, the number could run to a dozen or more.

Once the activity formulation has been completed and documented, results are presented to management and reviewed as part of the Present Business Description.

MODIFICATION

As Phase II begins, further insights into the business lead to a modification of the activity formulation. The statement of present business goals is revised to conform to the projections of future growth, or to changes in services and products, or other information secured through analysis of future direction. From this combination of present and future goals comes a statement of the true goals of the business.

The Phase I activities are then reshaped to agree with the goal statement. As this transition occurs, analysts will begin to leave the position of treating the business system as a whole, and work instead from the viewpoint of activities and activity models. This accent on activities will continue throughout Phase II and into Phase III, where the business will be integrated again.

The activity formulation procedure may be explained more effectively in the context of an actual case study selected from a company presently using the Study Organization Plan — Butodale Electronics. Butodale is a young, fast developing manufacturer of electronic equipment, rapidly outgrowing the model shop business system of its early days. When the Phase I study reached the period of initial activity formulation, an activity entitled "Quotation and Order Acceptance" was developed, among others. It encompassed the work of receiving and processing inquiries and returning a price and delivery quotation to the potential customer. However, activity scope was confined mainly to the sales administration function and showed a usage of only $60,000 out of a total $16,000,000 in expenditures. The team, following SOP practice, modified goal statements and reshaped the activities in Phase II to more appropriately reflect the situation as they learned more about the company, and arrived at quite different results. The activity "Quotation and Order Acceptance" gave way to "Provide Demand," and now, instead of being a simple response to inquiries, it covered the broader task of forecasting potential demand and handling propositions and orders for the entire company to the point of master scheduling. With this extended range, the activity was no longer confined to sales administration, but cut across functional lines of accounting, sales, engineering, and management. "Provide Demand," in its revised definition, used $1,450,000 of the total resources figure, and was a primary activity of the business.

After emerging from the reformulation procedure, activities will have an individual identity and fixed boundaries; they will be of a certain size and will be describable in terms of the goals they satisfy.

USE IN SOLUTION DESIGN

For Phase III, a number of alternative system solutions will be designed for each activity, and successively appraised to find a best system solution. When there are several activities, they are studied for the possibility of integrating common features of inputs, outputs, files and operation characteristics. Only after consolidation has been resolved can a detailed procedure be written.

This whole idea of activity formulation is extremely helpful even in mechanization and improvement studies, since it breaks the business into logical segments for more effective study and permits its reunification later. The advantages of this approach are considerable in these studies, even if activity reformulation is not carried out to its fullest degree, since the analyst is able to look at the system in an entirely new way. It further ensures that each application will fit together as the system grows.

Before a systems study can be carried out, a careful plan of action must be prepared, stating the purpose and scope of the work to be performed, and how the time and resources of the team are to be employed. The plan should reflect the desires of management, as well as the technical considerations for the study team.

SCOPE OF A STUDY PLAN

The plan is amplified as extensively as management requires. In a small, uncomplicated business, for example, where a single person could handle all tasks, the plan might evolve from several conversations between manager and analyst. In large companies where the study could continue over several months, this informal arrangement would be unsatisfactory. For the latter case, the study purpose would have to be stated precisely, areas defined for inclusion in or exclusion from the study, depth of penetration agreed upon, and a cost budget compiled for the estimated span of the work. Out of a general agreement on project scope, detailed schedules would be prepared to include personnel assignments and the sequence in which work will affect each selected area of the business.

Often, the manager will state the systems problem as he sees it and wishes it to be corrected: long delivery cycles, poor credit risk selection, slow response to customer inquiries, or high employee turnover. These views must be appraised and given consideration in the structure and direction of the study.

The statement of project scope should be recorded in a formal document after study purpose and boundaries have been completely examined and agreed to by management and the study team.

TIME SCHEDULES

Business size, study purpose, allotted time, and team size are variables affecting study schedules and costs.

Detailed study of a small business by a two-man team might be conducted in one week to a month if all goes well. For a multimillion dollar concern, the same two-man team could not undertake anything more than an overview-level study in a like time period. Examining the operations of a single department or division of a large company, however, might be a reasonable goal to accomplish in one month.

