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Computer Effects On Traditional Management Organizational Structures

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COMPUTER EFFECTS ON TRADITIONAL MANAGEMENT ORGANIZATIONAL STRUCTURES

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ABSTRACT

With the implementation of computer technology into modern company management, the very principles and concepts upon which the theory of management fundamentals are based, namely Planning, Organizing, Directing, and Controlling, are in jeopardy.

This study attempts to relate automation to organization and management and to explain how the computer has affected the traditional structural elements of managerial organization and decision making. Just what type of organizational structure will fit in where automation predominates? Line? Functional? Staff? Committee? Or some sort of combination? Indeed, are any of these traditional methods today even appropriate?

The ADP displaced worker situation is portrayed and actions for its alleviation are suggested. Managerial approaches to coping with decision making, personnel training, and organizational structure evolving from an ADP influenced society are presented. New equipment advances and current techniques are discussed and the feasability of the "total system" considered in terms of its relationship to management.

CHAPTER I

THE INTRODUCTION

The art and science of management are undergoing a radical change. At the heart of this change is the electronic computer. No other technical development has altered so many human activities in so short a time.

As applied to management and automatic data processing, the computer is little more than a decade old and its use has grown so rapidly that one can consider it the basis for a second industrial revolution. The next 20 years will show technological growth equal to that which occurred in the past 200 years since the industrial revolution.

Computer Growth

The first computer utilized for business type data processing was installed by the Census Bureau in 1950. Four years later, the General Electric Company installed an industrial computer at the Louisville plant.[1] In such a short period of practical application, the computer because of its speed in processing data has profoundly affected all aspects of the social and economic life in this country and has served as the foundation for industrial automation.

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[1]Bruce L. Garrett, The Impact of ADP on the Future Managerial Environment, 1965, Redstone Arsenal, Alabama, Redstone Scientific Information Center, p. 1.

To gain a proper perspective of computer developments, the history of electronic data processing should be examined in terms of the growth of computer installations and a brief look should be taken at computer system fundamentals.

A logical examination of the growth of computer installations must consider both numbers and dollar value. "The data processing industry had 'its biggest year' in 1965", according to Honeywell's President, Walter W. Finke. Finke also estimated that "The rate of increase of cumulative installed systems will start to decline this year as many earlier computers reach the end of their useful life."[2] But this estimate, according to Figure 1, is incorrect.

Figure 1 does show however, that the number of computer installations has increased rapidly to a point where it is predicted that the rate of increase will stabilize near the 1966 level. On the other hand, the rate of dollar expenditures, for fewer computers, is expected to continue to increase (Figure 2). This is due to replacement of older computers with more sophisticated and larger equipment.

The problem faced is, how has the computer effected the traditional organizational structures of company

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[2]Diebold Group Inc., Automatic Data Processing Newsletter, Vol. IX, No. 17, 18 Jan. 1965, p. 4.

