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The role of the chief information officer in the contemporary university

James Jon Scanlon

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THE ROLE OF THE CHIEF INFORMATION OFFICER
IN THE CONTEMPORARY UNIVERSITY

A Thesis
Presented to the Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Public Administration

by

James Jon Scanlon

June 1989
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Approved by:

Naomi Caiden
Department Chair

Guenther Kress

David Bellis

Date 6/2/89
ABSTRACT

Information technology, the use of machinery which stores, manipulates and retrieves information, is often a multi-million dollar investment within most organization both public and private. Until 1982, information technology was not managed in a comprehensive way. In that year, Synnott and Gruber posited the theory of Chief Information Officer (CIO). The CIO would be responsible for the planning and use of information technology within an organization.

Information transfer is at the very heart of higher education. Because of the organization-wide responsibility of the CIO, this model should prove very useful in higher education. But the transference of the CIO function from the private sector to the comprehensive university has not been systematically examined. To examine the possibility of transferring this function from the public sector to the comprehensive university, the suitability of the CIO model must be examined within various contexts. The concept of the CIO must first be examined in the private sector to insure that it is a valid model for the management of information technology within an organization. If the model proves to be applicable, then it must be examined within the context of the public sector, to insure that differences between private sector operations and public sector operations can be accommodated. Finally, the CIO concept must be examined within the context of higher education, in general, and the comprehensive university in particular.

Several areas of the CIO function will be examined. The first area is whether centralized information decision making is more effective than decentralized decision making. The second area which will be examined will
be the organizational structure of information management within the California State University. This will yield information which will be used to develop a service delivery model.

The CIO model will then be used to develop a service delivery model for a Comprehensive University.
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CHAPTER I

INTRODUCTION

The 1980's mark the beginning of the information age - an age when information and information management are vital components of most businesses and governmental agencies. The concept of the information age was popularized by Alvin Toffler in his seminal book, The Third Wave. Toffler characterizes the rise of civilization as a succession of three waves. The first wave was the transition from a hunter-gatherer society to an agricultural society, the agricultural revolution. The second wave was the transition from an agricultural society to an industrial society, the industrial revolution. The third wave, which brings us to the present, was the transition from an industrial society to a post-industrial information based society, the information revolution.¹

One of the main components of this revolution is information technology. Information technology is the mechanical means of storage, retrieval, and manipulation of information in an electromagnetic format. This technology would include computing, telephone, television, data communications, and telefacsimile. In some cases, the library is considered to be an instrument of information processing. Toffler, in The Third Wave, illustrates his view of the power of information technology when he describes the computer in this way:

Linked to banks, stores, government offices, to neighbor's homes and to the workplace, such computers are destined to reshape not only

business from production to retailing, but the very nature of work and, indeed, even the structure of the family.\textsuperscript{2}

Toffler's prediction is strong indeed, but his major premise that increased information management will change the nature of work has been incorporated into the philosophies of a growing number of managerial theorists. There is a growing body of literature by individuals like Tom Peters and Richard Waterman, John Diebold, and even the venerable Peter Drucker who have considered the impact of information technology on the modern organization. A major thesis of Peters and Waterman is that an increase in information is a major steppingstone for the enterprise to reach its full potential.

Information, in the information age, becomes a productive resource of an organization. The proper use of information by individual workers will increase their productivity. Increasing their productivity will lead to a net overall increase in productivity for the entire organization. For private sector organizations, this increased effectiveness results in greater profitability. In the public sector, increased productivity can be translated into rendering more effective and efficient service to the public.\textsuperscript{3}

Revolutions, even an information revolution, by definition are not tranquil events. A revolution implies dramatic and sudden change. This sudden change, or paradigm shift, when coupled with the complexity of information technology, has left managers in both the public and private sectors floundering in their attempt to cope with

\textsuperscript{2}Ibid., p. 143.

the new environment. A common sentiment is that information technology "...is so complex that controlling it, or even understanding it, is almost too difficult for words."⁴ This complexity of information technology led many organizations to explore various models for the management of information within their organization. For example, in 1983, William Synnott and William R. Grubers developed the Chief Information Manager (CIO) model. They defined the CIO as the: "Senior executive responsible for establishing corporate information policy, standards and management control over all corporate information resources."⁵

The concept of the CIO has since become one of the dominant theoretical organizational models of the information age. The main application of the model is in the private sector. Applications of the CIO concept have been attempted in the public sector, but in a much less systematized manner.

Therefore, this thesis will examine the concept of the CIO as it pertains to the public sector, in general; and to higher education, in particular. This examination will look at the applicability of the CIO as an organizational model in the above two arenas. The CIO model will then be further refined to be used in higher education. The CIO model


can be a powerful methodology for the management of information in higher education. This model will then be adapted to the needs of a contemporay public comprehensive university.

**Research Methods**

There were three methods of research used in this investigation. The first was a literature search of the relevant informaion about the CIO model. The body of scholarly material on the CIO is not large, but a rapidly growing body of "non-scholarly" materials is available. This "non-scholarly" material, which consists mainly of trade publications such as Datamation, ComputerDecisions, and InfoSystems, represents a rich body of material where new practical concepts are being constantly discussed as pragmatic experiences of the field.

Personal interviews of Chief Information Officers in higher education were also used to examine the applicability of the CIO model in higher education. These CIOs were primarily drawn from the ranks of the California State University, one of the few university systems in the United States with an Information Resource Management Policy (IRMD) in place. The IRMD model is similar to the CIO model where one individual is assigned to coordinate information policy on each campus. These individuals do not, however, have authority over all information management functions; nor do they all report to the Chief Executive Officer. This analysis was used to verify the effectiveness of the CIO in higher education.

Statistical analysis was used as a method of correlating the findings of the personal interviews. This methodology validated some
of the anecdotal information found in the course of interviewing the CIOs.

This paper will systematically look at the CIO by first examining the origin and history of information management from its inception to the model of the CIO. The theoretical role of the CIO will also be developed. This theoretical role will then be examined in relation to the function of CIO's in private industry. This CIO model, which was the first developed, has been moved to the public sector. To determine the effectiveness of the CIO for the public sector, an analysis of the similarities and differences between information management in the two sectors must be done.

Before moving on to look at the role of the CIO in the public sector and in higher education, an examination of the differences between information management in the public and private sectors is in order. The results of this investigation will have a crucial effect on the applicability of the CIO model for higher education. The CIO concept has organizational implications which are, or seem to be, at odds with the traditional Weberian concept of the public bureaucracy. This apparent conflict between the bureaucratic model and the CIO model will also be examined in some detail.

The final level of the examination will be the concept of the CIO in higher education. This level of examination begins with a section which places the major information processing entities in the higher educational context. This contextual setting examines the history and traditional organizational setting of the major information management organizations. A review of the current research on the
effectiveness is undertaken and an examination of the level of information management centralization on organizational effectiveness is also presented. The final section of this examination develops a model for the delivery of information resources for the contemporary comprehensive university.

Just as the body of management literature narrows when moving from the private sector to the public sector, the body of literature about information narrows when the same move is made. There is presently little information available about information management in the public sector. The literature that does exist deals only with the description of the CIO function, not with the effectiveness of the function. There is also no literature that does a systematic comparative study of the CIO function. This type of investigation would be extremely difficult because of the great number of variables involved in doing this type of study.

The field of information management in higher education is extremely limited. Most literature deals with an extraction of the concepts of the CIO from the private sector into higher education. Little systematic investigation of the effect of the external environment is done. The second type of CIO literature occurs in library journals. This type of literature investigates the relationship between the library and the computer center. As such, this library/computer center literature omits a major portion of the function of the CIO and tends to make gross generalizations of the information function.
CHAPTER II

THE CONCEPT OF THE CIO AS APPLIED IN THE PRIVATE SECTOR

Theories of Information Management

Information is formally defined in the American Heritage Dictionary as knowledge derived from study, experience or instruction. Information is non-material. Because information exists in the intellect, it has several distinct advantages over other types of resources. The first advantage is that information is intangible. Being intangible, it cannot be worn-out. Far from being worn-out, information, when properly used, can actually increase in value. Information can be used repeatedly by an individual or by several people simultaneously. Being intangible, information can easily be combined with other information to form new information. The combination of seemingly disparate pieces of information allows us to gain new perspectives on problems. Information can also be adapted to meet the needs of the users.