Level of study refinement has a major influence on time schedules. Improvement and mechanization studies require less background information than do creative, complete-system studies. For example, operational data rather than general or structural data is of consequence in Phase I for these types of study. If time does not permit close analysis of system requirements in Phase II, then the present system description will have to serve as an indication of areas with high potential for improvement. Otherwise, requirements are accepted as they have already been stated or implied.

At the end of Phase III, The New Systems Plan from a mechanization study will emphasize equipment and procedural changes necessary to accomplish the mechanization, while Phase III for improvement studies means modification of existing systems rather than complete new designs. Time schedules will be considerably shorter for these kinds of studies than for a completely creative study.

Even when SOP is being applied in its full-dress version for large-scale studies, certain compressions of time are possible. While the phases of understanding the present system, specifying systems requirements, and designing the new system must be performed in series, there are many opportunities for conducting parts of the study simultaneously, if team size permits. Several persons may collect data for the general and structural sections at the same time in Phase I; the activities are fairly autonomous after reformulation in Phase II, so requirements for each could be analyzed separately and simultaneously.

Activity formulation is an example of a sequenced task which requires time to define, and time for review through successive evaluations. Required steps in Phase I for one study included:

- Start formulation process
- Conduct interviews
- Group operations into activities
- Prepare Activity Sheets
- Reinterview, if need
- Regroup operations
- Modify Activity Sheets
- Complete Resource Usage Sheet
- Review results with management
- Start over, if need

Interviews take time, and management may be too busy to review results when the team wants them, and so on. Time cannot be compressed easily in this work, if results are to be worthwhile. Nevertheless, the ability to foresee lap-phasing possibilities will decide how large a team can work effectively at one time, and how long the total study will take to complete. Although lap-phasing should be planned wherever practical in the preparation of time schedules, it doesn't necessarily follow that nine persons working one month will accomplish as much as one person working nine months.

Time is readily predictable in some cases. Management may take the position that a two-man team will have a new system operating in exactly ten months. Unless it can be proved otherwise, study and design and implementation stages will take just that long. The schedule for each stage is arrived at by working back from the required completion date. If the steps in Stage 2, such as site preparation and programming, cannot be compressed and require six months, then this is the schedule for implementation. Should two months be reasonable to check out procedures on the equipment, then this leaves two months to study the present system, determine system requirements, and design the new system.

TEAM SIZE AND COMPOSITION

Purpose, scope, time, and depth of study will determine, in large measure, what team composition should be. Under normal conditions, there should be at least two members on the team, even if the business is very small, or the study quite limited. Two people working together can furnish enough stimulus to one another to make their efforts far more than twice as productive as one person working alone. Whatever the team size is, individual talents should offset one another; for example, it could be decided that one member should have a knowledge of methods and procedures, while his counterpart should be knowledgeable about the business system as it presently functions. Larger-scale studies might require the skills of a mathematician, operations researcher, or an economist, when a thorough investigation using management science techniques is contemplated.

Requirements for specialized knowledge and skills will vary considerably. Knowledge of functional subjects like accounting, manufacturing, engineering, and production control will be needed; knowledge of special techniques such as simulation and linear programming will also be necessary. More specialized, but still a requirement in most studies, are the skills of systems synthesis — for example, familiarity with computer characteristics, and with communications networks.

The individual assigned to lead the team should be a person with demonstrated abilities in the planning, organization and administration of work. He has the problem of coordinating the entire project, laying out time, cost and personnel schedules, reporting progress to management, and perhaps selecting other members of the team. Beyond this, his responsibility extends to understanding the scope and purpose of the study to the degree that he can speed up work in some areas, while expanding coverage to other areas; his judgment decides. The team leader is the one person who can never for a moment lose sight of end objectives, total costs, and management attitudes.

The leader's attitude influences the team's approach to its work. While he may be functioning in this position as a technical specialist or an administrator, he must be able to motivate people to work more effectively, and develop a climate in which conflict is directed toward the better ways to accomplish a task, rather than on the interplay of personalities.

