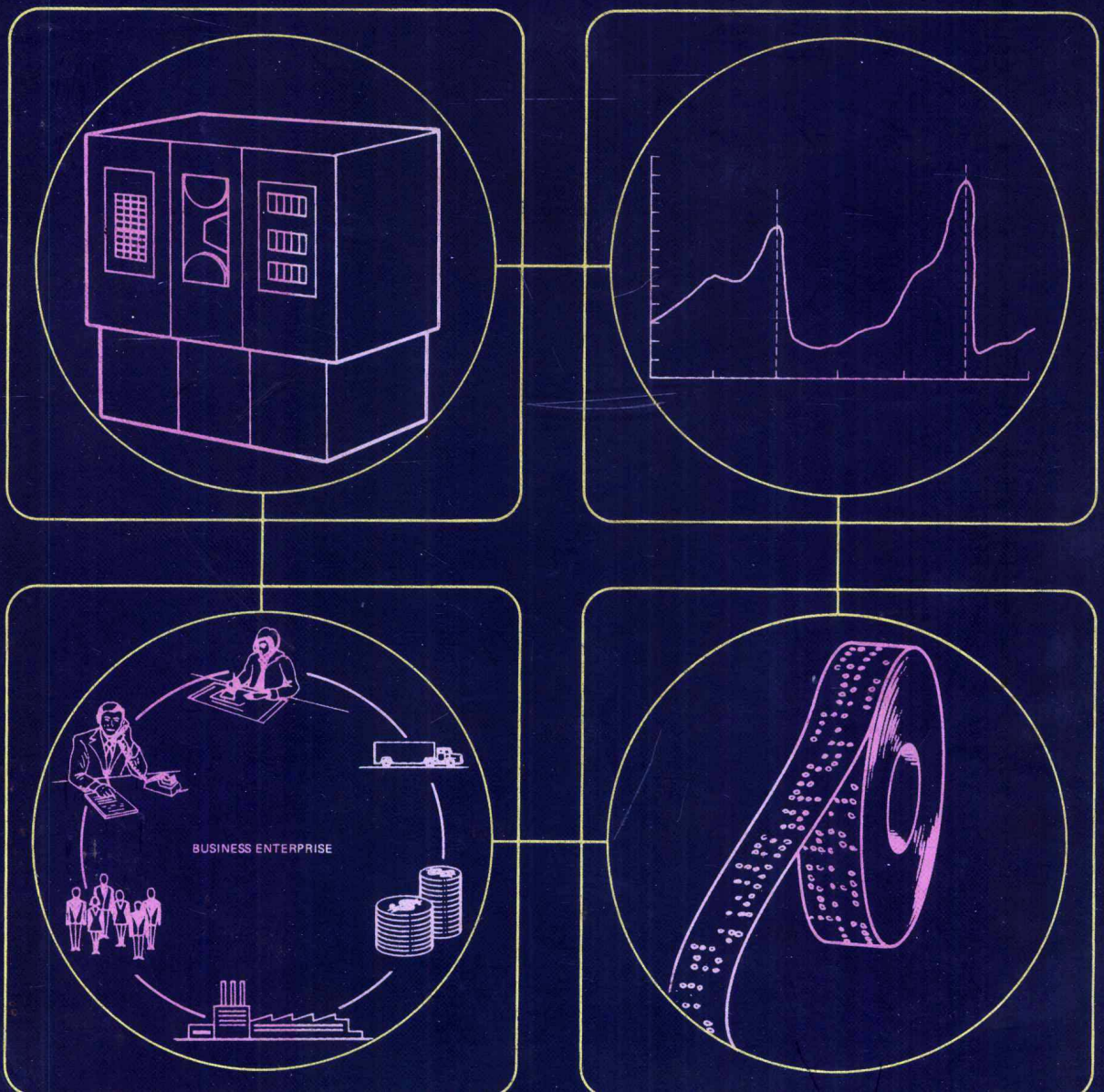
Introduction to Systems Analysis

Gerald A. Silver / Joan B. Silver



Introduction to Systems Analysis

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Preface

The pace and pressures of modern business activities have ended forever the places of chance, tradition, and guesswork in the decision-making process. The very life of a modern business enterprise depends on the availability of accurate, relevant data processed economically and promptly.