This adaptability of information lies at the very heart of contemporary society. The ways information can be manipulated and combined are almost limitless. These combining capabilities, which allow for new perspectives, allow the individual to greatly amplify his intellectual abilities.6 As an example, history and meteorology are both well established fields of study. One can combine the data derived from meteorological records with the historical record and determine a new set of information, for example, what effect weather had on historical events. Information is now considered to be

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a dominant resource in contemporary corporations much as other resources were considered in the past as being dominant factors of production. Forrest W. Horton Jr. has systematized the management of resources in corporations in the manner described in Table 2.1:

Table 2.1
Evolution of Resource Management

<table>
<thead>
<tr>
<th>Managed Resource</th>
<th>Type of Management</th>
<th>Decade</th>
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<tr>
<td>Money, Capital</td>
<td>Financial Management</td>
<td>1920's</td>
</tr>
<tr>
<td>People</td>
<td>Personnel Management</td>
<td>1930's</td>
</tr>
<tr>
<td>Equipment, Supplies</td>
<td>Materials Management</td>
<td>1940's</td>
</tr>
<tr>
<td>Materials</td>
<td>Property Management</td>
<td>1940's</td>
</tr>
<tr>
<td>Land and Property</td>
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</tr>
<tr>
<td>Information</td>
<td>Information Management</td>
<td>1970's</td>
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Over a period of 70 years, the function of business has changed. As businesses have changed, the most important or dominant resource has also changed. Throughout the early portion of this century the dominant resources were tangible, quantifiable entities. In the nineteen-seventies, the critical resources became intangible energy. The next dominant factor, information, is even more abstract than is energy. The management of this
dominant resource, information, was predicated in Toffler's Third Wave.

The evolution of information into a dominant resource did not occur in an orderly fashion. In a parallel fashion to the rise of information resources, little systematic analysis has been done to chronicle the rise of the information resource. The great majority of the discussions about information have centered on the importance of information to organizational function, rather than on the history of information management itself.

It can be stated that the information revolution started with a whimper rather than a bang. In 1952, John W. Mauchly, one of the developers of the first commercial computer, estimated the total demand for computing machines, worldwide, would be approximately 12 systems. This prediction was made a full year before the first delivery of computing equipment was made to private industry in 1954.7 The only possible users, at that time, were considered to be the federal government, particularly the Department of Defense and possibly the larger insurance companies.

The inaccuracy of this estimate is illustrated by the "1969 Moody Consumer Industry Survey." Fifteen years after Mauchley's prediction, there were 68,827 computers installed with another 13,643 computers on order.8


The growth curve of computing has continued upward to today's production levels where the total production worldwide is greater than this 1968 worldwide installation base.

In 1962, Fritz Machlup began the first systematic study of the following knowledge industries: education, research and development, communications media, information machinery, and information activities. Machlup's early studies indicated that in 1958 these information or knowledge industries made up approximately 29% of the United States Gross National Product. This figure had risen to 67% in 1984.9

In 1973, Daniel Bell wrote The Coming Post-Industrial Society.10 This book, which is an intellectual precursor to the Third Wave, helped to sensitize society to the need for the management of information. Although the societal value of information was well established by the middle of the 1973, there was little thought or effort given to the theory of computing or the growth of communications within an organization.

Computing was the first information technology to make it into the business world. The first computer sold to private industry was to the General Electric Company for use in its appliance park facility in 1954.11 For reasons which will be examined in detail below, other means of information technology were not yet generally available. Theories of information


11Fischer, IBM and the U.S. Data Processing Industry, 8.
resources management in the 1960's and 1970's were, therefore, confined to
the location of the data processing function within the larger framework of
the organization. Data processing generally came into corporations through
either their engineering departments, as a replacement for calculators, or
through their accounting departments, as a device to speed up the processing
of company books. Discussion revolved around where within the
organizational structure should the data processing function be housed.
Should it be a staff or a line organization? Should data processing report to
the financial officer, should it report to the engineering officer, or should it
report to the chief executive officer?\textsuperscript{12} In this case, theory was driven by
practical necessity.

The first comprehensive model of growth of data processing systems in
organizations was done by Richard L. Nolan in 1973. Nolan postulated a four
stage growth path for computing within an organization. This staged
approach to growth was later generalized into a model for the growth of
information management, in general, within an organization. These four
stages are initiation, expansion, formalization, and maturity. The main
indicator of growth through the stages was budget allocation which roughly
correlated with an "S" shaped curve. Nolan formalized this rough curve into
the smooth theoretical "S" curve. Predictable major points of inflection along
the curve marked the transition points between one phase and the next. This
curve is presented in Figure 2-1 below

\textsuperscript{12}Dick Brandon, Management Planning for Data Processing (Princeton,
Figure 2.1
Nolan's Four Stages of Data Processing Growth


Each of these stages of development had its own set of unique characteristics. One of the key characteristics of this model was an explanation of management techniques used for the operation of the data processing function during the various stages of growth. These areas during the stages are the following: type of management style, organization, control, and planning.

Stage 1: Initiation. As mentioned above, data processing usually enters into organizations through a line organization as a time-saving measure. The management style is lax with few or no controls governing the computing function befitting the localized nature of that function. The budget is also quite loose with very few controls. Because introduction is generally justified in terms of local or departmental cost savings, little consideration is given to the long-term impact of the function on the overall organization.
Stage 2: Expansion. In most organizations, Stage 1 is generally a success. Because of this departmental success, the function is generalized to the whole of the organization. With the organization wide functional scope, the manager of the data processing is raised to a higher position within the overall organizational hierarchy. The management of the organization is concerned with sales of the computing function to the rest of the organization. Control and planning are done in a sporadic manner that befits the rapid expansion of the organization. The budget, at this point, is also growing rapidly. The overall emphasis of the organization is on total growth of the data processing organization within the context of the larger organization.

Stage 3: Formalization. After two stages of increasing growth, the upper management of an organization generally fears that the computing function is growing out of control. As a reaction to this fear, new controls and constraints are placed upon the data processing organization. These controls are the hallmark of the third, or formalization, stage of development. Management style is based upon gaining control of the data processing organization. The number and rigidity of the controls applied to the data processing organization increases. The budget, while still increasing, comes under increasing levels of control, with emphasis on strong levels of control placed upon the budgetary justification of both hardware and new software applications. Control is achieved by the centralization of the function and the policy making authority is given to an oversight committee.

Stage 4: Maturity. The computing function finally became fully assimilated into the organization. The manager of the computing function,
reflecting this assimilation, was elevated to a senior-level status within the organization. Inefficient controls were eliminated; and the management control system was, in general, refined and brought into closer alignment with the management control system of the rest of the organization. The budgetary process became more long range, using 3-to-5 year time horizons. The overall management style of the data processing organization is one of resource control management.\textsuperscript{13}

While the basic Nolan stage model has proven a valuable tool in understanding the management and growth of the data processing and later the information function within the larger organization, it has undergone significant modification which has made it a more powerful tool for study. The first modification was made by Nolan himself. Between the third and fourth stages, Control and Maturity, Nolan added the stages of Integration and Data Administration. The Integration stage is the stage in which new technology is systematically integrated into the fabric of an organization. The application's development function was moved out to the departments, and the central data processing function became merely the custodian of the data. The fifth stage, Data Administration, calls for the sharing of data between departments of the organization. The final stage, maturity, is redefined as the stage when data, or the information, is treated as a strategic entity.\textsuperscript{14}


It should be noted that in this model the shape of the budgetary curve remains the same as that of the original Nolan formulation. Only the area of the proportions under the curve change in size; the curve itself does not change. This modification mirrors both existing practice in the integration of technology and innovations in the field of database management systems. Data management is directly related to the invention of database management systems, which is a methodology of dealing with large aggregates of data. This data is used for more than one computing application.

The IBM Corporation has modified the Nolan six stage formulation and reduced the number of stages in the model to five. Of Nolan's six step approach, the final three stages - Integration, Data Administration and Maturity - have been condensed into two stages. These two stages are planning and strategic information. In the planning stage, data, or information, becomes a resource to the organization as a whole and is involved in the planning function of the organization. This is similar to the integration phase of the Nolan typology. At the end of the fourth phase, the movement of information goes into a function of strategic information.15

The strategic information becomes a part of the strategic mission of the organization. During this strategic stage, the budgetary curve (as seen in the vertical axis of Figures 2.1 and 2.2) of the information management organization changes and the amount of resources given to the information

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function increases markedly. An example of an organization which has taken information and made it a strategic resource is American Airlines, whose reservation system was originally started as a resource to assist in the marketing of air travel tickets. The reservation system has become a profit center which earns a greater rate of return than does the basic air travel portion of the enterprise.\footnote{Ibid.}

The IBM five-stage growth model was again generalized by Philip Marchand into a model for the growth of information management within the organization. Although the Marchand model is a considerably more generalized model, the influence of Nolan is readily apparent. The five stages
of the model are the following: Stage 1: Paperwork Management; Stage 2: Management of Corporate Automated Technology; Stage 3: Management of Information Resources; Stage 4: Business-Competitor Analysis and Intelligence; and Stage 5: Strategic Information Management.