REPORTING

Among the personal relationships the team will develop in the course of a study, none will be more critical than building a mutual understanding with management. Once a good working relationship has been established through the resolution of study goals and scope, the team must keep management informed periodically of progress. During these review sessions, progress is summarized and measured against scheduled completion dates, current problems are discussed and resolved, and projected schedules are reviewed for the period ahead.

Progress meetings usually are brief and informal. However, when a major checkpoint is reached, such as the end of a phase, longer and more formal presentations will be necessary to adequately discuss the material. Other members of the business are invited for evaluation of critical areas. Some aspects of these reports will require considerable salesmanship (for example, activity formulation), if recommendations depart measurably from past practice. In all these contacts between team, management and operating personnel, the finesse of consultant-client relationships is practiced.

After study purpose, scope and objectives have been defined, time and cost schedules drawn up, and communications channels established, the team is ready to perform the study.

After a statement of study plans is prepared, it is communicated to those individuals within the business who will be affected by the study or who will be contributing time and effort to it. This is particularly important for individuals who come in direct contact with the study team or who will be interviewed during the course of the study. The communication of study plans to employees is a management responsibility, but one which is frequently given too little attention.

INTERVIEWS

The study team learns about the business first from available internal and external sources, but soon this information must be supplemented with interviews of operating personnel and their supervisors. Interviews should be scheduled well in advance, and the person to be interviewed be given some idea of subjects to be covered, and how long the interview may take.

In the first interview (there often is need for more than one), the analyst is interested in establishing an atmosphere of trust and confidence; consequently, he will take few notes and attempt mainly to understand the individual and his working background. Deep-seated resentments can be readily developed against outsiders who imply they are quite knowledgeable, or who convey an attitude of being out to "really clean up this mess." In one notable case, a study team was working in a hospital where the employees felt they were already overburdened with work. The team made a basic mistake: they tried to show management their capability by eliminating two positions in the X-ray department after a week's study. When news of this got around, everyone's job security seemed to be threatened by the team. They were never able to establish confidence with these people or even secure accurate answers during subsequent interviews.

A good interviewer takes command of the situation without seeming to, and encourages conversation without asking questions. Among other considerations, an analyst shows up promptly for the interview, sticks to his time schedule and subject matter, and makes additional appointments when they are convenient to the person being interviewed. Where possible, interviews are conducted in surroundings free from distractions.

STUDY TECHNIQUES

An analyst employs many different techniques for first analyzing a business, then putting it back together again.

Techniques of documentation, analysis and synthesis (Figure 7) will be used in varying emphasis throughout the three phases.

Documentation is the accumulating and recording of information with a clear objective in mind. Only significant data is selected, and only enough is collected to be useful in the study. Since the questions "What is significant?" and "How much is enough?" cannot be answered simply, this will be discussed in Chapter 7. Analysis is the breaking up of study subjects into manageable elements for individual evaluation. Synthesis, as opposed to analysis, is the combining of parts or elements into a complex whole; it is the reasoning involved in advancing from principles and propositions to conclusions.