The need for systems analysis to develop and guide this life-giving data flow has increased phenomenally and continues to expand into many other business areas as well. The future of business systems analysis shows great promise. The economic rewards from the systems approach to solving business problems are clearly evident. Large and small businesses alike are feeling the necessity of developing business systems in order to compete more successfully in today's marketplace.

Many tasks face today's systems analysts. They must be capable of solving a wide range of complex and sophisticated business problems. They must be able to manipulate and guide the expenditure of large sums of money, supervise the selection and installation of expensive, sophisticated electronic equipment; alter the physical environment of the business plant; train or retrain hundreds of employees; and cope with the psychological reactions of customers, employees, and management.

The costs involved in modern business systems have surged up in the last several decades. Systems must be implemented as nearly perfectly as

possible the first time around—there is little room for second chances, trial and error, or experimentation.

This text introduces the undergraduate student to the world of systems analysis. It defines the role of systems analysts and describes their duties, methods, techniques, and tools. It provides a comprehensive and complete survey of the major aspects, concepts, and theories of business systems. It stresses the fundamental while reducing extraneous detail. It strikes a balance between theoretical and applied phases of the discipline.

The text incorporates a variety of approaches designed to maximize its instructional value to the student. It presents fundamental concepts clearly and concisely in nonmathematical terms. It includes an explanation and discussion of the principles of the scientific method and encourages the student to rely on these principles as a sound basis for all problem-solving activities.

The text draws liberally upon visual media—pictures, drawings, flowcharts, and diagrams—to illustrate concepts and to reinforce the development of a sense of basic logic and reasoning.

In addition, the text stresses modern theory and applications, including electronic data processing and computers. Teleprocessing and communications theory are discussed and integrated into many of the examples.

Another important aspect covered in this text is the thorough treatment of word processing systems. Born as the "little brother" of data processing, word processing has come of age. The latest concepts related to text manipulation, as well as word processing, are explored with both theory and examples. Modern methods of data input, output, storage, and retrieval are also presented, along with a thorough discussion of all microforms—microfilm, microfiche, aperture cards, computer output microfilm, and others.

Finally, the text presents a comprehensive group of case histories. Drawn from real life situations, these diverse cases explore the wide variety of business systems found in industry today. They expose the student to the type of situations and problems that will be encountered on the job. The case histories are presented in survey form to allow the student to integrate the knowledge gained from the text without being burdened by less important details.

The authors would like to thank the manufacturers and equipment vendors who supplied the photographs and illustrations presented throughout the text.

Gerald A. Silver
Joan B. Silver

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Chapter 1

The Role of Business Systems Analysis

To some, this is the atomic age; to others, the computer age. But perhaps it might better be called the paperwork age.

Paperwork is the most abundant product produced by modern business. And processing this paperwork occupies the working hours of hundreds of thousands of secretaries, clerks, managers, office workers, and others.

Why the volume of paperwork? Basically, for two reasons—people and government.

Each person throughout his or her lifetime becomes the subject of an enormous amount of information—medical files, insurance policies, financial records, mortgage loans, employment and school records, to name a few. A growing population generates a tremendous amount of data and paperwork.

The second cause of the multitude of paperwork is increasing governmental regulations and control. More and more, records of transactions that make up daily business life must be preserved in the form of reports and documents for governmental perusal and processing.

In the year 1967, for example, it cost private industry $20 billion just to generate the data required by the government alone. The federal government spent another $8 billion to process its way through the mountain of paperwork created.[1] And this represents only a part of the paperwork produced

[1] Rudolph J. Passero, "Better Utilization of Systems," *The Office* (January 1972), p. 104.