Beginning in the late 19th century, businesses increased both in complexity and geographic dispersion. This increase in size and complexity naturally led to a need for increased and more efficient record keeping. The growth trend, when coupled with the increase in the governmental regulatory activity due to the then popular Progressive Movement, substantially increased the amount of paperwork required to run an organization. The Progressive Movement, as typified by the efforts of Theodore Roosevelt, attempted to protect the citizenry from the effects of unrestrained Capitalism. To insure that Capitalists or private sector businesses were behaving properly, the government required reporting of what it considered vital information. This information was passed on to the government in the form of paper. Increases in the amount of paperwork were also accompanied by increased costs for space, supplies, equipment, and personnel. This combination of factors made it imperative for businesses to reduce the costs of processing paperwork. Like their manufacturing counterparts, paperwork managers turned to the techniques of Taylorism, or Scientific Management. Emphasis was placed on the routinizing and standardizing the paperwork units. Supervision of this paper-handling function was placed in the hands of first-line managers with titles like mail-room supervisors, records managers, etc. This movement to Taylorism led to increased levels of procedural efficiency and reduced costs.
The incorporation of electronic data processing and of data communications moved businesses into the second phase of information management: the Management of Corporate Automated Technology. Stage Two was marked by the movement of certain very repetitive functions from paper media to electronic media. This movement took place for three reasons: 1) to replace relatively expensive labor processes with mechanized processes; 2) to streamline cumbersome processes; and 3) to simplify processes to allow for greater worker flexibility. Information technologies were incorporated because they were cheaper and faster than traditional manual methods. These functions were generally overseen by technical personnel whose management authority was based on their technical expertise rather than on any managerial ability.

The third stage which started in the early 1980's was Information Resource Management. This stage was brought about because of the convergence of electronic data processing, office automation, and telecommunications. These three areas of information management have become quite technically similar. During this stage of development, management has come to rely on the use of information technology for the efficient management of the organization. Information then became the resource of the organization. The information managers were moved up in the organization to the point of parity in reporting levels with other major operational entities because of the universal application of information technologies. Because of the organizational importance of information, the management philosophy became, as in the Nolan model, one of resource control. Therefore, the informational needs of the organization were viewed
from a holistic perspective.

When a corporation has a high degree of control over the information resource of the company, external information requirements become much more important to the company. The fourth stage of the model, Business-Competitor Analysis, focuses on integrating information about the external environment into business planning. This external information is combined with current operating information to be used as the basis for the forecasting of all future developments, issues, and trends. The information management techniques of the organization do not change; only the focus changes.

The final stage of the model is the use of information as a strategic function. Knowledge gained from the internal and external environments of the organization is known throughout the organization. Information becomes vital to the management of the organization and is integrated into the business plan of the organization. Just as sited above in the American Airlines example, information management becomes the basis of operating the organization. At this point, the information manager is a senior manager within the organization. Information has become a perceived force in the organization.17

When one places the strategic information management development model and the IBM-modified Nolan Stages of Growth model side by side, the parallels are striking. Although the beginning stages and the modus operandi used within the two models are different, the latter stages of both models

mirror each other focusing on the use of information as a strategic quantity within an organization. Even more striking is the parallel which runs between the two models when one examines the business functions which are achieved.

In Stage One of the both models, the purpose of this action is to cut costs. The main technique is to take advantage of commonalities or work characteristics needed to accomplish a certain function. In Stage Two of both models information technology is applied to problems because it is more efficient than the current manual techniques. Stage Three is one of consolidation and resource management, a time when greater management constraints are imposed. Stage Four has a focus external to the organization. The reconciliation and integration of the internal and external environments into the operation of the organization are of primary importance. In the final stage both models, as stated above, include information management, or data processing, in a strategic management context within the organization.

Adherents to both the Nolan and the Marchand model feel that the majority of organizations are currently in the third stage of development, the consolidation of the information function. It is within this context, the consolidation of the organizational information resource, that the concept of the Chief Information Officer was developed. Although today's job of the CIO is the consolidation of information, the future role will be to guide his organization out of the third stage, through the fourth stage, and into the fifth stage.
The CIO in Industry

Not all organizations are uniform in their uses of information technology. Some organizations are at the very beginnings of Stage Three, and some organizations are moving into Stage Four, while a few organizations have functions which can be considered to be in Stage Five. Each of these stages is without temporal constraint, having no particular time limitations. Some organizations spend very little time moving through the first two stages and have spent a very long time in Stage Three. To move organizations from their current state of information integration to the strategic use of information, the CIO has to perform a new set of functions. There are three primary functions for the CIO in the contemporary organization: 1) pro-active change agent; 2) coalescence planner; and 3) integrator. Each of these roles is important to the proper use of information in the future.

The pro-active change agent is what one analyst, Andrew Grinday, calls an interpreter of technology. The CIO must continually scan the literature, both technical and non-technical, for new innovations in technology. When appropriate technology is found, the CIO must find appropriate places within the organization to sell the benefits of the newly-discovered technology. One of the main sub-functions of the CIO, as a pro-active change agent, is to be a salesman for technological innovation and the wise application of this technology.

18 Synott and Gruber, Information Resource Management, 52-64.

The second function of the CIO as a coalescence planner is to identify and manage the information resources of the organization as a whole, while coalescing the various technologies into an integrated system which will serve the organization well. This requires that the CIO have both a corporate scope of vision and great technical expertise. The CIO must also have the mandate to examine the resources of the entire organization. At the same time, the CIO must have the authority to make and apply decisions which affect the entire organization. Without these two abilities, the CIO will be little more than a technology scanner.  

The CIO, as an integrator, must have the vision to see the corporate mission of the organization and integrate the new information technologies into that mission. This integrator function requires that the CIO be more than just a technician -- he must be a businessman with a sense of vision for the purpose of the organization. This integrative function would indicate that the CIO is a member of the management team.

To be able to carry out the three functions, the CIO must be placed high in the organization. In theory, the CIO should report to the Chief Executive Officer. This reporting requirement would imply that the CIO should be a Corporate Vice President or Vice President. Eugenia Brum conducted a study of the CIO's of the Fortune 100 service companies and the Fortune 100 industrial companies. Of the 111 respondents, 30.6% reported to the Chief Executive or operating officer; 57.7% of the respondents reported to an officer


* Although the Chief Information Officer may be either male or female, the author, for the sake of convenience, has chosen to use the masculine gender throughout the body of the text.
at the Vice Presidential level; and 11.7% reported to someone other than a
president or vice president. Of the respondents, 73% held the title of Vice
President or above.21

Of interest in this survey is the functional areas of responsibility
reporting to the CIO. The most common area reporting to the CIO was
telecommunications (82.8%). This was followed by mainframe computing
(73.6%). Office automation and systems reported 72.4% of the time to the
CIO's. The next closest function reporting to the CIO was Information
Centers or End-User Computing which reported 27.6% of the time to CIO's.22
From these findings, it is readily apparent that there is a clear consensus in
private industry as to the CIO's areas of functional responsibility. The CIO is
responsible for telecommunications, computing, and office automation. The
thread which holds these three areas together is telecommunications. Both
mainframe computing and office automation are heavily dependent on
telecommunications to function properly.

A total of 42.3% of the respondents stated that they were a member of
the management team; 36.9% indicated that they were sometimes part of the
management team; and the remainder, 20.8%, indicated that they were never
members of the management team.23 Only 4 of the 111 were female.

In 1983 the Conference Board of New York conducted a survey of the
senior data processing executives within the Fortune 300 largest service

21Richard Layne, "The Truth About CIOs" InformationWeek190 (10

22Layne, "The Truth About CIOs" 52.

23Layne, "The Truth About CIOs" 54.

23
organizations. Senior data processing executives are the precursor of the contemporary CIO, as 67% of Brumm's sample came from the data processing environment. A total of 40% of the respondents to that survey indicated that they were vice presidents; this compared to more recent figure 36% stated above in the Brumm survey. Additionally, 10% indicated they were Senior Vice Presidents. For reporting purposes, 25% of the respondents reported to the Chief Executive Officer.24

When one compares the outcome of the Conference Board Study with the Brumm study, the results are not particularly encouraging for the CIO function. In the five years between the two studies there was only a 4% increase in CIO's reporting to the Chief Executive Officer. The number of CIO's who hold the title of Vice President or above has increased about 23%. The above two changes between the surveys would indicate that although CIOs have gained greater prestige within organizations, they have not gained significantly greater access to organizational power. When this finding is compared with the respondents' request to rate themselves as members of the management team, 57.7% indicated that they were either not members of the team or were members of the team on a part-time basis. The role of the CIO has not increased the functional responsibility within organization as much as theorists might have wished.

According to the survey results, the CIO's major responsibility is to be a pro-active change agent, bringing the fruits of technology to bear on the function of modern organizations. However, when technology is brought to

bear on an organization, is there a fundamental change in that organization? Does increased functionality require a different form of structure and governance than does the pre-information organization?

The Effect of Information Management on Organizational Structure

Initially, organizational change brought on by information technologies was thought to have two effects on the organization. First, the role of middle management would increase. There would need to be more middle managers because of the time required to develop, install, and administer these new computing systems. Essentially, there would be the need for a whole new set of middle managers who were responsible for the management of information within the organization. This increase in the number of managers would be overlaid onto the existing organizational structure. Second, the individual middle manager would maintain a higher degree of control over subordinated because of the increased amount of information that would be available to the manager. This increased control would be accomplished because of sophisticated techniques which would result in more regularized decision that is, rules which, in turn, would lead to fewer decisions which needed to be made by the subordinate managers. In general, all middle managers would be free to manage.