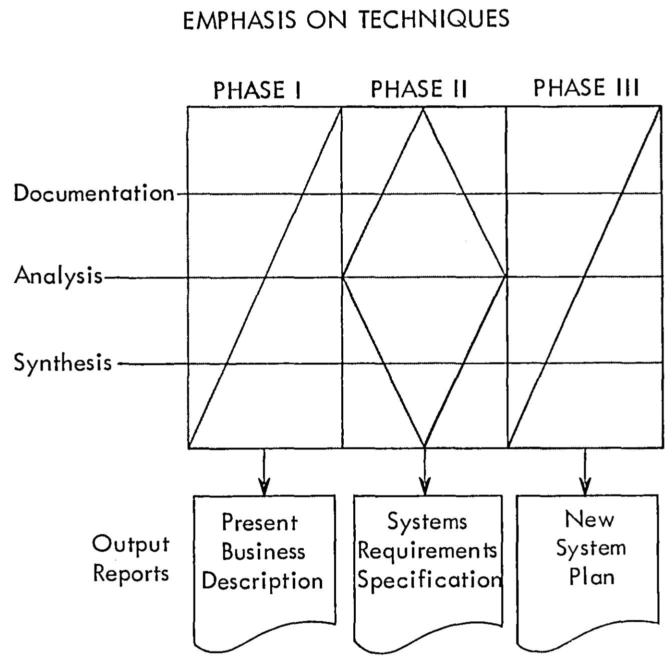

Figure 7

An example of synthesis in Phase II is the formulation of true business goals. From sources such as the present system description, statement of present system goals, analyses of demand for current and future products and services, and interviews with management, information is organized and integrated by weighing values, dropping out extraneous considerations, and extracting meaningful facts to produce a set of true goals and objectives that are representative of the business.

Among management science techniques, simulation is particularly useful in systems studies. A simulation is an experiment in which real-world conditions are imitated in a model to avoid disrupting the daily routine of a business. Decision rules can be tested for validity over a range of situations, or an entire business system can be evaluated for effectiveness of operation. For example, one simulation performed on a computer examines the operations of a job shop over a whole year in a matter of minutes.

Other kinds of models are also useful in systems work. Queuing models investigate problems surrounding waiting lines; Monte Carlo models introduce variable values into simulations for problems like production scheduling. Some models are simply descriptive; others must be manipulated on a cut-and-try basis to arrive at an acceptable solution. Some models accept only fixed information; others permit data variation.

Optimizing models employ the techniques of calculus, game theory and linear programming. Almost any operational system can be described by one or more models, although design and construction of the complex models generally require the skills of a mathematician.

DEPTH OF PENETRATION

Three levels of language are recognized in the Study Organization Plan, each one reflecting a different depth of penetration into the detail of the system.

A broad-gage, general-purpose description is referred to as an overview. Only major decision points, important events, and key volumes are investigated and reported at this level. The general and structural sections of a Present Business Description are examples of language at this level.

There is often a requirement for more thorough description and analysis of certain activities and operations. Language at a moderate depth of penetration is called the systems view: phrases such as "update file" or "prepare invoice," typically found in the operations section of the Present Business Description, are examples of this level of language.

Detail view is the most extensive level of penetration. A programming language, such as COBOL, is an example of detail view.

All three language levels will be used in system studies — whether the studies are aimed at a completely new system, improvement of an existing system, or straightforward mechanization. An analyst recording information at an overview level, for example, might occasionally be required to look more intensively at certain critical areas, and momentarily dip down to a systems or detail view depth of penetration. This is a technique known as the "buttonhook."

DATA DISPLAY TECHNIQUES

When organizing study material, the team is faced with presenting the information to more than one kind of audience. The management group must read, understand and approve the output reports from each of the three phases, while specialists must check and use the data to write detail systems procedures and computer programs in the implementation stage. Therefore, display of results has to be carefully planned. Visual devices like graphs, charts and schematics as well as narrative form are effective in meeting management's requirements for clear but brief summaries. Flowcharts, decision tables and procedure statements are effective in meeting the more detailed requirements of analysts and programming specialists.

A flowchart is quite useful for demonstrating a sequence of events and decisions. Through a series of symbols connected by lines, it provides a framework for relating operations logic requirements. Narrative form is valuable when background information is to be presented, as in the Present Business Description, and for listing requirements. Decision tables are especially useful for displaying the cause-and-effect relationships in complicated systems logic. Procedure statements can be employed to describe special problem areas requiring precise computer-level definition. Most team reports will use each of these techniques as the material warrants.

PRODUCING ORIGINAL DESIGNS

The study team, in approaching its work, may perform in a stolid, workmanlike manner and grind out acceptable solutions, or it may seize the opportunity to produce a thoroughly creative and original systems solution. The more imaginative the design, the greater chance the new system has of contributing to significantly improved future profitability and efficiency. When a considerable amount of money, time and effort is being expended on a complete systems study, the study team bears a heavy responsibility to be original.