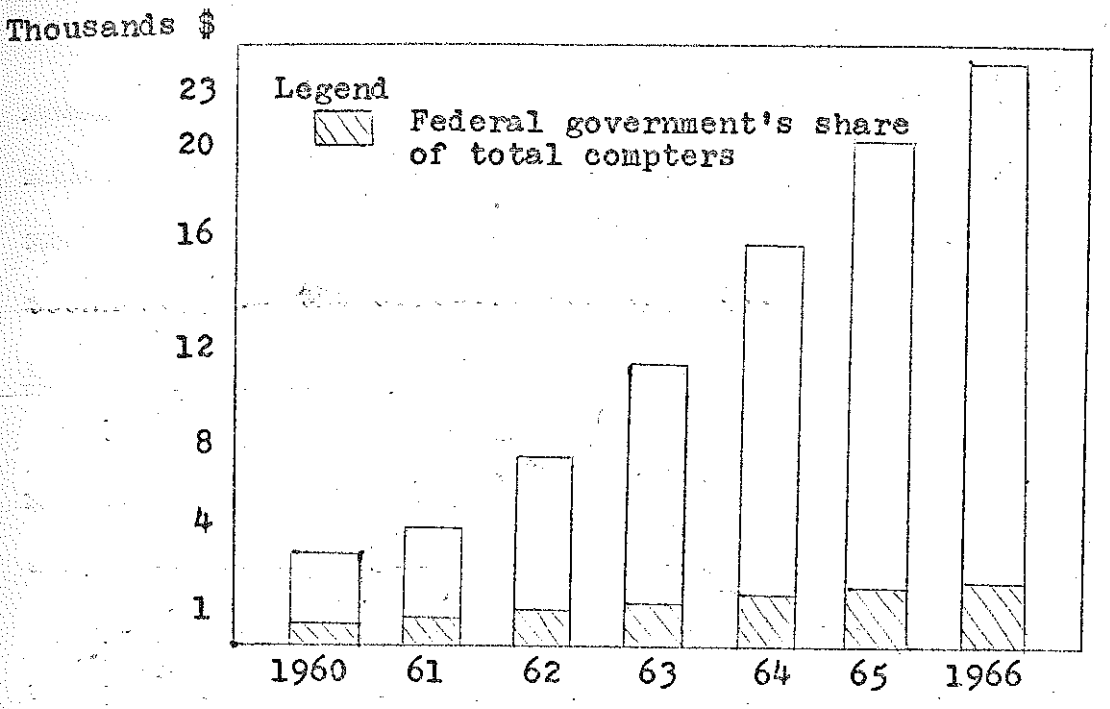

Figure 1.--Growth in Number of Computers

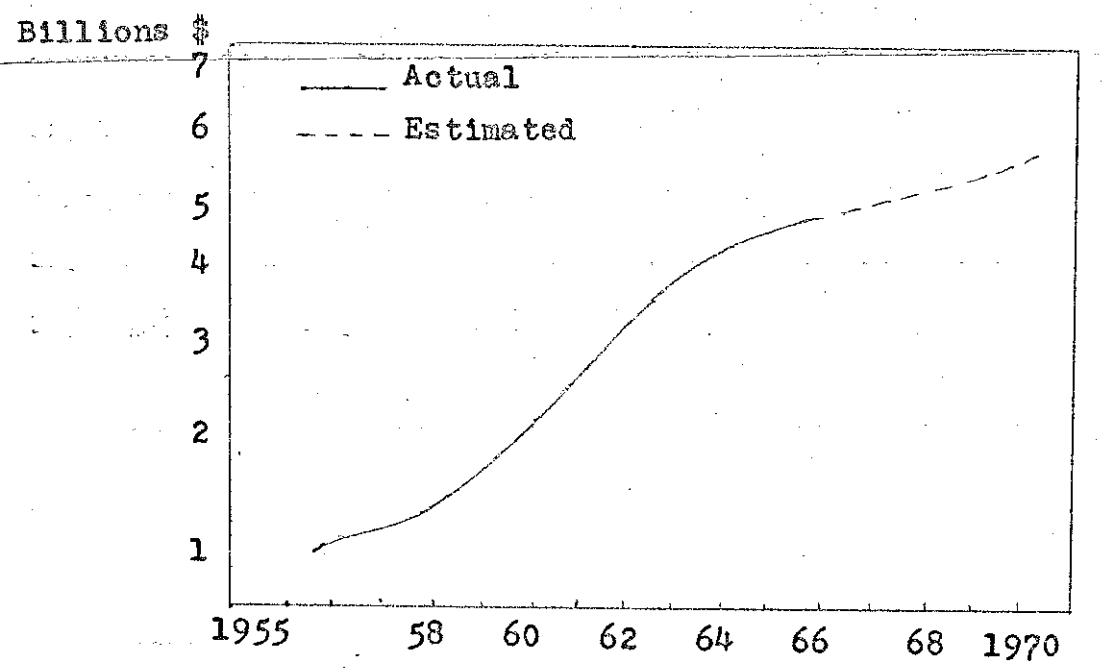

Figure 2.--Expenditure for ADP Equipment 1955-1970

SOURCE: Donald F. Blumberg, "New Directions for Computers", Computers and Automation, Jan. 1964.

management? Have they been advanced, disrupted, or even mildly disturbed? Providing insight to and a critical analysis of the effects of this rapidly growing computer technology is the objective of this study.

Computer System Fundamentals

The modern manager, in order to recognize an automation organizational problem, should review the basic computer oriented principles and functions.

The general organization of digital computers follows the pattern shown in Figure 3 for the UNIVAC 1050-II Real Time System. This system is presently replacing the RAMAC computer system, recently used in the Minot AFB Supply organization, and it currently comprises the USAF Standard Base Level Supply computer system. All computers, including those mentioned above, have four basic functions: input, processing, control, and output.

> The purpose of most digital computer systems is to receive and store data, to process this data and to supply the result of this processing to whoever requested it. To illustrate this input-processing-output function in terms of the components shown in Figure 3, assume that a computer is to add 2 + 2. Two 2's are supplied for processing from the input. The input does not specify whether these 2's are to be added, subtracted, multiplied, compared, or what have you. The 2's are stored in the memory portion of the processor in specific locations known to the programmer. An instruction is then supplied to the processor, also by way of the input.

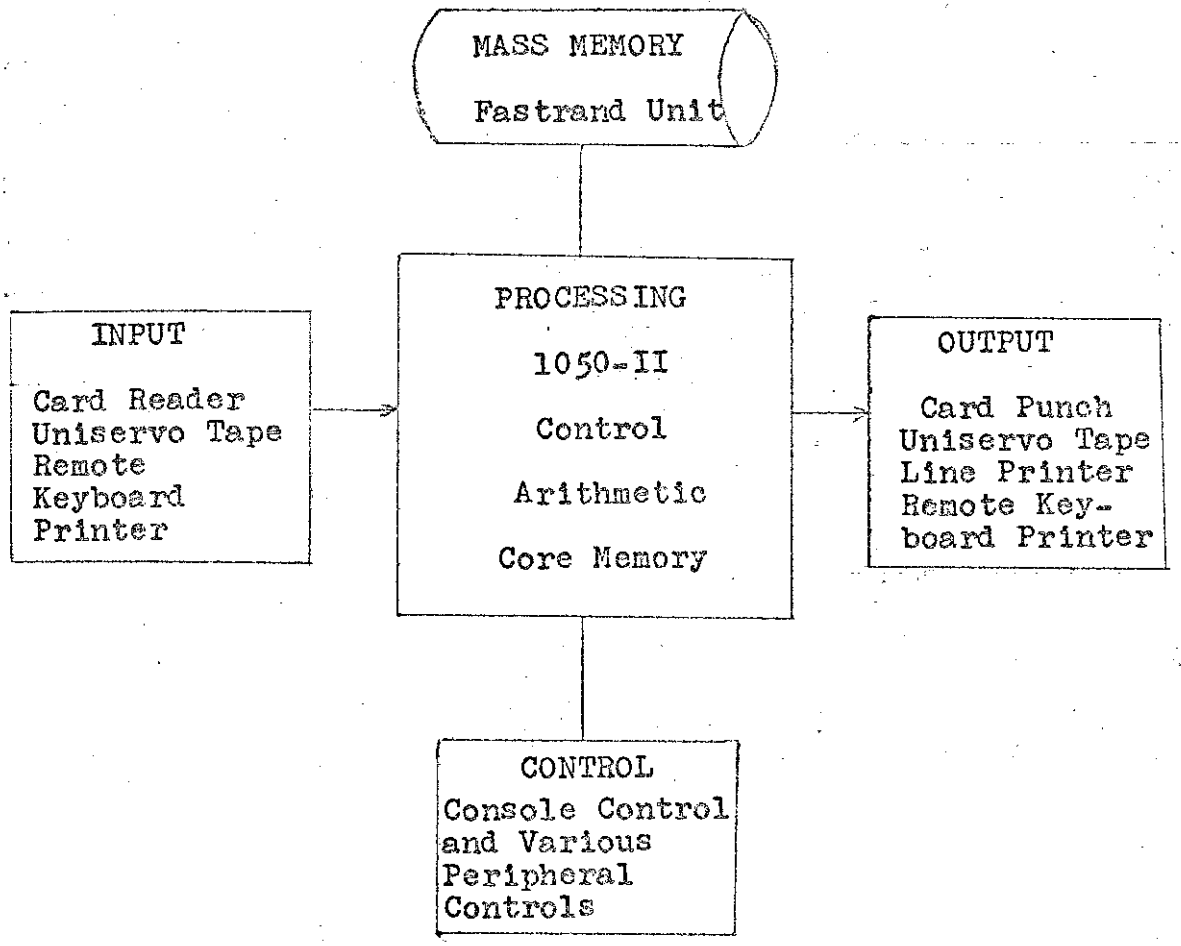

Figure 3.--Basic Organization of 1050-II System

SOURCE: Operator's Reference Manual, Unpublished Training Manual, United States Air Force, Air Training Command, Amarillo AFB, Texas, 1966.

> The instruction specifies precisely how the 2's are to be processed and what is to be done with them afterwards.[3]

If processed information is not to be retained in the processor memory or in the magnetic-drum memory, the processor controls can automatically "output" the information in the form of printed characters, card codes, or tape cards.

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[3] Operator's Reference Manual, Unpublished Training Manual, United States Air Force, Air Training Command, Amarillo AFB, Texas, 1966.

CHAPTER II

ANALYSIS OF ORGANIZATION BY TYPE

The tremendous impact of the computer on the total business structure has created doubt in some quarters as to the validity of recognized basic principles of organization.

The objective will be to outline and discuss the organizational concepts, and to determine which structure, if any, is most able to cope with the advancing age of automation.