In actuality, the opposite effects have been noted. Organization structures have tended to become flatter; spans of control have increased; and there is less formalization of the organizational structure, while the imminent demise of the middle manager has been predicted. It is important to understand the structure of the information-rich organization, if only for comparative purposes between the private and public sectors. Certain changes that are a part of the information-rich organization may not be applicable to the public sector for a variety of reasons. Later in this paper, an examination of the similarities and differences of information management in the public and private sectors will be presented. Included in this discussion will be an examination of organizational changes due to information technology. One must understand the information-rich environment to establish its validity in the public sector.

In their survey of successful or excellent organizations in *In Search of Excellence*, Peters and Waterman postulate the proper structure for information-rich organizations will be the matrix form. This matrix form can exist even within the largest of organizations. Members of the organization are either a part of a project on which they are working or they are a part of a technical organization. The employee is always, for reporting and administrative purposes, part of a technical organization. As part of the technical organization, the employee is responsible for keeping a high-skill level and performing the work of the technical organization. When the employee is part of a project team, the employee gives his full loyalty to the project. The matrix is then defined as the ability to move quickly from the
normal technical function to the project.  

Peter Drucker goes even further by describing the information-rich organization as one which resembles a hospital in function. Individual departments still exist within the overall structure of the larger organization. As new problems arise and needs become known, individuals are called upon to contribute their expertise to solving problems in much the same way a physician uses the laboratory or the X-ray departments in a hospital. This model is extremely decentralized in its function, although not necessarily in structure. 

This matrix organization has both the features of a less formal organizational structure and a flatter span of control. Employees moving from the traditional line or staff functions to task force require a very high degree of informality. Formal organizations with standardized organization tables would not be easily adaptable to the matrix type of management style.

In the matrix organization, the project manager becomes the dominant manager within the the information-rich organization. The role of the middle manager changes from being a department manager with no staff function to a staff officer. The middle manager becomes a personnel officer who insures that the employees' security needs, payroll, and benefits are met and has no line function. Because there are fewer and fewer functions for the middle manager, there is less and less need for the middle manager; and

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there is actually more need for the project manager who becomes a combination of line supervisor, who is responsible for getting the job done, and a senior manager, who makes policy decisions for the task force. Employees have less time to develop allegiance to their organizations, but they increase their alliance to their professional function.

In the information-rich company, information generally becomes decentralized to all levels of the organization. Because all members of the organization know more about what the organization is doing, more members of the organization are in a position to make rational decisions about the organization. 29 The increase in the number of decisions which are pushed lower into the organizational structure is matched by a corresponding decrease in the decisions that must be made by the middle manager, creating a further erosion of the function of the middle manager.

As there are fewer middle managers, there is a need for fewer supervisors for middle managers or lower senior managers. Because of the decrease in both the number and levels of managers, the organizational structure becomes flatter. Drucker uses the analogy of the orchestra to illustrate the flattened structure of information-rich companies. Each employee is a specialist who performs a prescribed function within the organization as a whole. Each employee is supervised rather loosely by a section leader. But the musician/employee is under the rather tight supervision of the conductor. There are no vice conductors or regional vice conductors; the entire organizational structure is essentially two layers

29 H. Alan Raymond, Management in the Third Wave (Glenview, IL: Scott, Foresman and Complan, 1988), 146.
This lowered level of organizational depth demands a wider span of control.

The type of decision-making processes has an effect on the organization of any organizational structure. Perrow uses what he refers to as technology, the way organizations transform inputs into outputs; for the purposes of this illustration, these technologies will be called knowledge technologies. Perrow defines four knowledge technologies based upon two dimensions. The first dimension depends on whether the inputs to the organization are highly diverse or highly uniform. The second dimension upon which the scheme is found are solutions to variable or exceptional cases. The exceptions depend on whether the solutions are codified or non-codified. When these two dimensions are combined, a yielding the decision table as illustrated in Figure 2.3.

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30Drucker, "The Emerging Organization" 52.
Figure 2.3
Perrow's Model for Decision Technology

<table>
<thead>
<tr>
<th>Uniformity of Cases and Situations</th>
<th>Uniform</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment based upon Professional Judgement</td>
<td>Craft</td>
<td>Nonroutine Work</td>
</tr>
<tr>
<td>Decentralized Structure</td>
<td>Knowledge Worker</td>
<td>Polycentric Flexible Structure</td>
</tr>
<tr>
<td>Routine Work</td>
<td>Combine Programs to fit cases</td>
<td></td>
</tr>
<tr>
<td>Manufacture</td>
<td>Engineering</td>
<td></td>
</tr>
<tr>
<td>Centralized Structure</td>
<td>Flexible Centralized Structure</td>
<td></td>
</tr>
</tbody>
</table>

Must Search For New Procedures: Processes not codified

Standard Procedures Exist: Technology Codified


Organizations which have standardized inputs with very fixed rules for determining the outputs represent one end of the Perrow spectrum. At the other end of the spectrum are those organizations which have very non-routine workloads and have no codified rules to transform these inputs to outputs. Lying in-between these two types of organizations is an entire range of organizational typologies. Organizations with structured inputs and codified transformation processes are bureaucracies and are called mechanistic. Mechanistic organizations are those organizations in which decision making takes on a machine like pattern in which certain similar inputs always yield the same outputs. Organizations which are at the other
end of the spectrum are organic and take in the area of knowledge workers, those individuals who work with information. An organic organization makes its decisions in a manner which allows for variable outputs when faced with similar input sets. An increase in the amount of information coming into an organization can have a profound effect on the structure of the organization. Because the information management organization deals with many highly variable inputs and has few decision rules, the CIO's organization is an organic organization.

The CIO has the management control over all information resources within an organization. This statement posits a dual line of authority for the management of an organization. The line manager is also responsible for the overall day-to-day and strategic operation of an organization including information management. If the CIO is responsible for the management control of information resources, there is an apparent and, in most cases, an obvious conflict between the line manager and the CIO. Synott deals with this dilemma by stating that the CIO is in tune with the goals of the organization. Being in tune with the goals of the organization, the CIO will naturally make decisions which are in the best interests of the organization with whom he shares the information management responsibility.31

The concept of the Chief Information Officer is firmly grounded in the private sector. Although the concept is not as pervasive as management theorists might wish, the model is quite common. The universal applicability of this model is to a large degree dependent upon the applicability of the CIO model to the public sector. Its applicability in the

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31 Synnott and Gruber, Information Resource Management, 68.
public sector depends upon the differences in information management between the private and the public sectors.

Returning to the Brumm study cited above, the role of the CIO is well established in private industry. This is indicated by the fact that out of the 200 industry executives polled over half (55.5%) responded. Large industry, as represented by the largest industrial and service companies in the Fortune 100, has a large enough infrastructure to support a CIO. There has been little systematic study done on the effect of the CIO on medium to smaller businesses. This lack of research of the CIO's role in smaller private sector organizations is also noted in the public sector. The first step in determining the applicability of the CIO model to the public sector is to examine differences in information management in the public sector which are dictated by differences in requirements between the public and private sectors.

32. Layne, "The Truth About CIOs" 54.
CHAPTER III

THE USE OF THE CHIEF INFORMATION OFFICER IN THE PUBLIC SECTOR

Since its inception, the Chief Information Officer model has proved to be a powerful model for the management of information in the private sector. This model is used by at least 55% of the Fortune Magazine's 100 largest service and industrial corporations in the United States. To determine the applicability of the CIO model to the contemporary university, two questions must first be answered. The first question is, "Can the CIO model be transferred from the private to the public sector?" If the differences between information management in the public and private sectors are not overwhelming, then the transference can be made. To make an acceptable transition, neither the function of CIO nor the organization can change. An interesting sub-problem in the making of this transference of the CIO from the private and public sector is to consider what are the effects, if any, of the CIO model on the structure of public organizations. If the differences between information management in the public and private sectors are not that great, then the question must become, "Is the CIO model applicable to the university environment?" The second question concerns the acceptability of the CIO concept applied in the context of a comprehensive university environment.

Although the following is an examination of the differences in information management requirements between the public and private sectors, the number of commonalities of information management in both arenas are very great. Information is still information, regardless of the location of the organization that is using it. The media of storage,
manipulation, and retrieval of information remain the same. The location of the technology does not change the fundamental physical properties of the electron which still remains at the heart of the technological revolution. The basics of sound information management principles are universally uniform.

If the casual observer were to look at a modern office without knowing the mission of the organization(s), he would have a great deal of difficulty determining whether the office was part of the private or public sector. The equipment used in both offices would be very similar. The management of a voice/data communications network requires the same set of technical skills and tools in the public sector as in the private sector. Also, the insurance of data integrity in a computer system is identical in the public sector and the private sector. Good technical management skills are required in both the public and private sectors. Attention paid to the delivery of information in the public and private sectors must, at least, be equal. It could even be argued that the requirements for service in the public sector may, at times, be even greater than those seen in the private sector. For example, the level of service required by the Computer Aided Emergency Dispatch Center which handles 911 emergency calls is certainly higher than that required by the typical taxicab company which performs what is, essentially, the same basic dispatch function.

The areas of commonality between information management requirements in the public sector and the private sector are very great, perhaps even greater than the differences between the two areas.