Creativity rarely comes from undisciplined, random attempts at solution of a problem or the willful disregard of rules. More frequently, a flash of insight occurs only after countless days of pondering on a subject. Creative work demands great devotion, concentration, study, and hard labor. When someone asked Newton how he made his great discoveries, he replied: "I'm always thinking into them."

There are many standard techniques for resolving the various problems encountered by the study team: trial and error, application of scientific analysis and synthesis, etc. Each is helpful in a way, but techniques merely set up the problem for the analyst to solve. Once technical forces have been applied, then logic, insight and imagination are necessary to achieve a significant result.

The real breakthroughs do not come by gradually inching forward or by making changes in small increments. Instead, they come suddenly after extended periods of hard work and application.

A breakthrough recently occurred regarding the use of manufacturing bills of materials. For years, the accepted way for an engineer to describe a product's structure has been through a bill of materials. This has become a critical input document for manufacturing, and much effort is expended on its form and arrangement. The use of collation charts and single- and multiple-level parts explosions are two examples of interior improvements in form and arrangement. With the advent of the computer, the manual bills were simply converted to magnetic tape or punched cards or stored in memory. Then somebody had a startling idea: the bills of materials would not have to be stored at all, if the design logic locked up in the mind of the engineer could be reconstructed and stored instead! This was the breakthrough. Product characteristics could be generated directly from customer specifications, if the design logic were stated in such a way as to make the transformation possible.

As another example, take a company that maintained a 50,000 ledger card standard cost file. The average record for a part contained ten to twelve lines. Because of its size and complexity, the file was updated just once every two years; consequently, material and labor variances ran as high as 50%. One key cause of these high variances was that the price of copper sometimes changed every few weeks. Since copper was used on a large number of parts, this posed such a massive clerical problem that master records weren't modified. Instead of thinking through the problem, the company decided to wait for the development of some suitable advanced computer with a large enough memory to store the entire file on a random-access basis. However, it was pointed out that the amount of copper used on each part was fixed. If this amount were stored for each part, then by calculation the correct current standard cost could be determined and the entire standard cost system could easily be processed on existing equipment.

The analyst who can find the true nature of business problems and detect the fine interrelationships which exist among operations is usually able to extend potential payoff considerably. To a systems engineer operating from the unified systems approach, the general statement of business goals is more important than the particular: it incorporates functions, rather than the means by which functions are performed. From this viewpoint a railroad does not run trains from one terminal to another; it provides a transportation service for passengers and freight between designated points. A door is not a rectangular construction of wood or metal with hinges on it; it is a control of entry and exit. Through generalized concepts an analyst lifts his thinking out of conventional molds.

Creativity, then, is a fresh approach to solving problems; it is vital for the development of new systems concepts. Combined with technical competence, it is the scientific method.

In a systems study a team faces many decision points. At the outset there may be differences of opinion with management over study scope and objectives. How far does the team press its views on issues of substance? When the work for each phase is completed and the report is written, how can the effort be measured as to completeness and competence? What pitfalls must be avoided in conducting a study? What level of accomplishment should be set for a team? These questions and others will be asked time and again, often without response.

The basic approach in the Study Organization Plan is direct and straightforward. But all through their work, study teams will be called upon to make decisions on quality and proportion, decisions which require mature and objective judgment. While each team will be guided ultimately by its own evaluation of these situations, some of the more common ones are mentioned here.

MANAGEMENT CONSTRAINTS

While the team leader attempts to adopt a management viewpoint in his thinking, it may be difficult at times to reconcile desires of the team and practical judgments of management. A team which has developed an enthusiasm for its work may be suddenly confronted with constraints such as restrictions on project scope, or limitations on modifying inputs, outputs and resources.

Usually, these constraints result from management decisions on what is necessary and proper for the well-being of the business. For example, study objectives in the beginning may have been stated as the nominal improvement of an existing system, or the direct mechanization of a manual system without any change at all in present procedure. The study team may accept this at first, but after delving into the business, may find opportunities for making a considerable improvement, if given more time and people. Management may still wish to stay with the initial scope and objectives. The user may request the continuation of a certain document within the system because it is well recognized in the trade, or may decide that in-place equipment is satisfactory and will be incorporated in the new system design.