Historically, there have been three basic types of organizational structures, one of which most companies have found compatible. They are Line, Functional, and the Line-Staff combination. Some writers[4] consider the Committee as a basic form of business organization; however, it is generally not as well accepted as are the others, because in the committed decision-making takes longer and usually results in some sort of group compromise. As an advisory function the committee is fine, but it is a weak control device and a poor substitute for proper organization.

The Line Organization

The most common form of administrative organization, especially in small and medium sized companies, is the direct line of command. It is usually regarded as the

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[4] See J. C. Hall and E. M. Robinson's College Business Organization and Management, McGraw-Hill, 1964, for a good discussion of the Committee form of organization.

simplest of all forms, since duties and responsibilities flow directly along a predetermined chain of command. In every case the chain of authority is an unbroken line from the top to the bottom of the enterprise (see Figure 4).

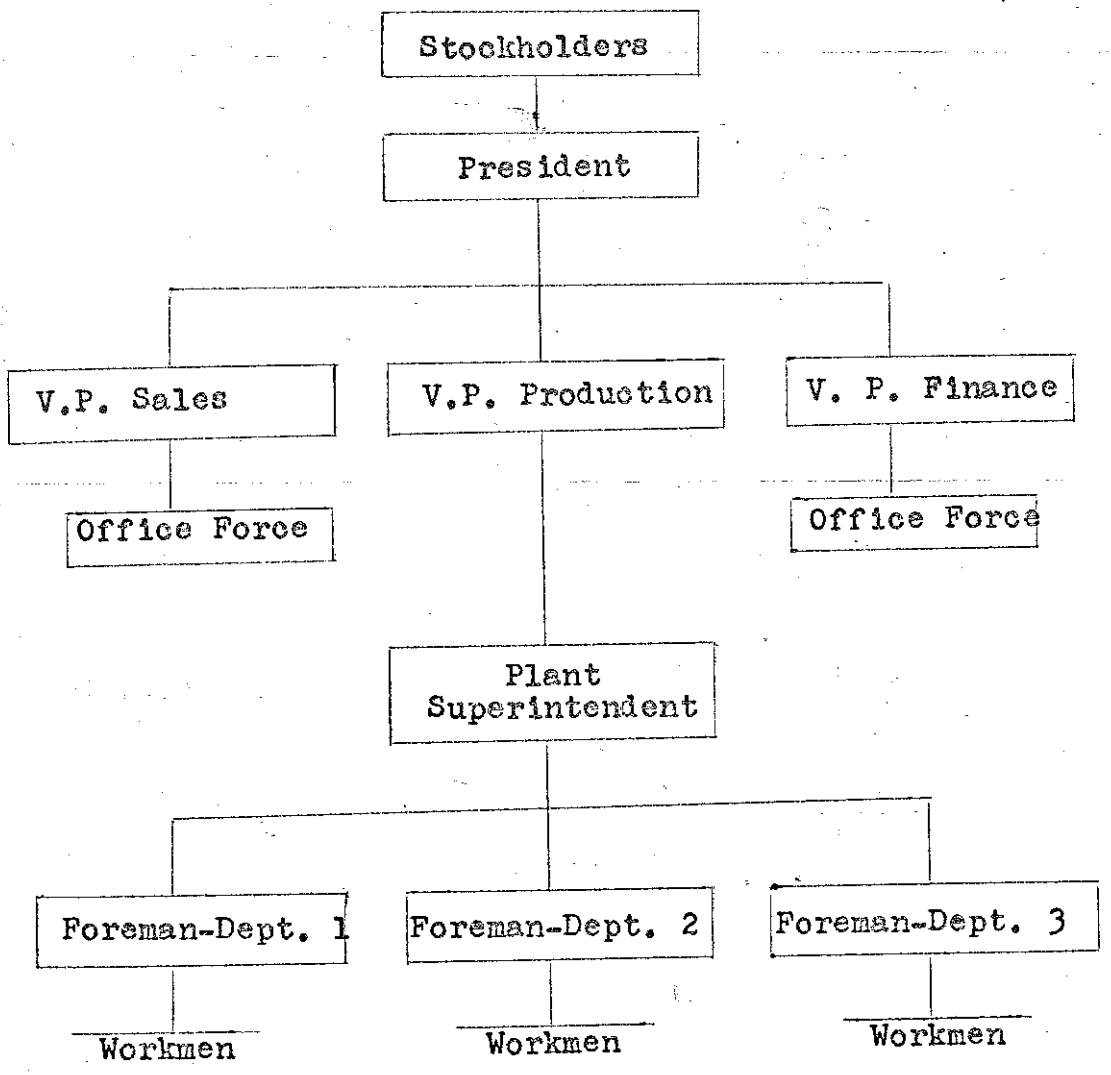

Figure 4.--The Line Organization Chart

SOURCE: Extracted from Industrial Management by Sprigel and Lansburg, 5th Ed., 1963, John Wiley and Sons, N. Y., p. 5.2.

The line form of organization has the advantage of clearly defining the duties and responsibilities of each man; hence it achieves good results in both discipline and control. However, the extreme rigidity in the line form of organization seemingly tends to dull initiative, for operations must be conducted on instructions from above even if the instructions are incorrect.

In general, the larger the enterprise, the more apparent are the weaknesses in line organization. It suffers from the common fault of all extended chains. It is no stronger than its weakest link. The line system, however, remains effective in smaller enterprises; and in such organizations it is probably the most effective system.

As a factor in this study, the <u>completely</u> line-oriented organizational structure is of little value. This tends to be particularly true since the line structure compliments the smaller company. While it is true that smaller companies may utilize computer facilities, it is usually on a short-time rental basis (possibly for a particular problem--year end accounting, etc.) and not for major corporate information requirements.

<u>The Functional Organization</u>

In this form of organization, the operations are divided according to the different functions of the business.

Each function is directed by a specialist, and he is authorized to issue orders in his field throughout the organization (see Fig. 5).