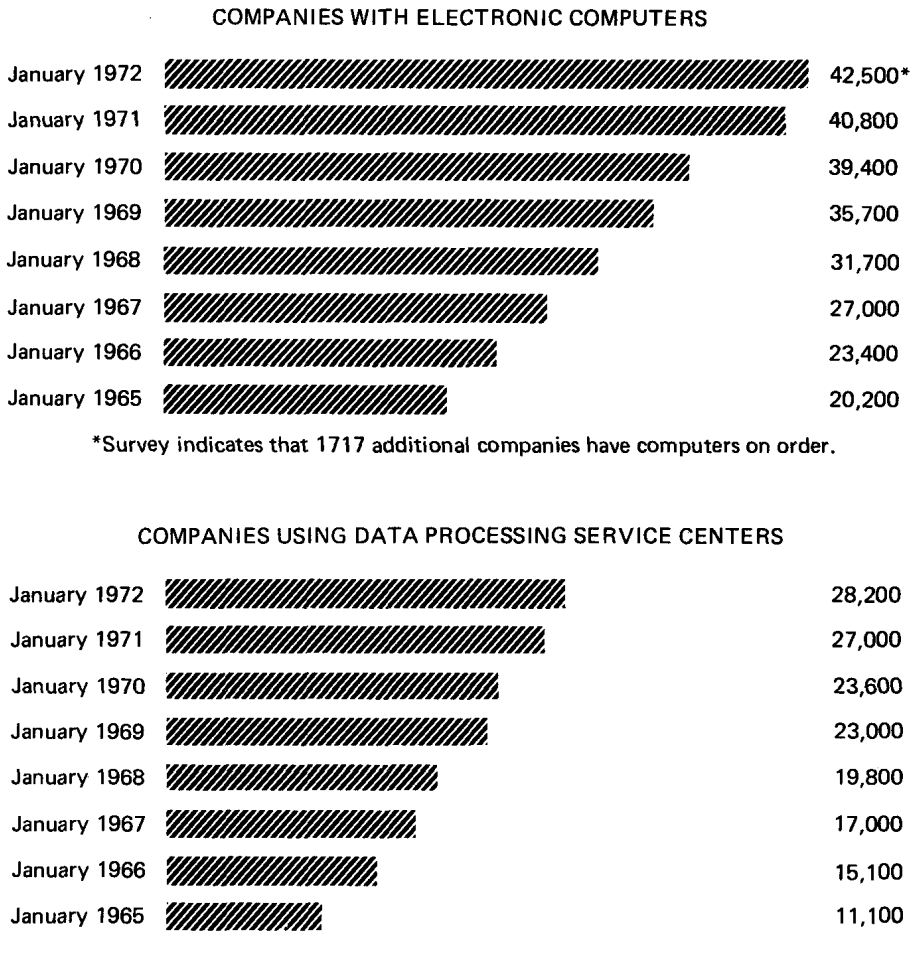
throughout the nation by large and small businesses, schools, hospitals, factories, and others.

Data is used by different organizations in many different ways and for different purposes. It becomes the information base from which large and small business decisions are made. It is used to set policy and to dictate employment, purchasing, and distribution patterns. More often than not, it creates even more data.

The flow and availability of data has become an indispensable, vital element of almost every human enterprise. Molding this data into coherent, usable form does not occur by chance. It requires planning, people, machines, and money.

Over the last several decades the science of systems analysis has developed to meet this need. Its goal is to make the appropriate data available

Figure 1.1. Charts



Source: *The Office*, "Progress in Automation Made by Readers of *The Office*," Jan. 1972, p. 22, Vol. 75, No. 1.

to the right person at the right time in the business cycle, and at a cost and level of accuracy suitable to the needs of the organization. The job of the systems analyst has grown in stature and number, becoming an indispensable part of modern business operations.