Because of the high level of commonality between physical representation of information and the equipment which handles information in the two sectors, the differences in the information
management requirements must be due, to a high degree, to the differences in public and private organizations. These differences must be systematically examined to determine the validity of the CIO model in the public sector.

A Model for the Analysis of the Differences Between the Public and Private Sectors

To understand the differences of information management in the public and the private sector, we must begin with a study of the differences of function between the public and private sectors. To provide a framework for examining information management in the two sectors, a model of the level of publicness of an organization developed by Bozeman and Bretschneider will be used. This model is, in turn, based upon four sub-models: (1) The Economic Authority Model, (2) the Political Authority Model, (3) the Work Context Model, and (4) the Personnel and Personnel Systems Model. The interaction of these four sub-model defines the level of publicness of an organization. In this model, there is no clear cut dividing line between where a private organization ends and a public organization begins. Rather, there is a continuum of organizational functions which range from the completely private organization to the completely public organization, so that the possibility of a quasi-public organization exits. While defining "publicness", this model provides the essence of differences between the public and the private sectors.

The Economic Authority Model best describes the private sector organization. The function of the organization is to grow and increase profits. The method of growth and increase in profits is an internally-directed function of the organization. There is no attempt to maximize the public
good for the private sector organization. The thrust of the private organization is to maximize the financial return to a limited number of individuals, either the owners or stockholders, not the public as a whole.

By contrast, public organizations are driven by the Political Authority Model. In democracies, all public organizations' authority comes from the elected representatives of the populace. This grant of legal authority makes all public organizations political organizations. The goals of the public organizations are externally derived and transcend the self-interest of the single organization or individual. The legal and constitutional authority of public organizations separate them from private organizations. The final political difference between public and private organizations is the area of individual rights. All public organizations in democratic political systems must emphasize civil rights and due process with the organization and to the client. This emphasis on due process is not inherent in the activities of private organizations.

The Work Context Model focuses upon differences in the working environments of public and private managers. Private sector managers generally work at a higher energy level than their public counterparts; but public administrators have the two main work accelerators: public scrutiny and the pressure from elected officials to constantly get something done so that the official can show results. Public management is more crisis-driven than is the private sector as a result of these two accelerators. Because of this crisis-driven nature, public policy is often more disjointed than is private policy. The final difference is that public officials generally have greater levels of public scrutiny and accountability mechanisms than do private officials.
The final sub-model difference is the Personnel and Personnel-Systems model. Public managers have a lower expectation of reward for a job well done, both financial reward and promotional opportunity. Because of these diminished reward structures, there is a lower worker satisfaction and less of an identification with the organization. The public sector is more formalized, more rule bound, and doctrinaire. Studies of graduate students who enter the public sector show that they score higher on dominance, status-seeking, and flexibility attributes which are not characteristic of private sector-bound graduate students. Also, public-sector bound graduate students tend to be less interested in wealth or personal financial gain than do students entering the private sector.33

These four sub-models can be interrelated in a hierarchical manner as shown in Figure 3.1. The Political Authority and Economic Authority Models make up the distal environment, or the external environment, of the organization which provides broad and sweeping inputs into the organization. These distal environments also influence the proximal environment or internal (the work context) personnel behavior. The proximal environment, in turn, influences the attitudes and behaviors of the individuals within the organization which determined the personnel and organizational behavior.34 It is within the context of this model that an examination of the external or distal environmental effects of the public


34Ibid., 482.
organization will be examined further as it relates to the management of information within that organization. Some of the internal or proximal environment effect will also be examined.

Figure 3.1
An Integrated Model of Publicness

(Distal Environment)
Economic Authority Political Authority

(Proximal Environment)

(Work Context)
Personnel and Organization Behavior

<table>
<thead>
<tr>
<th>Privateness</th>
<th>Publicness</th>
</tr>
</thead>
</table>


In their explication of the Integrated Model of Publicness, Bozeman and Bretschneider make the assertion that externally based MIS evaluation is rare in the private sector35, and often it is very damaging in the public sector. By this they mean that most evaluations of information management are done based on factors which are internal to the organization rather than external to the organization. In their model, an external evaluation would

35Ibid.
indicate a political evaluation. To politically evaluate, an operational function could be potentially damaging to the entire organization.

**Differences in Information Management**  
**Between the Two Sectors**

There is a narrowing of the range of research available when moving from private-sector management to public-sector management. This narrowing focus is also true in the field of information management, and the analysis of information for management, because of environmental reasons. The majority of this analysis will examine the external effects on information systems from a largely theoretical view, because little systematic research exists on the effects of public-sector management of information systems. Looking at external environmental effects on information management in the public sector is, therefore, entering into terra incognito.

To keep this examination of "the external effects of the environment on information systems" from being an academic exercise, some effort must be made to identify those modifications in the CIO's responsibility that are substantially changed by being in the public sector. Constraints on the CIO are of two types. The first of the constraints, or reactions of the CIO, are philosophical reactions which change the basic function of the CIO. The second constraints are operational. Operational changes affect the day-to-day operations of the CIO's function, but do not change the basic function of the job. Starting with the distal environment and moving to the proximal environment, one finds that there are differences between the public and private sectors.
Because public organizations are political in nature, several requirements are placed upon the organization. Ultimately, the consumers of the information managed by the public sector manager are all of the people within the public sector. The concept of the consumer being all of the people implies that there is a great diversity among the customer base. This diversity of influences leads to competition among interest groups for the output of the information product or control of the organization. This competition among the interest groups leads, in turn, to ambiguity of goals and often few indicators of success. The overall effect of offering a product which is available to the general public is to have closer public scrutiny and an openness of the public system. Therefore, the effects of these external environmental factors on information management must be systematically examined.

The world of democratic politics is, by definition, one of change, as different competing groups vie to elect members of their interest group to the government. When the elected official takes control of a public organization, he is generally a temporary employee. Having a series of managers requires a great deal of flexibility in system design to keep up with the ever changing system requirements of many different types of managers.

Although this flexibility in system design is not substantiative, change in the supervision of the CIO represents a parameter within which he must


work. Flexible systems represent an operational constraint rather than a philosophical constraint. This flexibility also must include other areas besides system design; and, in allocation, budgeting must be incremental/contingent rather holistic/rational. The decision making processes of most public organizations is based upon the incremental/contingent model; and, therefore, the budgeting style of the organization must reflect the same methodology. Incremental budgeting is, by nature, a conservative method of financial planning; it is not immediately responsive to changes in the environment, but changes gradually over time. When competing interests compete for control of an organization, there can be no assurance as to the continuation of a stream of revenue. This method of budgeting is quite an important factor of which the public CIO must be cognizant. This, too, represents an operational constraint.

The political systems of public jurisdictions are open systems; and as open systems, the CIO function is under considerable public scrutiny. The need for public scrutiny of its bureaucracies is central to the premise of democratic bureaucracies. This control of bureaucracies comes from several directions. The bureaucracy is nominally controlled by the political party which has won the most recent election and is in vertical control of the bureaucracy by virtue of control over the executive branch. The second form of control can come from another bureaucracy which is given an oversight function for a program, or for the monitoring of the first bureau's budget. This form of control is horizontal. All governmental systems must be
designed with horizontal and vertical linkages included so that information can be quickly and easily moved across organizational boundaries.38

Governmental agencies have a very high number of both horizontal and vertical external linkages. As was defined in Chapter One, many political jurisdictions have agreements with other jurisdictions which involve information. An example of this type of covenant is a radio communications common frequency agreement between two police jurisdictions; this would be considered a horizontal external linkage. The number of reporting requirements from operational agencies to their funding agencies represents an example of vertical linkage. Reports to the State University Chancellor's Office regarding financial account are an example of another vertical linkage.

Open systems imply direct scrutiny of information that is stored within these systems. Individuals, particularly under open records acts, have access to all manner of stored governmental information. Counterbalanced with openness of information systems is the individual's right to privacy. The CIO in the public sector must understand individual privacy rights and be sensitive to the rights of the individual citizens. There are several examples of privacy rights which are currently enforced within the information management community. In education, only certain identifying information about students can be released by the school. Generally, this information consists of directory information, such as name, address, and phone number, if the latter two are released by the individual. In the case of a student athlete, the school is allowed to include the student's height and weight. The

American Library Association has a very strict standard on releasing information relating to books checked out by patrons. This latter policy is not statutory, but it is part of an ethical code promulgated by the Association. This understanding of and sensitivity to the privacy rights of the individual is very important to the CIO. Again, this is an operation restraint, not a philosophical restraint.

Competing interest groups who alternate control over the functions of the government cause ambiguous goals to be set. Because of this ambiguity, information systems must be able to meet a variety of needs. Additionally, information systems must be procured and internally sold on the basis of their own merits for technical reasons, rather than on goals assigned to a project by the interest group which is in power at the time the system was developed. Once again, this represents an operational constraint.