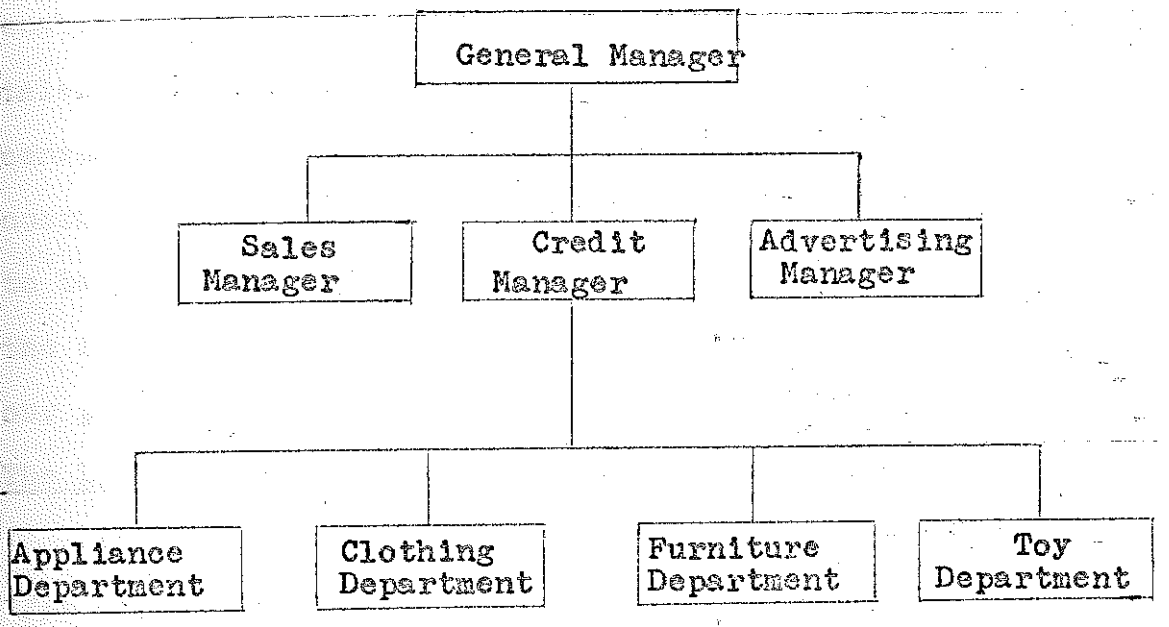

Figure 5.--The Functional Organization

NOTE: In this functional organization of a department store, each department head is responsible to three managers who are specialists in their particular fields. Such divided leadership can cause confusion.

SOURCE: Extracted from College Business and Organization by Edwin M. Robinson and J. Curtis Hall, 3rd Ed., 1964, McGraw-Hill Book Co., N. Y., p. 79.

"Each employee is directly responsible to a different supervisor for each important part of his job. Also, each department is responsible to several specialists, each of whom has jurisdiction over a specific type of activity."[5]

The advantage of the functional operation is that it enables a company to make the maximum use of specialized talent. In this form of organization, however, the concensus of most authors is that, it is difficult to achieve coordination of the separate functions. Discipline tends to be weak and confusion arises. For these reasons alone the functional organization is regarded as inadequate for our purposes.

The Line-Staff Organization

Robinson and Hall perhaps best describe the Line-Staff type organization in its most advantageous light. "The Line-Staff organization combines the best features of the line structure and the functional structure. . .and is today perhaps the most popular form of business organization."[6]

Under this kind of organization (see Fig. 6), the line division is engaged in carrying out the operations of the business. The staff division is engaged in solving special problems and in providing needed facilitating services.

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[5]J. Curtis Hall and Edwin M. Robinson, College Business Organization and Management, 1964, New York, McGraw-Hill Book Co. p. 78.

[6]Hall, p. 80.

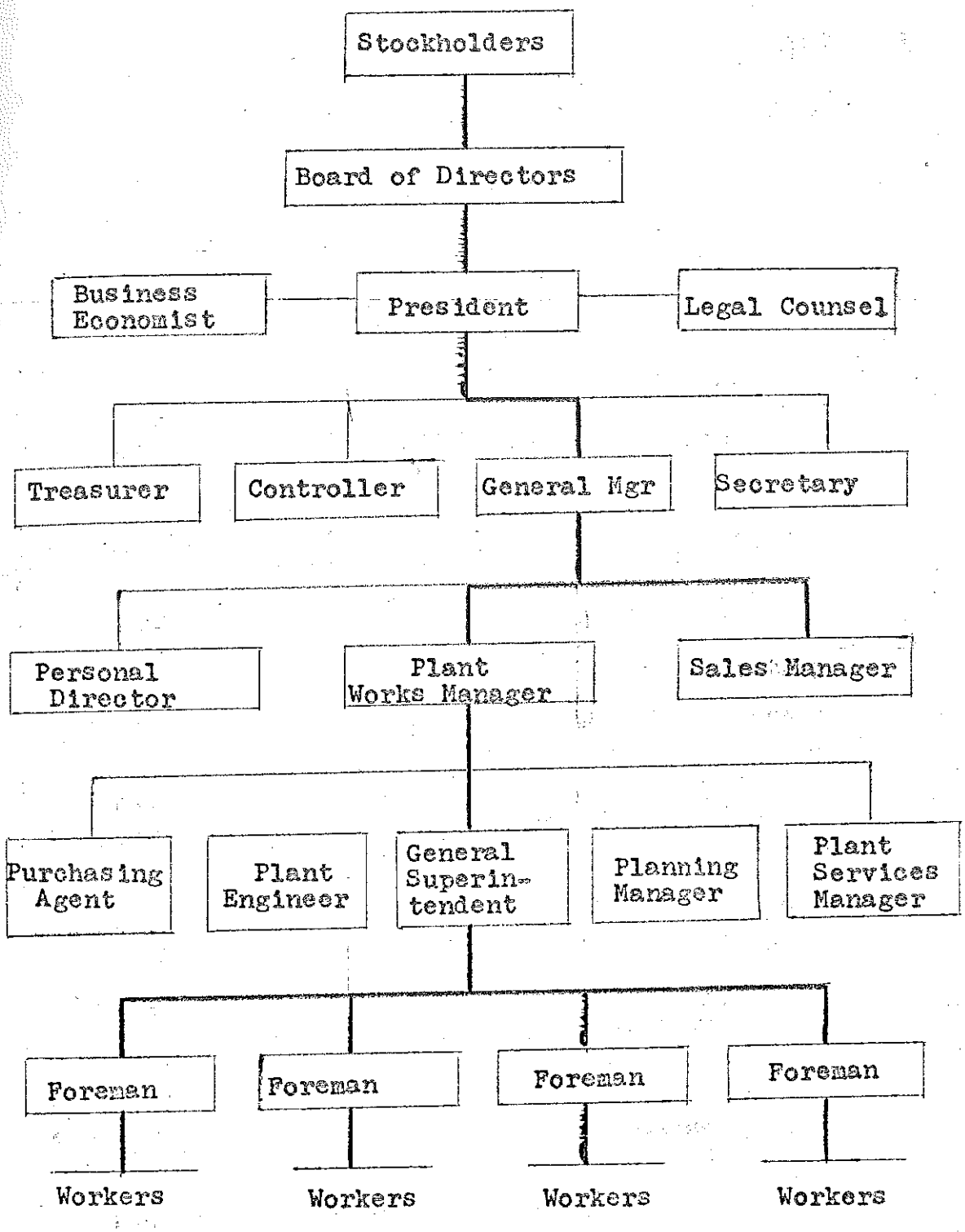

Figure 6.--The Line-Staff Organization

SOURCE: Extracted from Business Management by Lyman A. Deith and Carlo E. Gubellini, 1958, McGraw-Hill Book Co., New York, p. 402.