When these constraints materially interfere with or severely hamper system design, the team leader should make a strong case for their relaxation. His position, however, must be supported with a well thought-out and documented analysis on costs and results. Should management persist in its position, the team has no alternative but to proceed and graciously accept the restrictions. Most of the time, this will not be a difficult problem and a suitable compromise will be worked out.

PITFALLS

In systems studies, especially large-scale ones, there are an endless number of chances for teams to become derailed or stray from the straight and narrow path. Even the best-intentioned and most farsighted leader may fall prey to certain common pitfalls, several of which are noted here.

One common, serious error is <u>improper problem formulation.</u> Problem areas are often specified or pointed out by management. The study team should take time to evaluate whether the problem has been correctly stated and is actually the one to be resolved. For example, the problem of devising a better method for handling customer complaints may actually be a problem of product quality. The really basic problem is not always obvious, and much time can be wasted tracking down one which does not exist or has been improperly formulated.

Another danger lies in the tendency of teams to <u>concentrate on the techniques</u> of problem solution and lose sight of the problem itself. In mathematical modeling techniques, for example, it is fascinating to investigate all the possible combinations of solutions which are generated when resources and inputs are altered slightly. A team may become so engrossed in operating the model that it loses sight of the original problem.

Then there is the problem of deciding <u>how much documentation is needed</u> to support recommendations and future phases of study. It is easy to say in documentation, "Don't collect too much or too little," but this doesn't resolve the dilemma. This one is related closely to two other problems: <u>What are the significant areas to investigate</u>? and <u>How deeply should they be probed</u>? Analysts working from the overview level in Phase I, for example, will occasionally buttonhook to deeper levels of penetration when the situation demands, then return to the overview level as soon as possible. The key to knowing when to probe deeply and amass a quantity of data is closely tied to considerations made at the beginning of a study. Experienced study teams always hold the business at arm's length to maintain proper balance among events. Whenever a period of deep penetration occurs, the analyst takes breathers and steps back for a while to see where he is and where he has come from. In addition, there should be a good indication of what areas are important (and what areas are not so important) soon after the study begins. Priority should be assigned to the significant areas of opportunity on which major effort will be expended. If the parts of a study are always related to the whole, and major opportunities identified, this knowledge usually leads to a correct decision on "how much" and "how deep."

A common shortcoming in study teams is <u>the con-</u>

sideration of too few alternatives. There is seldom only one way of defining, attacking and solving a particular problem. Successful teams consider commonly known and standard alternatives, and supplement these with others they have developed to satisfy the special requirements of the situation. This is most important when standard alternatives are only partially satisfactory. The invention of a wholly new approach to special conditions will contribute purposefully toward effective systems design; of course, the team does not try to develop new techniques if standard ones work satisfactorily.

The last common failing mentioned here is excessive ambition, or the attempt to cure all ailments with one potion. Only so much can be accomplished in a study, once the parameters of time, cost and personnel have been defined. If problems have been formulated correctly, a careful study plan worked out and followed, and a reasonable number of alternatives evaluated, then this is about all that can be expected of the team. This proposition includes, of course, the assumption that the team diligently and resourcefully apply itself to its work.

QUALITY OF DOCUMENTATION

Data quality is of consequence during all phases of study, but especially so in Phase II, when the validity of the Systems Requirements Specification is being tested prior to system design. As data is collected, manipulated, organized and presented in report form, it must be checked and rechecked for objectivity, reliability, accuracy, validity, relevance, completeness and usefulness. Each of these quality requirements may be expanded briefly, at the risk of using a check list.

Objectivity is the absence of potential for bias in information. For example, "Henry Anderson is one of our sharpest, most productive salesmen" is prone to personal bias, while "Fred Miller sold 13 endowment-at-65 policies last month worth a total of $175,000" is objective.