The bureaucracy in a democracy must serve all of the citizens equitably. In order to serve all citizens equitably, systems must be designed in such a manner as to not exclude any individual or group from acquiring governmental services to which they are entitled. Information systems must be sensitive to the needs of all of the people and be designed in a manner to insure that these needs are considered. In the Bureau of the Census, there is a consistent under-counting of the number of minority Americans because the staff of the Bureau of the Census has not been sensitive to the needs of minority Americans. Therefore, enumerators have not been able to locate these groups during the census count, causing under-representation of minority groups. The obverse side of sensitivity to the needs of certain groups is the privacy needs of groups. The CIO must again be sensitive to the
privacy requirements of groups and should not design systems which discriminate against these privacy needs.

The Economic Authority Model postulates that public organizations operate in situations where there is a failure of the free market or where there is a need to manage public goods. Public goods are those goods which are jointly consumed by all, or a substantial majority, of the public and, thus, are indivisible in the sense that some, or all, of their benefits cannot be priced in the market. Public utilities can certainly be considered to be public goods. Governmental communications technologies, such as emergency services radio systems; governmental agencies telephone system; and the emergency services communications system can easily be considered a public good. A "public utility" which is gaining considerable importance, particularly in suburbia, is cable television (CATV) and FM radio reception. The majority of jurisdictions which offer CATV service do so through a franchise agreement. In certain instances, the CIO might be called upon to assist the jurisdiction to adopt and enforce regulations governing the operation of this public utility, giving him more of a regulatory function.

Turning from the distal to the proximal environment - i.e., the work environment of the public organization - there are several organizational requirements for information systems which take effect. Public information systems are often developed under severe time constraints; additionally, the internal politics of the organization differ between the public and private sectors. The public sector must deal with a broad diversity of function, and

the governmental structure is likely to be more formalized than is the private sector.

Because of the broad diversity of population and interest groups served by the private sector, there is a greater variety of information services required of the public-sector CIO than from the private CIO. An example of this would be a comparison of the corporate structure of a large manufacturing company like Apple and the county government of San Bernardino. The Apple computer company is a large manufacturing organization which annually produces approximately $3.3 billion in sales. The company has two basic product lines: the Apple GS computer and the Macintosh Computer. There is one model of the GS line and currently four models of the Macintosh line. The company employees 6,780 people on a full-time basis. There are three manufacturing and sales organizations: one U.S., one European, and one Asian; research and development is done on a centralized basis. There are three staff positions: the Chief Financial Officer, the Personnel Director, and the Director of Corporate Development.40

Compare this with the County of San Bernardino, California. San Bernardino County has the largest land mass of any county in the United States, with a total area of 20,064 square miles and a population of approximately 900,000. This population makes San Bernardino a large county, but by no means is it the most populous county in the United States. In 1988, the County had a budget of $923,218,676 and employed at total of 9,791 employees. The County operations were divided into eight operational areas

and included such diverse functions as a jail, a medical center, an agricultural commission, and a museum.41

The impact of this diversity is that each of the constituent units of the public organization have their own specialized informational needs. Appropriate information systems for each of these functional areas are often available. But the equipment and software that is available is often "solution specific," meaning that the solutions developed for one organization will not work for other organizations. This lack of interdepartmental transfer stems from either a lack of common function, operating equipment, or common data format. The CIO must be cognizant of the needs of each of these various units within the organization, strive to meet the organizational needs as an integrated whole, and develop appropriate plans.

Public administration tends to function by moving from crisis to crisis. Because of accountability to the citizenry at large, answers to questions must be obtained quickly; programs must show immediate results or they will be terminated. Information-management programs must be extremely flexible to be able to meet these constant and ever-changing demands. Although the demand for flexibility does not fundamentally change the role of the CIO, it does change the style in which he operates. The CIO must develop systems which are responsive to needs that may not have been developed. To do this, the CIO must be well attuned to public administration and the needs of the elected officials within the jurisdiction.

41 San Bernardino Country, California, Final Budget, 1988-89 (San Bernardino, CA: County of San Bernardino, 1988) all.
CIO's should have a good understanding of public administration and public decision-making processes, while the CIO's themselves are not policy makers. At the highest levels of public organizations, the decision makers are usually politicians or political appointees. The CIO should not be a political appointee, nor should the CIO should be a first-line manager within the organization. There is some debate as to where or to whom the CIO should report in the administrative structure. Bozeman and Bertschnieder feel that the CIO should not be a senior level executive within the organization, but should be at the operational level.\textsuperscript{42} To be able to interact and anticipate the demands of the policy makers within an organization, the CIO should be at a high enough level in the organization to come into contact with the policy makers on a routine basis. In addition to understanding the goals and desires of the political officials, the CIO should be placed high enough within the organization to have the necessary internal political authority to enforce relevant decisions.

Governmental procurement policies are considerably more rigid and formalized than are those policies in the private sector. For a number of reasons, which are not germane to the subject at hand, the government, when procuring equipment, must appear to be "fair". Approval procedures used in the public sector can often be complex. The Procurement policy of the California State University requires no authorization for the purchase of information-management equipment under $1,000. The authorization of the Information Resources Management Designee is required for purchases of between $1,001 and $100,000. For requests of more than $100,000 dollars, the

\textsuperscript{42} Bozeman, 484.
authorization of the Information Resources Management Designee is required along with certification by the Office of the Chancellor of the University system before a purchase request can be sent to the State Department of General Services for bid. This formal and complex procedure is a major contributor to the long period of time required for purchase of expensive information-management equipment. To be able to move procurements through this system, the IRM must understand the complexities of the organizational bureaucracy.

The fourth layer of this Model of Publicness concerns the personnel management system of the public sector. While this is certainly an important feature of management in the public sector, it has little or no impact on the role of the CIO since there is little difference between information professionals in the public and private sectors.

To be effective in the public sector, the CIO must know how to work within a system which is essentially a politically-motivated system. This system is represented by competing interest groups, who, when in ascendancy, often present contradictory goals for which there is little definition or effectiveness. These difficulties in goal setting and evaluation take place in an atmosphere where the systems that are designed are both open, but at the same time, provide a reasonable level of privacy for the public. In the delivery of public services, the CIO must ensure that all systems deliver services in an equitable manner.

43 California State University, Office of the Chancellor, Executive Order #440, (Long Beach, CA: Office of the Chancellor, California State University, 1985), 1.
The CIO must operate in an organization which is quite complex and has a broad diversity of informational needs. Work done within this diverse environment is usually done in a crisis atmosphere and must be accomplished within a very formalized structure. The senior management of the organization are politicians who have little or no interest in the day-to-day operation of the organization.

Although the above differences in the role of the CIO between public and private organizations represent difficulties in the carrying out of the CIO function, they do not represent significant deviations from the role of the CIO in the original Synott construct. These differences of function probably vary little from the function of the CIO in any given industrial setting.

Organizational Impact of the CIO Model

The role of the CIO posits two distinct features which are counter to the normal function of the public bureaucracy: multiple lines of authority and a flattened personnel structure more aligned with the Peters and Waterman Matrix Structure. To understand the implications of the CIO model, brief explanations of the Weberian Bureaucratic Model and the Peters and Waterman Structure are in order. At the heart of the discussion are the roles of centralization and decentralization within an organization.

Many definitions have been given for centralization. For the purposes of this paper, centralization will be defined as the degree of retention or
delegation of decision-making prerogatives or commands by a single body.\textsuperscript{44} An organization which is highly centralized is one in which all decisions relating to the operation of the organization are made by a single individual or organizational entity. At the other end of the organizational spectrum would be a very decentralized organization in which decisions are made in multiple locations throughout the organization, even to the level of assembly-line worker making critical decisions such as stopping the assembly line.

The two extremes of centralization and decentralization are represented by the paradigms of Weber (very centralized bureaucracy) and Peters and Waterman (very decentralized matrix model). Weber's bureaucratic hierarchy, based upon rational-legal authority,\textsuperscript{45} is made up of technically-competent workers who are arranged in a strict hierarchy. This strict hierarchy is bound by a set of very strict rules. Occupants of the hierarchy must deal with their superiors and clients in a strictly impersonal manner. The key feature of the Weberian hierarchy is that each lower level in the hierarchy is under the control and supervision of the next higher level in the hierarchy.\textsuperscript{46}

The Peters and Waterman paradigm describes very decentralized organizations where decisions are made at all levels of the organization. In

\begin{itemize}
\item \textsuperscript{44} Fred Luthans, \textit{Organizational Behavior} (New York: McGraw-Hill Book Company, 1976), 128.
\item \textsuperscript{46} Luthans, 118.
\end{itemize}
this model, workers at even the lowest levels can make decisions which have great influence on the organization. Peters and Waterman advocate relatively flat organizations with few levels of control and supervision. There are few restrictions with which the employee works, and he is given the maximum amount of flexibility. In the Peters and Waterman world, the employee is encouraged to identify with the client and to become an advocate for the client within the organization.47

All organizations must have rules which govern the conduct of employees. The number and formality of these rules determine the amount of formalization an organization has. Companies which have few rules, which are very general in nature, would tend to have a low level of formalization. On the other hand, companies with many highly-structured rules would tend to be formalized.48 Within the context of the Weberian bureaucracy and the Peter and Waterman decentralized dichotomy, the Weberian bureaucracy would be be very formalized, while the Peter and Waterman concept would be much less formalized.