An apparent advantage of the Line-Staff structure is that it accomplishes a satisfactory division of labor without sacrificing clear-cut control. The supervisor, who is in a line position, is able to exercise direct control over his employees. At the same time, he is relieved of the responsibility for solving many special problems that are beyond his understanding or ability to handle. The service personnel do not interfere with effective control of operations, yet they provide a valuable helping hand when it is needed.

Thurston's Analysis

While the Line-Staff type organization is in predominance today, and seems destined to remain there, there are indeed marked changes on the horizon. The question immediately brought to mind is, who will play the most important role in the age of computers, the operating manager or the staff specialists? Just who will predominate? In his penetrating article, "Who Should Control Information Systems?"[7], Philip H. Thurston analyzes the strengths and weaknesses of specialists and operating managers with regard to their desirability for managing information systems. His analysis, as extracted from the works of Lester R. Bittel, follows in part.

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[7]Lester R. Bittel, Management by Exception, 1964, New York, McGraw-Hill Book Co., pp. 259-260.

The Staff Specialists Advantages:

1. They are the principal source of new ideas. They develop these ideas because:

a. Their positions and time allow them to observe and study current operations and the implications of change.

b. They are not limited by the need to show a profit in a given operating period but can take a long-range viewpoint.

c. Underlying these other reasons, the principal significance of their job lies in examining and changing systems.

2. Specialists are trained in new methods and new data-handling equipment and tend to take a broad view of systems problems. Where as operating managers, with their emphasis on expense responsibility in the current period, tend to take a narrower point of view and regard systems problems as separated by department lines.

3. The appointment of a specialist to carry out systems work represents a commitment by management to improve systems.

The Staff Specialists Limitations:

1. Operating people resist planning in which they have no part; they resist efforts of specialists to seek information or to install systems changes; and they delay accepting responsibility for new operating systems installed by specialists.

2. Specialists are blocked not only by the resistance of operating people but also by the specialists' limitations. Few men can, in a matter of months or years, move between such diverse areas as manufacturing, engineering, and marketing, and in each assimilate not only the principal flows of information and the major exception routines but also every lesser requirement which must be met. Operating people have a distinct advantage in their understanding of the process with which they work.

3. Some specialists perceive the successful performance of their jobs in terms of achieving change to the extent of disregarding the practical needs of some operating situations and of underestimating the importance of cost and timing considerations.

The Operating Mangers Advantages:

1. They possess detailed knowledge of the jobs to be changed. This helps them in assembling information necessary for systems decisions and in recognizing what changes will improve the immediate work situation.

2. Once the supervisor in control of an operation is convinced of the desirability of making a system change, his position enables him to effect the change with greater ease than can the specialist.

3. Operating managers make another contribution to system changes through their strength in manpower, which enables them to give substantial support to systems projects in many areas at the same time.

The Operating Managers Disadvantages:

1. They are limited in their knowledge of methods for handling information. As indicated earlier, they tend to think in terms of existing areas of responsibility, where as the specialist has a broader outlook.

Operating people also tend to emphasize current operations, showing a reluctance to change existing work patterns.[8]

It is evident that though both the operating manager and the staff specialist have their related faults, both are indispensible within the framework of an effective automatic data processing system. Later, it will be shown how line and staff positions are disappearing as separate functions with a resulting interaction between the two.

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[8]Ibid.

CHAPTER III

MACHINES AND TECHNIQUES

Equipment Advances

Computer "equipment advances" are now clearly defined as requirements evolving from shortcomings of early equipment, particularly in the area of input/output devices.

The rate of technological improvement has been one of the computer industry's outstanding characteristics. Despite its short history, two generations of computers, vacuum tube and solid state systems, have already been introduced, a third generation is now available and widely utilized. These machines use such advanced components as magnetic thin films, tunnel diodes, and microminiaturized circuits, and operate at speeds measured in billionths of a second in solid state computers. Future computers will perform up to 2 million operations a second.

These technological advances are leading to lower costs per calculating operation. Third generation computers cost 2.5 times more than second generation equipment, but will operate 10 times faster.

Techniques for Computer Use

It appears to be almost unanimous among ADP users and manufacturers that most mechanical problems that have

retarded optimal computer use are either solved or well on the way to solution.

As remarkable as the progress has been in computer technology over the past decade, industry experts regard computers as at the same stage of development that automobiles were when they began to be generally accepted by the public.

Already we have seen the emergence of very expensive computers being used on a monthly rental basis. These units are general-purpose stored-program digital units, similar, in many respects, to the logical-processor module used in UNIVAC's 1050-II and other large systems. The system does not have to be very fast since it is primarily used as a desk calculator (but vastly more efficient) with a stored-program memory.

We can expect the following developments in computer systems design:

a. The physical size of systems will continue to decrease with the introduction of integrated circuitry, and the switch from electro-mechanical to electronic input/output devices associated with the computer.

b. Micro-electronic components will become cost competitive with standard logic circuitry, causing substantial repercussions in the structural design of meduim and large scale computers.

c. Parallel, modular computers systems, built up from a standard set of logical processor modules, I/O devices, and memories, will become the basic system of the late 1960's.

d. There will be continued development of higher-level programming languages and executive routines, making the computer more accessible to the user. This closer man-machine interface will be further enhanced by the availability of displays, permitting continous exchange between the man and the machine.[9]

Another example of the highly advanced systems which research into human processes is making possible is the perceptron, a pattern recognition device. The perceptron distinguishes between different letters of the alphabet and can recognize faces or other objects.

In communications, the laser beam is a new component which is the result of study in electronics and optics. The laser makes possible an entirely new means of long distance communication through storage of electronic energy in a crystal. The discharge of the energy as a burst of light is so well modulated that it can be converted back to an intelligible telephone conversation between men or machines.

> Continuing military requirements will result in further developments in large-screen display devices. Slide-projection displays appear to be the most reliable and easiest to maintain, and will probably be used to satisfy most industrial requirements. Matrix display systems will probably appear as production equipment by 1968-1970.
>
> We can also expect dramatic new improvements in the field of electrostatic and Xerographic copiers. Office photo-copying and microfilm equipment will be developed as integrated elements of a total information processing system, by the end of the 1960's.[10]

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[9]Blumberg, op. cit. p. 28.

[10]Blumberg, op. cit. p. 30.

Total Systems

Much has been said about "total systems" of computerization, but as far as big business is concerned, no real total system has yet been developed.

> In a total system, all the pertinent data would be caught up at its source, screened, classified and stored, and forwarded to those who can use it. Any manager in any department could obtain any information he needed at any time.
>
> Parts of total systems do exist. For example, when a customers's order is translated into machine language and fed into a computer, it may be merged in the master production schedule, the parts and sub-assemblies determined and compared with an inventory, and shop schedules created. There may also be 'feedback' in the form of information from the production floor on the status of the orders, and so on. But this is really a 'sub-total' system covering one part of the total company operation -- the filling of orders.[11]

The continued development and perfection of these new and sophisticated concepts and systems will again lead to a readjustment in the organization structure. It will also require and bring closer to reality the development of a modern executive capably equipped with the essentials formerly needed by both the Line Manager and Staff Specialist. One might call him a modern Managing Specialist.