BUSINESS SYSTEMS—PAST TO PRESENT

The demand for data has not always been so great. It reflects the tempo, temperament, and technology of the times. Before the advent of jet airplanes, intercontinental television, and international telephone networks, the pace of life and business was slower and more leisurely.

Travel was measured in days, not hours. One could not hop a plane in the morning, arrive in another city by noon for an important meeting, and be home again in time for dinner.

The telephone was fine for conducting local business, but most communications beyond that distance went by mail or telegram. And since the shipment of goods and supplies was expensive and slow, business dealings with companies outside the local area were relatively infrequent.

Radio, newspapers, and magazines were slowly breaking down the pro-

Figure 1.2. Business office environment circa 1920

Courtesy of the Bureau of the Census library.

vincialism and isolation of the country, but there was no national television to infuse new ideas, new products, and new methods into everyone's living room in full color.

The attitudes and atmosphere of business firms 40 to 60 years ago reflected these conditions. Businesses were small, local, individualized, and often family-owned. The owner, or proprietor, served in many capacities, without any academic training for many of the tasks he or she performed.

Information gathering and data processing activities were limited to what the proprietor might need in the short term—for example, hours worked by employees or amounts owed by credit customers. Most data processing had to be done by hand, and it was relatively time-consuming and expensive.

The quality of business decisions reflected this lack of precision. Most business people relied on hunches, guesses, intuition, personal experience, or plain old tradition to solve business problems. Since the influence of a single decision, made by one person, was limited—usually involving only a few people and a small amount of money—these methods often appeared to be sufficient. Consequently, errors or mistakes in judgements were also limited in their effects, and, most of the time, changes and corrections were easily made.

Attitudes toward business problems reflected the times as well. The time pressures that we know today, and the far-reaching effects of many business decisions, were not yet present.

Figure 1.3. Cataloging system, early 1900's

Courtesy of the Bureau of the Census library.

Figure 1.4. Early keypunch equipment from the 1900's

Courtesy of the Bureau of the Census library.

Forty or sixty years ago, if a businessman wanted to improve the data processing activities in his office, he might wait until a lucky salesman dropped in to show off the latest in manual typewriters or mechanical calculators. If he had the money, and it seemed practical, he made a purchase on the spur of the moment. On the other hand, if a salesman did not come around and the problem could not be solved immediately—well, it would keep for a while until more time could be devoted to it.

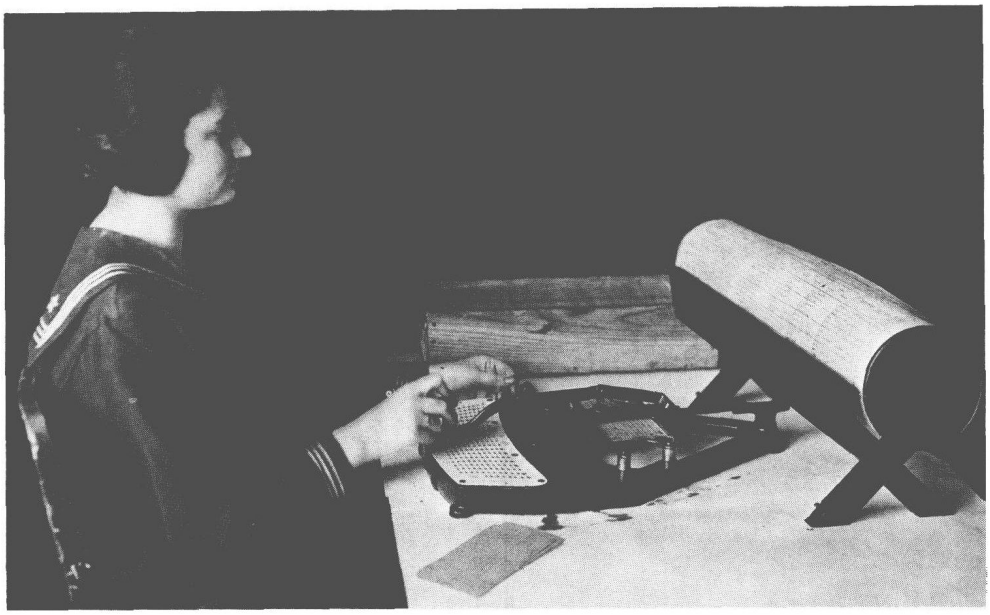
This method of solving problems was, in some ways, adequate for the times. For most small problems the range of available solutions was limited and usually within the knowledge and grasp of the ordinary business person or manager. And, as yet, there were not a great many alternative methods for solving business problems.