Reliability indicates confidence. The same measurement repeated several times on the same object will not produce markedly different results if the measurement process is reliable. Should the results differ substantially, the process would be considered unreliable to the extent of the spread in measurement.

Measurements are subject to constant and variable error: a speedometer may be 5% high on all readings (constant); a cutting tool may register -.005 in one cut and +.005 on the next (variable). Accuracy is the absence of constant error.

Validity means that a measurement really measures what it is supposed to measure and nothing else. For example, the number of hours an instructor spends preparing himself to attain proficiency in *teaching* a subject is not a valid measure of the number of hours a student will require to attain proficiency in *learning* the same subject.

Relevance is concerned with the applicability of information to the subject under consideration. An individual's grades in a logic course are related to his potential success as a computer programmer; the number of training sessions required to teach repair of engines is probably related to the number of sessions required to teach repair of transmissions.

Completeness is the presence of all relevant factors of information. A decision on reordering stock, for example, could not be made if information on stock usage were not available.

Usefulness is the ratio of significance of a result to the cost of obtaining that result. This is a very rough and relative measure, which says that if the value of a result is considerable, and its cost is low, then it probably is a good buy. Conversely, if the value is not substantial, but the cost is high, it may not be a good buy. For instance, if the cost of a real-time feedback system to record parts completions every ten minutes is high, and the significance of this timeliness is not important, the usefulness of the feedback system is low. On the other hand, if the cost of a plant fire detection system is low, and the value of fast fire detection is high, then the usefulness of the system is high. At times, a result may be absolutely necessary, and therefore the cost is accepted, regardless of usefulness.

REPORT STANDARDS

Although the study team keeps management informed periodically concerning progress and plans, the reports at the end of the three phases have a special importance and therefore require extra effort, whether presented orally or in written form (or both). These reports are the basis for management's decision on whether Stages 2 and 3, systems implementation and operation, are to become reality.

A written report is desirable; an oral presentation is also most advisable, if at all possible. The team must examine the written report for adequacy, conformity, unity, consistency, proportion, clarity, completeness, simplicity and accuracy. There should be a logical flow and structure of information from introduction to conclusion; form should be the same from one section to another, with events leading from one to another in systematic fashion. The language should be generally understandable, events explained with commonly used terms, and sentence structure free from awkward, stilted phraseology. Report content, further, should be complete, with no gaps in coverage and with adequate supporting material included for each topic, without being excessively wordy. Lengthy narrative can be avoided with visual displays: graphs, diagrams, tables, and the like.

Oral reports are more effective when visual aids are used and the presentation is fairly informal. Instead of covering the same ground as the written report does, the oral presentation concentrates on important features and highlights and leaves incidental matters to subsequent discussion sessions.

RETROSPECT

The Study Organization Plan, as introduced in these pages and in related manuals on methodology and documentation, is a complete program for the study and design of business systems. It is not easy to apply, for it includes many complex and interacting subjects. But then, the business system has never been a simple, clear target for direct frontal attack. Consequently, past practice was to develop a specialized strategy, right on the job. Some of these were good while others were quite bad. At best, the good strategy still had no really big payoff, while the bad might have driven the enterprise out of business.

The Study Organization Plan is an organized, documented approach for conducting systems studies whether they are aimed at improvement, mechanization, or completely new design.

As a flexible plan, it is useful in large and small companies, for long and short studies, whether the business be commercial or government.

To span this range of application, SOP is a tool of variable magnifying power. It accomplishes this through selective documentation and language levels, whereby areas of potentially high payoff can be subjected to intense scrutiny while others of less potential are accorded less attention.

From a Phase I study, understanding of the present business is gained to support analysis of systems requirements. From Phase II, specifications of what a system must do are used to support creative design. And from Phase III, the new systems design furnishes a base for the systems implementation and operation which follow.

The application of the Study Organization Plan will result in a system solution. The real challenge, however, is not just to produce solutions — it is to create good or even outstanding solutions. The degree to which this can be accomplished is up to the study team and to management. It is a direct function of their joint skills, their energies and their attitudes.

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