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[11] Ernest Dale and L. C. Michelon, Modern Management Methods, Cleveland: The World Publishing Company, 1966, pp. 194-195.

CHAPTER IV

EVALUATION OF THE ORGANIZATIONAL EFFECT OF THE COMPUTER

The Workers

Any office worker, with several years remaining prior to retirement, having no basic appreciation for ADP will most likely find he is not fully equipped to complete his active work life. ADP to many workers involves a complex set of machines, controlled by a peculiar language, and understood only by a group of exceptionally talented people. However, most computer displaced workers can, if willing, be satisfactorily retrained. After an initial acquaintance with ADP, the worker will find that it is not nearly as complex as it seems; but that with diligent and properly directed effort in the form of training he can perform some useful part of the changed technology.

> It is estimated that 35,000 workers are displaced by automation each week.[12] The raging argument over whether technology simultaneously creates even more jobs than it destroys is irrelevant to the fact that nearly every new job demands more human skills than each old job; the net result is always a need for more job training. Studies have also revealed that 30 per cent of high-school drop-outs permanently join the two million unemployables and the 35,000-per-week displaced workers. Obviously, this enormous and growing pool of people needing education and re-education can only be drained through a massive retraining

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[12] Diebold Group Inc., op. cit. p. 7.

> program implemented with mass-education technology. There is already strong indication that the Government plans to 'fight automation with automation.' President Johnson, in proposing a doubling of the total national expenditures on education, specifically proposed first-year spending. . .to establish 'regional educational laboratories. . .to train teachers and to develop new teaching systems.';[13] It is in these experimental training centers that the first steps toward instructional automation may be taken.[14]

The Federal Government has managed to cope with the problem of worker displacement due to automation, within its own ranks, better than some private businesses because of the large number of jobs regularly available in which to place displaced workers.

> Beneficial factors facilitating the reassignment of displaced employees have been the growth in agency programs, the magnitude of Government employment, the new positions created by automation itself, and the leadtime of two or more years between the initiation of plans to convert and actual operation. Normal employment attrition is expected to continue to contribute to reducing the number of employees requiring reassignment.[15]

Among the implications of technological change for management is the fact that many of the new jobs created by automation will disappear among these jobs. Advanced developments in the organization of computer systems as well

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[13]Blumberg, op. cit. p. 61.

[14]Rod E. Packer, "Computers, Education and the Government," Computers and Automation, March 1965.

[15]The Diebold Group Inc., Automatic Data Processing Newsletter, Vol. IX, No. 7, 17 Aug. 1964. p. 3.

as in the effectiveness of computer software will gradually take over a good deal of the type of programming work that has been most common in the early years during which computers have been applied to business.

The answer, if the worker is willing, lies in training and retraining. In some instances labor and management have joined in research and training programs to assist the worker in transition from one job to another. However, there remains some fear among the labor unions that automation will not replace jobs as rapidly as they are eliminated. The view of labor concerning the entire area of automation can well be applied to the ADP area. Table I is a summary of those views with labor-proposed solutions.

The recent increase in appropriations by the Federal government for education, the willingness of labor unions to contribute to automation-displaced worker retraining, and the efforts on the part of Business Management to influence school curricula all indicate the problem, though large, is directed toward solution. However, the individual and the manger must assume responsibility for the transition.

The Managers Role

Management Levels -- The chief executive of a company, working with a board of directors, has the responsibility for the conduct of the business. This responsibility is usually shared with a deputy and the senior administrative officers who constitute top management. The senior officers are usually

TABLE I

AUTOMATION: How labor sees the issues and the action to be taken

Major Issues Industrial	Action To Be Taken By Industry
Decreasing job opportunity in manufacuring, mining, and transportation industry	Through collective bargaining establish provisions for:
Workers are being "dislocated;' they need more job security	Shorter work week
Change in wage structure and job evaluation systems	Stronger seniority rights
Labor not sharing in the gains of productivity from automation	Severance payments and other supplementary benefits
Industry's labor needs are changing fast; workers must be retrained	New systems of compensation, eliminating incentive-type wage payment plans
	Higher wages
	Earlier retirement
	Retraining programs
	Special funds to cope with automation problems

SOURCE: John Diebold, Beyond Automation, The McGraw-Hill Book Co., 1964.

the heads of the major company functions. By virtue of their positions, these men in top administrative posts have a chance to see the company's problems in the aggregate. The top group may constitute a kind of cabinet and can integrate their views into common policies and attitudes by exchanging information and thoroughly knowing one another.

> The term 'middle manager' or 'junior administrator' designates an officer of intermediate rank charged with responsibility for administering from one part to more than a dozen separate parts of the organization. Frequently he has charge of one or more ranks of supervisors.
>
> The top management of the future ordinarily will be drawn mainly from middle management, with some members from the staff of advisory officers and some from outside. Most of those in line for top positions will have to go through the discipline of middle management. They can develop satisfactorily only if they broaden their view as far as possible, looking at things from the point of view of the company rather than their individual departments. This overall view comes about best by successful efforts of coordination. The middle managers as a group need to pull together to keep the machine functioning smoothly and to build for their own as well as for the collective future.[16]

The impact of ADP on business has served to validate the premise that managers must be dynamic in their guidance of an organization. The ability to detect and apply useful new management tools and instill within employees the desire for improvement are more essential to good management than ever before.

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[16]Mary Cushing Niles, The Essence of Management, New York: Harper and Brothers Publishers, 1958, pp. 111-112.

"Most company managements are out-moded and no longer adequate to direct the complex structures of their companies", Dr. R. L. Martion, head of Olin Mathieson Chemical Corporation's Advanced Systems Department, told attendees at the Systems Engineering Exposition and Conference held in New York in 1964. "A new brand of managers is urgently needed," he said, pointing out that we are only at the beginning of harnessing modern computers and the systems engineering approach to control the business environment. "The corporation executive of the 1970's will be seated behind a computer, not a desk," according to Martion - and "the board room of the corporation of tomorrow will look like the war room of an army general with computers displaying all the pertinent information upon which the staff must make its decisions."[17] Business is a complex information system, but we have yet to organize an effective approach to handling the flow of information within the business.

The problem of building systems control requires the most thorough consideration and analysis by management. Yet management's very first rule, that authority must be commensurate with responsibility, is disregarded at almost every computer installation. The responsibility for incorporating technological advances, and putting them to work, is almost

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[17]The Diebold Group Inc., Automatic Data Processing Newsletter, Vol. IX, No. 2, 22 June 1964.

universally placed at too low a level, usually in a financial department, sometimes in the engineering department. Further, this responsibility tends to be associated with just one functional leg of the business and is not accepted as a company-wide service.