But times were changing—the population was growing, technology was advancing. Business was on the verge of outgrowing many of its traditional, leisurely ways.

World War II thrust the nation into a new era. Industry was suddenly faced with the monumental task of supplying the country with the tools of defense and war. These new tools were more complicated than any that had yet been manufactured, and they were needed faster than ever before and in ever larger quantities.

With the nation's survival at stake, industry could not rely on guesswork or inefficient methods of decision making. Methods lacked precision and reproducibility. They had high error factors, no cost controls, and relied

Figure 1.5. Early data entry device used by the Bureau of the Census



Courtesy of the Bureau of the Census library.

too much on isolated individuals rather than on systems. Managers, now under pressure, looked for ways to improve efficiency and output. Scheduling, timing, and planning were critical if defense plants were to meet the demands placed upon them.

The scientific method of problem solving and statistical techniques pointed the way toward the answers. These tools gave managers powerful systematic procedures for analyzing, defining, and evaluating new techniques and solutions to problems. They were used to develop programs that could find the best mixture of employees, machines, and materials to produce the maximum output in the least amount of time. Terms such as PERT (Program Evaluation and Review Technique), operations research, systems analysis, and CPM (Critical Path Method) were born of this thrust.

With the birth of the computer in the late 1940's, the fledgling systems analysts were quick to recognize an even more powerful tool. The computer joined their growing repertoire.

ACCOUNTABILITY AND COST EFFECTIVENESS

As time passed, other factors increased the pressure on the decision-making process. In the 1960's and 1970's, inflation, pressure on government to reduce expenditures and taxes, and international competition forced business people and government administrators to look carefully at costs. Now managers not only had to find the most efficient ways to produce products; they also had to account for each dollar spent.

The emphasis shifted to accountability and evaluating results in terms of costs. Such cost effective programs involve justifying each dollar spent with respect to outcomes or benefits returned.

Business and industry turned to their systems analysis departments to structure their cost effectiveness programs. Systems analysts recognized that such a company program was largely dependent on data gathered from all parts of an organization, processed, and then dispersed in new form back again throughout the firm. Designing an effective, efficient data flow system became the primary step in structuring a cost effectiveness program.

To do the job, systems analysts at first borrowed cost reduction and planning tools and techniques from production and manufacturing departments. As their stature and experience grew, they began to design and develop their own tools. They drew upon many disciplines—statistics, electronic data processing, psychology, management, and more. Today the systems analyst uses many sophisticated, specialized, and effective tools to design better and more efficient ways of moving data throughout an organization.

FUNCTIONS OF THE MODERN BUSINESS SYSTEMS DEPARTMENT

Thousands of business firms across the country now employ trained staffs of systems analysts, and the number will continue to grow. In the early 1960's, about 10,000 people were formally employed as systems analysts. By the end of the decade there were over 200,000 individuals in this category. By the end of the 1970's, the demand for systems analysts will increase by 183 percent.[2]

Systems analysts in a firm often work in a centralized unit called the systems analysis or operations research department. Sometimes their function falls elsewhere on the organization chart. They may be part of the data processing department, under the direction of the company controller, or within the scope of the accounting department.