Complexity refers to the substantive variation of the workload encountered by the workers of the organization. An organization in which the work force has repetitive jobs, such as on an assembly line, would be considered very non-complex. Whereas, an organization which offers the work force a wider variety of functions would be considered very complex. An example of a complex work environment would be a hospital emergency


48 Hage, 36.
In institutions of higher education, there is, generally, a very high correlation between the number of students and the level of complexity. Economies of scale, brought about as a result of an increase in student populations, allow institutions to achieve higher levels of faculty specialization. Higher levels of faculty specialization, in turn, leads to a greater diversity of course offerings. The more courses offered, the greater the complexity of the institution.

Generally, the relationship between centralization, formalization, and complexity is driven by complexity. Hypothetically, organizations which have complex work environments have very decentralized structures. Such structures are typified by very low levels of formalization. Organizations which have non-complex work environments can be most efficient when they are very formalized and marked by high degrees of centralization.

In the final analysis, the degree of centralization is determined by a mix of complexity and formalization as well as a host of other factors which have evolved in the lifetime of the organization. Brooke, in the book Centralization and Autonomy: A Study in Organizational Behavior, lists fourteen factors which tend to promote centralization. The following table summarizes these factors:

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<table>
<thead>
<tr>
<th>Factors promoting or enabling centralization</th>
<th>Factors promoting or enabling decentralization</th>
</tr>
</thead>
<tbody>
<tr>
<td>The possession of scarce knowledge, expertise or ability, including the ability to see the whole picture. Threat of disaster.</td>
<td>Holding of specialized knowledge in the units.</td>
</tr>
<tr>
<td>The need to concentrate on the benefit of the whole when that is greater than the sum of the parts.</td>
<td>The inability of the center to make decisions fast enough or of sufficient applicability to the units.</td>
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<tr>
<td>The pressure for short-term results.</td>
<td>The ability to leave the units to manage themselves.</td>
</tr>
<tr>
<td>Complexity of group linkages making decentralization difficult.</td>
<td>Single links make decentralization more likely.</td>
</tr>
<tr>
<td>Acceptability of large-scale organization.</td>
<td>Lack of acceptability of large-scale organization.</td>
</tr>
<tr>
<td>Acceptability of authoritarian system.</td>
<td>Acceptability of democratic system.</td>
</tr>
<tr>
<td>Organizations with routine work.</td>
<td>Organizations which need flexibility.</td>
</tr>
<tr>
<td>Lack of access to the top.</td>
<td>Access to the top.</td>
</tr>
<tr>
<td>Growth to middle size.</td>
<td>Growth to Large size.</td>
</tr>
<tr>
<td>Care of the organization which leads to entrusting specialists at head office with the duty of continuous review.</td>
<td>A lassie-faire attitude to organization or the establishment of a viable unit which has the resources to run its own affairs.</td>
</tr>
<tr>
<td>Ambiguity of purpose within organization.</td>
<td>Ambiguity of environment.</td>
</tr>
<tr>
<td>Lack of Confidence.</td>
<td>Framework of confidence and trust.</td>
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</table>

It should be pointed out that historically the university setting has a structurally decentralized organization. A high degree of autonomy has been delegated from the general university administration to the various departments, schools, and colleges. The above mentioned units have a great deal of control over curricular matters and basic administrative functions. This should be remembered when reviewing models of administration with regard to decentralization in the context of higher educational administration.

As seen in Brooke's List of Factors for Centralization, the public bureaucracy has several factors which would indicate that they should be centralized and that the hierarchical model is most appropriate. These factors can again be examined in the context of the Bozeman and Bertschneider Publicness Model.

The first level is the Political Authority Model which, briefly stated, affirms the fact that public systems are ultimately open systems which must react to political realities. Several examples of this need can be taken from the Brooke factors list. There is a need to concentrate on the benefit of the whole because it is greater than the sum of its parts. This is true of the public as a whole which is served by practitioners of public administration.

Because the system is essentially political, those at the head of the organization have the "knowledge" of how to properly run the organization and see the whole picture. This same reasoning would lead to the need for specialists at the head office who have the duty of continuous review. The
politicians who are responsible for the operation of the organization must continually scan the operation of the organization to insure that it is functioning in the way they desire.

The "politicization" of the system makes the external linkages of the system quite complex. This complexity of the linkages bodes the politician to look for a single point of contrast between the external environment and the organization. Again, this is another factor for centralization.

The typical bureaucratic organization is considered to be slow moving and reactionary. These two characteristics may, not in some cases, be negative assets. A major requirement of public services is that services are available in a systemic and dependable manner. If an organization were designed to change or adapt to change in a quick manner, it could seriously effect the delivery of services. For instance, there is some benefit to knowing that the garbage will be collected every Tuesday and Friday.

The CIO model also posits a split line of authority. The Line officers are responsible for the operation of their department, and CIOs are responsible for the operation of the information management-equipment within organizations. Because of the great diversity of applications which can be used in the public sector, this model may not be the most appropriate. Additionally, imposing a second-command structure on an organization may be counter-productive. When met with conflicting requirements, the public employee may not know which dictate to follow. An example where these dual lines of authority would be extremely difficult would be the militarily services. Each of the services has its own very strict lines of command. To impose another line of command would slow down and confuse the reaction of the system.
To work well within public structures, the CIO model must be able to adapt to the organizational demands of the public sector. These demands would include a continuation of the hierarchical organizational structure, and an adherence to the strict lines of organizational control which are required in the public sector. The public CIO must be extremely flexible; but, at the same time, (s)he must be able to operate within a very formalized system. Because of the openness of the system, the CIO must be a good political actor who understands the nuances of political situations which often have conflicting interests. As can be seen, the role of the CIO in the public sector is both demanding and challenging.
CHAPTER IV

A MODEL FOR INFORMATION MANAGEMENT IN THE COMPREHENSIVE UNIVERSITY

The CIO model is an effective model for the management of information resources and can be, with modifications, an effective model for the public sector. Because higher education is a unique subset of the public sector, several modifications to the CIO model are needed to insure that the model is applicable to higher education. To understand the context of information management in higher education, one must have an knowledge of the history of the various major information handling organizations: Library, Audio Visual Services, Administrative Computing, and Academic Computing. To fully appreciate these functions, this historical investigation must provide some insight into the ways these organizations fit into the organizational matrix of the university. Higher education has some characteristics of the public sector and some characteristics of the private sector. These characteristics have a major effect on the organization that is handling information in the university. There are several different models of information handling which are in common vogue. These models will be examined using institutions of the California State University system as examples. Finally, the model for the operation of the CIO within the California State University setting will be developed. This model will be developed on two levels: the macro-level examining the position and the organizational structure of the CIO's function with regard to the University as
In his electronically published paper "The Virtual Library: The Electronic Library Developing Within the Traditional University," Harvey Wheeler calls the contemporary university an extension of the computer. Wheeler then extends his comparison by discussing electronic publication and showing how the university can actually be an electronic entity. He demonstrates the importance of what is known as information technology to the contemporary university. Information technology is the use of electronic equipment which stores, manipulates, and retrieves information in an electromagnetic form. On the contemporary university campus, the main information technology centers are the library telecommunications, audiovisual services, and the departments of administrative computing, academic computing.

The following sections will define each of the above organizations, briefly review the history of each organization, and place them within the larger organizational framework of the contemporary university administrative structure. The history of the organizations will be studied as a

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means of better understanding the function and to understand the logic behind the positioning of these organizations within the larger university structure. Each of these organizations has an interesting past, and each will be studied in the chronological order it evolved. This sequence of study will be the library, audiovisual services, academic computing, administrative computing, and telecommunications.

The Academic Library

The word "library" comes for the Latin word "libris" meaning book. The dictionary definition of a library is a collection of written, printed, or other graphic media. The earliest libraries were not collections of books, but rather archives for the royal families, usually containing handwritten material in the form of scrolls. These familial archival libraries date back to 2700 B.C. Libraries, from the inception, were the property of the ruling class.

During the Dark Ages there were two types of libraries: one, primarily religious, in Europe, that was associated with the church; the other, which covered a considerably greater intellectual area, still remained associated with royalty in the eastern world. The tight control of the Church over intellectual matters led to a strict censorship over all western books during the Middle Ages. Because of this strict censorship, private libraries were almost unheard of by nobility, much less the commoner. Where libraries did exist, they contained less than 100 volumes.