The role of middle management will change as the function of allocation of resources is performed by computers. Some predict the disappearance of middle management as a line function and the growth of a new staffing function - the analysis and continuing reappraisal of the computer models and of the assumptions on which they are based in order to keep the system sensitive and itself receptive to change.

> Rear-view management is no longer tolerable in a dynamic, fluid, competitive economy where profits are hairline margins and decisions can involve many millions of dollars. The computer then, is a time breakthrough. On the other hand, the computer's prime contribution to management will not lie in the area of supplying timely data. Rather, it will be in providing a framework for planning strategy. Computers allow management to do this through a technique known as simulation for modelmaking.[18]

Decision Making -- Some observers have predicted that computers will make some middle management skills, as well as many types of clerical skills, absolete. They visualize real time systems so total that all the information needed to run the business can be transmitted to and examined at the top, and all the decisions made there. Some have even

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[18]J. C. R. Licklider, "Man-Computer Partnership," International Science and Technology, May 1965.

predicted that top management decisions themselves will be made by computers.

Both possibilities seem unlikely for a long time to come. In 1964 Ernest Dale conducted a survey[19] of thirty-two representative companies that had been using computers for some time, including companies from many different fields ranging from aerospace to banking and retailing. In no case had the computers taken over top management decision making, and the middle management decisions that they were handling were mainly of a routine nature.

According to Dale and Michelon,

> There are other good reasons why 'all' decisions can't be made at the top. If one or a very few people are to make decisions on the data provided, data must of necessity be put in very succinct form because there's a limit to the amount of material a few people can read and consider. So there's a question whether a wise decision can be made on the basis of figures when many of them must necessarily be estimates, for there are always factors that cannot be quantified exactly.
>
> Moreover, at each point where data are fed into the system, someone must decide which data to use and how to evaluate the intangibles quantitatively, and no one can do this unless he has a knowledge of the business itself. Many companies, in fact, prefer training their operating people in computerization to training computer experts in the fine points of the business. It's easier, they say, for the man who knows the business to learn about computers than for the man who knows all about computers to learn about the business.

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[19]Ernest Dale, The Decision-Making Process in The Commercial Use High Speed Computers, Ithaca N.Y.: Graduate School of Business and Public Administration, Cornell University, 1964.

> Finally, since computers increase the number of alternatives that can be considered, they may increases the need for human decision making. For example, an engineer may investigate 100 different designs for 1 per cent of the cost of calculating a single one by hand. Since he's relieved of the routine calculations, he will be able to weigh many more alternatives than he could otherwise possibly consider.[20]

Bowman and Fillerup, however, offer heated argument to the above conclusions. They feel that,

> There is enough in the record and in the reports of serious researchers to support a general conclusion that over the next two decade - the technical capability of computers will advance to the point where they will be able to handle many - perhaps most - of the kinds of managerial decision-making tasks that are now handled by human managers, and to handle them at least as effectively as they are handled by human managers.
>
> What they also suggest is that while our experience tells us that managers at all levels, from corporation president to gang foreman, get involved to some extent with all kinds of decisions, it is generally true that top-level managers deal much more with unstructured decision situations, while lower-level managers deal much more with structured decision situations.
>
> This conolusion suggests, of course, that the future displacement of managers by machines will be more likely to occur in decision situations that require processing and analysis of information in either large volume or high complexity of simultaneously operative variables. The principal opportunities for computerization would lie in decision-making situations that not only have these characteristics, but in addition are well structured, with components predictable in advance and regularly recurring. In general, this would mean that computer applications are more likely to be found in some of the jobs now handled by middle and junior managers than in most of the

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[20] Ernest Dale and L. C. Michelon, Modern Management Methods, Cleveland: The World Publishing Co., 1966.

administrative assignments in the upper strata of organization structure.[21]

The Organizational Structure

Today's business organization structure is a legacy of the first industrial revolution in which specialization of labor was followed by mechanization around specialties. Industry is now in possession of technology which allows it to build information systems transcending the compartmentalized structure of business organization. Much of the difficulty that has been experienced in putting these new tools to work in recent years results from the fact that it clashes with the fundamental organization system. This is a problem that is not yet recognized by many of the organizations experiencing it.

It is suggested that much of the confusion is caused by violation of the basic organizational principles rather than by their becoming obsolete. Certainly the use of ADP with its operations cutting across organizational lines combined with the lack of managerial understanding on its full use, has contributed to the feeling that something is wrong. This is understandable since ADP permits the machine to accomplish internally many steps that were previously the estate of several organizational segments.

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[21] David M. Bowman and Francis M. Fillerup, Management: Organization and Planning, New York: McGraw-Hill Book Co., Inc., 1963, p. 25.

With its advantages of flexibility and coordination, the Line-Staff type organization seems best suited for adaptation into the company in which the merging of corporate functions is a necessity because of highly involved automation advances and computer processes.

However, according to F. C. Gosewisch,

> The 'line' man and the 'staff' man are disappearing from the management scene because of the concept of integrated data processing. As soon as the idea of integrating the information flow between two 'line' activities was accepted, the former line managers found themselves involved in staff work.
>
> There is a relationship between the declining interest in line and staff distinctions and the rise in management demand for men with 'line' talent who also possess some knowledge and skill in the area of information processing techniques.[22]

> The designation of some persons as 'management' carries the implication that some portion of those individual's time should be devoted to the management functions of planning, organization, coordination, direction, and control. One breakdown of this time distribution is shown in Figure 8.
>
> This chart is intended to show only that if a company accepts the concept of several members of the management 'team' then, according to the level of each individual's position, there is an expected time distribution between his management activities and the performance of his assigned 'line' function. It is not intended to establish the position of the dividing line, or to describe the characteristics of straightness. The line might be a curve or a 'staircase'. Also, the line need not terminate at the corners of the chart. However, it is generally accepted that such a line will slope downward and to the left.[23]

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[22] F. C. Gosewisch, "The Changing Organization Structure", Ideas for Management, Cleveland: Systems Procedures Association, 1964, p. 254.

[23] Ibid., pp. 253-254.

The opinion is that the line shown in Figure 8 is shifting to the right, and that line management people are spending more time on general management functions.