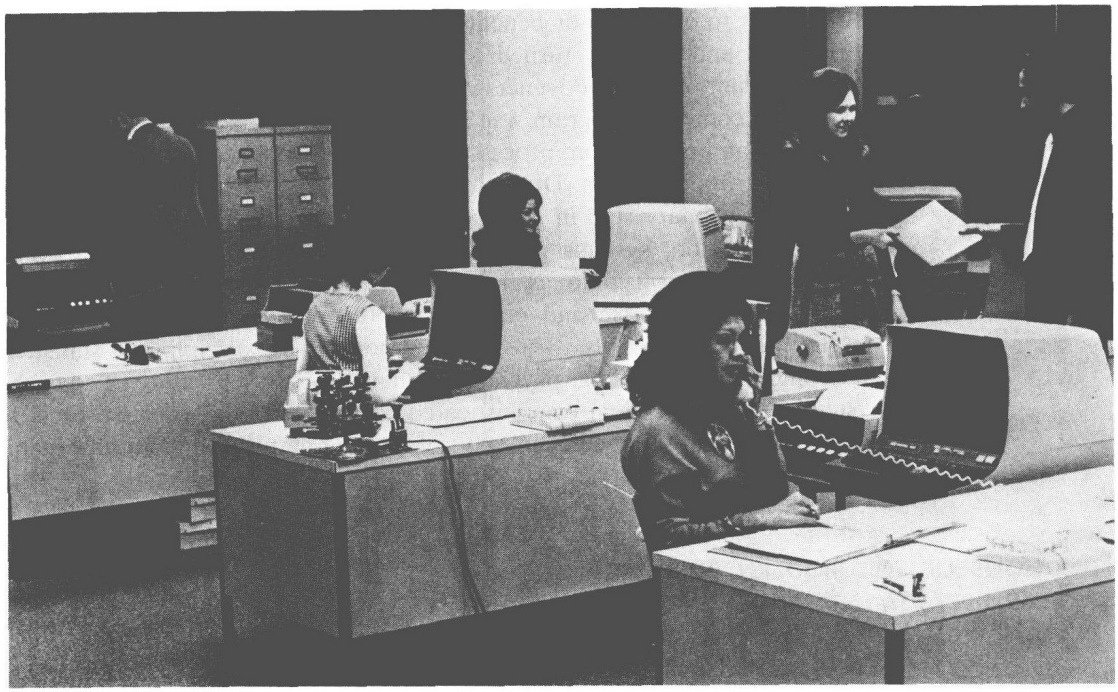
While the precise role of the systems analyst is not as yet formally defined, most serve in similar capacities within a firm. However, specific duties may vary depending on where this position falls in the organizational structure, the size of firm, and other factors. Analysts are usually involved in the following areas:

1. Financial and accounting policy decisions. Systems analysts assist management in setting corporate policies regarding financial and accounting matters and objectives.

2. Forecasting and simulation. Systems analysts play an important role in analyzing and planning future goals and growth patterns of a company.

[2] William J. Rost, "A Quarter-Century of Systems," *The Office* (January 1972), p. 60.

Figure 1.6. Business systems circa 1975



Courtesy Control Data Corp.

They predict financial and economic trends using various mathematical and computer techniques.

3. Sales and marketing of goods and services. Systems analysts supply information and research data and assist in decisions regarding the sales, marketing, and distribution of a firm's goods.

4. Planning the orderly flow of data throughout an entire business enterprise. Analysts specify what data will be collected, what form it will take, and how it will be processed and reported to management.

5. Modifying or redesigning existing business systems. The systems analyst has the responsibility for proposing changes and improvements in a data flow system to meet new or continuing needs of a business firm.

6. System implementation. Once a system has been designed and specified, the systems analyst directs and oversees its orderly implementation. This involves such factors as the selection of personnel and equipment, and the hiring of consultants.

7. Computer programming and utilization. Systems analysts indicate the types of computer programs needed for a new system, and monitor their development, testing, and final implementation. (The actual task of writing programs is often delegated to a programmer.)