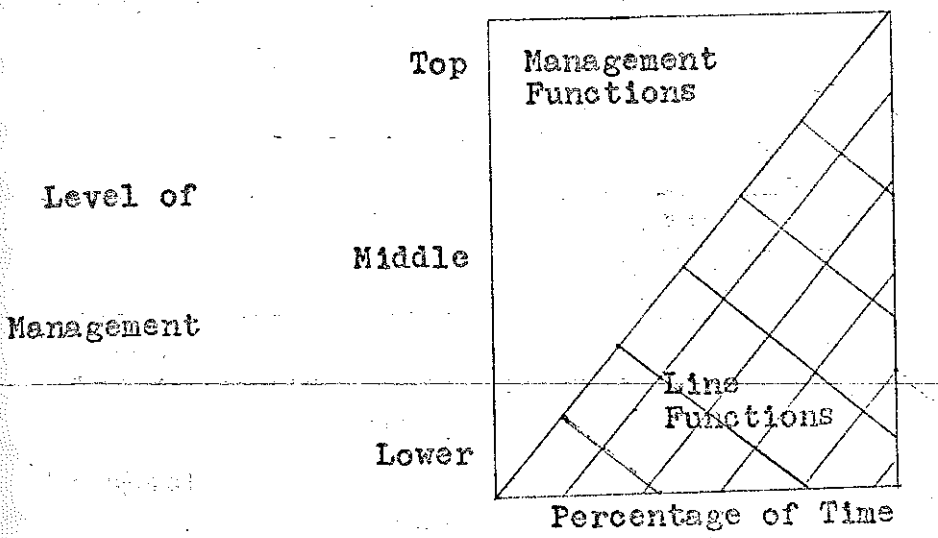

Figure 8.--Management Functions

SOURCE: F. C. Gosewisch, "The Changing Organization Structure", Ideas for Management, Cleveland: Systems Procedures Association, 1964, p. 254.

CHAPTER V

SUMMARY AND CONCLUSIONS

More and more it is apparent that change is becoming the norm. That change in itself is an asset. And that breaking away from tradition and old ties is the thing to do. True, change properly channeled, can be extremely beneficial in our modern day and age. But change for the sake of change, as a prestige factor or "to keep up with the 'industrial' Jones", is fallacy in the simplest form.

The changeover to the industrial computer first requires a basic need. Policy planning will have to be reevaluated. Managers and workers must be trained in the new applications and advancements of the computer. This new machine will have a profound affect on the decision-making capability of the manager and will eliminate entirely the jobs of some, normally, less skilled workers. And, of course, the organizational structure will be affected.

The fact that the line manager and the staff man are the backbone of the Line-Staff type organization further validates the conclusion that the Line-Staff type organization is best suited for adaptation to the world of the computer.

Due to its flexibility and adaptability to change, the Line-Staff type organizational structure is recommended for use in the age of automation. The durability and applicability of this recommendation is already being tested, as was discussed by Gosewisch, with the integration of data processing and the continuing development of the modern Managing Specialist.

These projected developments will affect the organization and operations of companies in all industries. For some, the effect will be relatively slight; for others it will be great. If handled properly, advances in ADP will provide great benefits.

Exactly how the automated organization structure will change is as yet relatively undetermined. However, the following schematic (Fig. 9) meets the basic requirements of an automated information system which can be further refined and expanded to cope with the future application of more sophisticated systems.

Management must understand that company organization may have to undergo changes before the computer system can reach its full potential. Often, previously independent corporate functions will be merged.

With the systems approach, the responsibilities and costs for the system may be concentrated at one organization point and in the hands of fewer people. The job content in different company areas will change as the

computer is used for calculating and determining actions for many operations. Individuals at all levels will face greater opportunities, challenges, and difficulties. In some instances, it seems likely that fewer people will be used for a given volume of work.

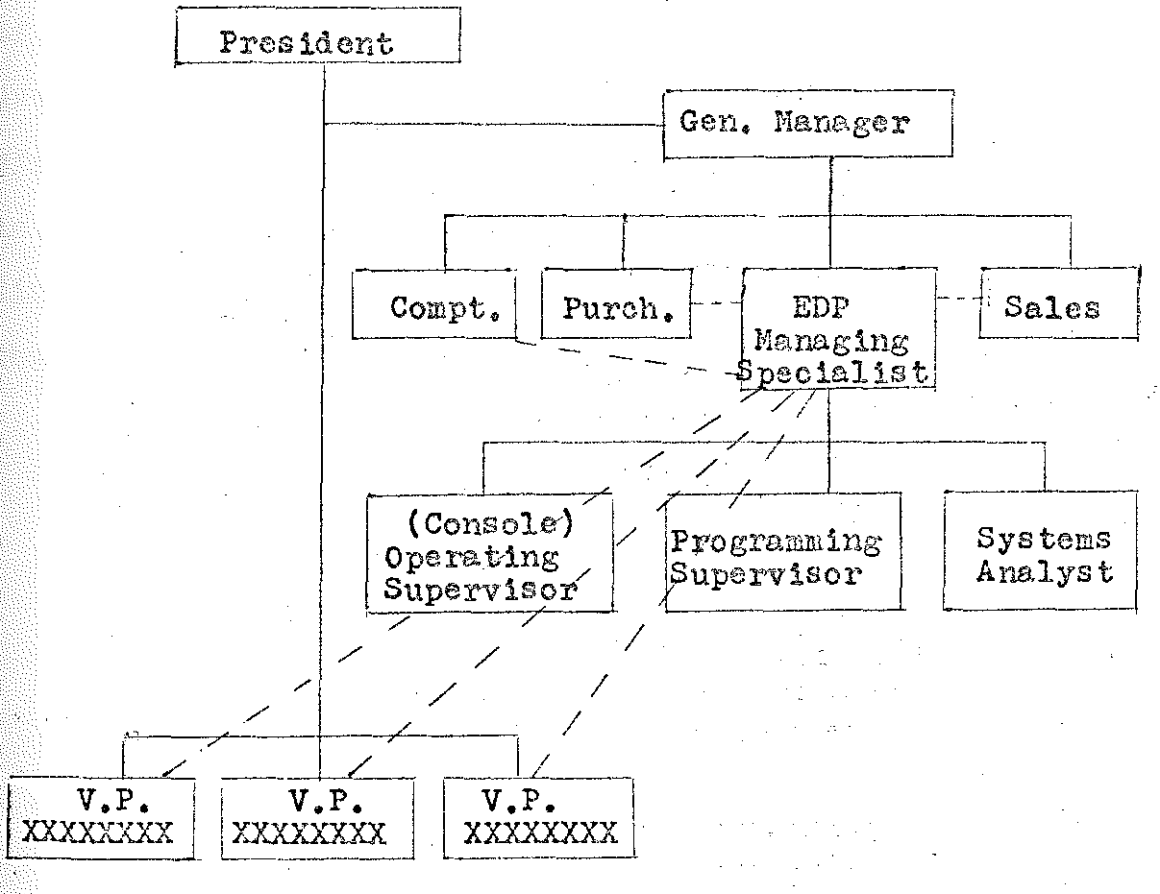

Figure 9.--The Automated Oranization

An attempt has been made to provide a review of ADP developments and changes concerning equipment, workers, managers, and organization. During the next decade, ADP will "grow up". The next 10 years will mark somewhat of a deemphasis on machine development and concentrate on the perfection of exotic applications. The social contribution of automatic data processing will be recognized as the masses learn to accept and use the technology. The impact of these computerized developments will be the control issue of the period and will effect the organizational structure of the entire business enterprise. Our success in handling this new power could lead us to an entirely different world wherein man would enjoy a greater leisure than ever before.

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