8. File design and maintenance. Systems analysts specify what information will be included in a file and plan the layout of data fields in the

records. They define and develop the procedures necessary to keep the information in the file current and accurate. This includes processes such as adding new records or deleting outdated records.

9. Forms design and management. Systems analysts plan and design the forms, documents, and records to be used in a system. They select the forms, their content, sizes, routing, and storage, and specify maintenance procedures.

10. Establishing policies and procedures. Systems analysts write the policy manuals that are necessary for a system to work efficiently, and they define routines and methods for handling data flow.

11. Employment and training of company personnel. Systems people are involved in specifying personnel needs for various clerical and office work stations, and they describe training programs and procedures.

12. Work measurement. The system analyst records data on the output of various clerical, management, accounting, and data processing personnel. This is used to compare, report, and analyze the productivity of personnel involved in the flow of paperwork.

13. Work simplification. Analysts develop easier, faster, more accurate, and improved methods of processing data.

14. Office layout. Systems analysts are involved in planning the office environment and many working conditions throughout the firm. They help to design and lay out offices and administrative suites, including such things as the number and type of desks, cabinets, files, or dictation equipment. The analyst indicates the number of work stations, their locations, and the equipment needed by each.

15. Selection and specification of office and data processing equipment and supplies. A substantial amount of time is spent by the analyst in comparing and selecting hardware, devices, and other machines necessary for the efficient movement of data throughout a firm. This includes computers, unit record machines, copying machines, duplicating equipment, mail handling, routing machines, and others.

16. Planning and designing internal and external communications. An important responsibility of the systems analyst involves the firm's data and electronic communications facilities. This includes specifying the type and number of transmission lines, data lines, switch-boards, dictation equipment, telephones, Teletype terminals, data transmission equipment, and facsimile machines.

ADVANTAGES OF USING SYSTEMS ANALYSIS

During the past three to four decades, the application of systems analysis techniques to business problems has benefitted businesses in several ways. This method of problem analysis and solution has shown results in these key areas of the business operation:

1. Efficient systems. Systems analysis methods help a firm to develop and maintain an organizational structure and operating procedures that lead to attaining maximum efficiency.

2. Maximizing profits. A business firm that operates efficiently and systematically is more likely to generate greater profits.

3. Resources used to the best advantage. Systems analysis aids a firm in achieving maximum output with the least investment of time, material, manpower, and other resources.

4. Reduction of human effort. Systems analysis encourages the best utilization and allocation of human effort and labor. Systems analysts attempt to uncover duplication, redundancy, and wasted effort, and to automate procedures whenever practical.

5. Speedier delivery of the end product. Effectively organized procedures and operations make it possible to reach end goals faster. This is true whether the output of the firm is the production of a good or service, or the movement of information, data, money, or the like.

6. Reducing or eliminating errors in data and information. An important goal of the systems analyst is to increase the level of accuracy of information generated and processed by a firm.

7. Documenting methods and procedures. Clearly written policy statements, diagrams, flowcharts, and such make it more likely that a firm's procedures and practices will be followed and maintained in a consistent manner. They also serve as guides for needed modifications or alterations.

LIMITATIONS OF SYSTEMS ANALYSIS

Systems analysis is not a panacea for all business problems. It has limitations and weaknesses that must be understood and considered during all phases of systems analysis work. The following list summarizes some of these areas.

1. Some business problems are beyond the scope of systems analysis techniques. The most skillfully designed data flow system cannot help a company that is failing because of serious financial problems or because it is marketing a product no longer wanted by society. Problems created by pressures from outside the enterprise, such as from stockholders or the public, are also often beyond the grasp of the systems analyst.

2. Systems analysis costs money, time, and effort. Finding a long-term, permanent solution to a problem can be an expensive investment, compared to a short-term temporary answer.

3. Human elements can cause complications. A systems analyst must take the human element into consideration in his or her work. Much of the analyst's activities involves making changes—in routines, systems, organizational structure, working patterns and conditions, and other areas.