With the end of the Middle Ages, the intellectual tutelage to the church decreased with a corresponding increase in the ownership of books by
private individuals. In parts of Europe, a lively book trade flourished. In 1250, Robert de Sorbonne, Chaplain to Louis IX, started a college which was named in his honor. He bequeathed his personal library to the institution, and gifts poured in from others, following Sorbonne's example. By 1290, the university library amounted to 1,000 volumes, quite a substantial library for the time. The Sorbonne was the first university founded that had provisions for a library. The Sorbonne was to become the model for other universities. The relationship between the library and the university was firmly established as early as the end of the Middle Ages.51

In the North American Colonies libraries and education enjoyed a close relationship. In 1636, the Board of Governors of the Massachusetts Bay Colony voted the sum of £400 to establish a "school or college."52 Two years after the opening of the college, in 1638, the Rev. John Harvard donated to the new university £779.17.2 in money and more than 300 volumes.53 In honor of his donation, the university was named Harvard. Early academic libraries grew mostly by donations from the university presidents, friends of the university, and library-keepers (predecessors to the modern-day college librarian). There was little systematic attempt made to use institutional monies for the purchase of books to increase the size of collections. Although

51 Gates, 11-17.


libraries played an important part in colonial higher education, their inadequacy gave rise to the student literary society movement where students met to read and discuss the latest books.\textsuperscript{54} Until the turn of the twentieth century, colleges "emphasized textbook teaching and discouraged wide reading; their libraries were open chiefly for the occasional loan of a book to a professor..." Because of this philosophy, freshmen and sophomores were prohibited from using these libraries.\textsuperscript{55}

The development of non-governmental accrediting agencies, such as the Southern Association of Colleges and Universities, provided the impetus for the development of the university library as we know it today. These associations considered the library a major area of importance to achieve accreditation. From the turn of the century until today, academic libraries have continued to grow at a rapid pace.\textsuperscript{56}

The placement of the library in the academic management structure comes from the functional role of the organization. The library has, from its very inception, been associated with the academic portion of education, as opposed to the management of the educational process. The purpose of the library has always been to "provide access to the human records needed by members of the higher education community for the successful pursuit of

\begin{itemize}
\item \textsuperscript{55} Gates, 69.
\item \textsuperscript{56} Ibid., 184.
\end{itemize}
their academic programs.\textsuperscript{57} Because of this historic mission, the library is generally placed under the supervision of the chief academic officer.

**Audio Visual Services**

Audio-Visual Services is the service organization within the university organization which applies that the media -- born of the broadcast communications revolution: radio, television, and camera, "which can be used for instructional purposes alongside the teacher, the textbook, and the blackboard."\textsuperscript{58} The history of audiovisual services closely parallels the rise of broadcast communications technology. Before the invention of the sound film, this organization was known as "Visual Services" since there was no audio medium available. Early devices used in Visual Services were the stereoscope, the steropticon (Magic Lantern), and the movie projector. The advent of radio broadcasting, sound recording, and sound movies were rapidly incorporated into the repertoire of the now-called audio-visual specialist.

Although audiovisual services was an evolving field, the educational community was not much affected by its beginnings. It has been estimated


that over $50 million were lost on commercial efforts to develop media for educational purposes in the period before World War II. World War II marked the turnaround in the acceptance of audiovisual services. Audiovisual equipment, including the overhead projector which was developed during the war, was perceived as a major source of success for Armed Forces training. Based upon the strength of these showings in WW II, audiovisual instruction was the subject of a great deal of interest in the period immediately following that war. For instance, after the launching of Sputnik in 1957, Title VII of the National Defense Education Act included $40 million for audiovisual research.

Television is the last major area of interest to audiovisual services. The meteoric rise of instructional television matches the growth of television industry as a whole in our society. Interest in educational television started out quite high. In 1952, the Federal Communications Commissions set aside 242 television frequencies for the use of educational television (ETV). During the 1950's, the Ford Foundation spent more than $170 million for research in educational TV. But by the mid-1960's, interest in ETV had declined. The Ford Foundation turned its attention to public television rather than in-school education. Although there is no definitive reasons given for the lack of ETV use by teachers, factors included the following: teacher resistance,


expense of installation, and the inadequacy of the medium.61

Because of audiovisual services, primary attention to the delivery of instructional material through various media is generally found under the Chief Academic Officer. Often the organization is subordinated to the library as much of the material used by audiovisual services fits within the general definition of a library collection. In some respects the function of audiovisual services parallels the media collection of the library.

**Academic Computing**

Although administrative and academic computing share the same methods of information storage, manipulation, and retrieval, namely the computer; and to a high degree, common origins, the raisons d'être for these two organizations are completely different. As will be seen from the following two sections, the evolution of the two functions is also different. Therefore, both of these organizations will be treated separately. In keeping with the rule of moving from the oldest technology to the newest in technology, academic computing will be considered first, then a discussion of administrative computing will follow.

The roots of academic computing follow from the very beginnings of computing. Initially, the modern computer began as a research project in the physics laboratories of Dr. Howard Aiken at Harvard University during the

61 Ibid., 11.
1930's. The first actual internal memory computer was the ENIAC (Electronic Numerical Integrator and Computer) which was built at the Moore School of Electronic Engineering of the Harvard University by Wallace Eckert and John Mauchly in 1943. These original computers were used by the United States Army ordnance to calculate artillery trajectories.

Many early computer systems were used by the U. S. military, with the Semi-Automatic Ground Environment (SAGE) air defense system being the most important. Because of the military uses of the computer, the majority of interest in the computer was as an object of research. It is difficult to tell when the computer shifted from an object of research to an object for research. The first university computation center was opened at the Massachusetts Institute of Technology in June 1957. At this time, there were approximately 29 computers existent in all of higher education in the United States. The MIT Computation Center was the first organization which was devoted solely to general purpose computing, as opposed to specialty computing; it was also a common method for administration during

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that time. The IBM 704 computer was used to run a variety of different programs. Users of this computer had to come to the center and enter their data and programs into the computer through rather crude, by present day standards, input devices; their results were received from the same centrally-located computer. This centralized computing center with a large (mainframe) computer was to serve as the model for academic computing centers well into the 1980’s. Computer use spread rapidly in the years that followed. There were 997 computers on university campuses in 1966; 1,768 computers in 1969; and 2,147 in 1976. This latter number represents 87% of the 2,477 U.S. colleges and universities in existence at that time. 66

The general model of the large centralized computer, serving a broad range of computing requirements, did not change until the advent of the microcomputer (small scale computer). The microcomputer was not possible until the development of the microprocessor which was invented by Ted Hoff. Microprocessors and microcomputers stayed in the realm of hobbyists until the genesis of the Apple computer and the subsequent entry of IBM into the microcomputer market in 1982. The entry of these two companies into the microcomputer market changed the whole face of academic computing.67 These relatively inexpensive computers, often costing less than $3,000, are able to service more computer users simultaneously than the larger mainframes costing several orders of magnitude more. It would be difficult

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for a $3,000,000 large computer to support the dollar equivalent of 1,000 microcomputer users. It should be noted, however, that the large computers have abilities that cannot be found in the smaller computers, such as speed and memory size. Contemporary academic computing organizations have the full range of computers, from microcomputers to large mainframe computers.

Universities often consider these large numbers of computers to be a function of the academic mission, and they locate the academic computing function in the office of the Chief Academic Officer. Other institutions, because of the large computer origins of the organization and the early automation of various administrative systems, locate all computing under the chief administrative officer (i.e., Vice President for Administrative Affairs or equivalent).

Administrative Computing

Administrative computing is the computing which relates directly to the operation of the university. As such, the rise of academic information management most closely parallels the rise of computing in the business sector. Initially, computing utilized punch-card equipment, which was invented in an effort to save personnel time and money in performing repetitive tasks involved in the day-to-day operation of the university. The original business computers were simply extensions of the card-processing machines. As the sophistication of the computer increased, the sophistication of the programs written to operate on these computers increased. Presently, all functions of university instruction have been automated for computer
Synott and Williams define the function of administrative computing succinctly as the following: "The typical corporate EDP function was the manufacture of paperwork. It processed the transactions for operating a business." The computer simply took the place of several clerks, doing the same function, but more rapidly and less expensively.

Richard L. Nolan, in his seminal article "Managing the Computer Resource: A Stage Hypothesis," divided the life cycle of computing within an organization into four distinct stages. Each stage of the life cycle has different types of applications developed for the organization. Although his examples are for the private sector, there are analogies in the public sector. Stage One applications are those applications which are developed to reduce the cost of accounting. Stage Two has application development spreading into all functional areas. At the end of Stage Two, the organization has usually used up all of its resources and draws back so that there is a moratorium on new application development and interest is on control. The fourth and final stage is represented by database applications.

The first administrative computing application to involve a large number of students was the Purdue Academic Student Scheduling (PASS).
which was developed in 1956. The system, as written, provided for the classroom scheduling of the 21,000 students who attended Purdue University.71

A secondary use of administrative systems is the gathering of information about the institution. This process assists administrators to make decisions which allow for more effective management of the university. Shoshana Zuboff, in her book In the Age of the Smart Machine, makes the following statement about the types of information which come about through the use of automation:

information technology is characterized by a fundamental duality that is not fully appreciated. On the one hand, the technology can be applied to automating operations according to the a logic that hardly differs from that of the nineteenth-century machine system—replace the human body with a technology that enables the same processes to be performed with more continuity and control. On the other, the same technology simultaneously generates information about the underlying productive and administrative processes through which the organization accomplishes its work. It provides a deeper level of transparency to activities that had been either partially or completely opaque. In this way information supersedes the traditional logic of automation.72

Administrative applications have changed very little from their initial days. Programs and systems are continually rewritten to take into account the latest technology, but there is basically no change in the actual operation of these programs.


Because of the business origin of administrative applications, this area is usually under the control of the Chief Administrative Officer. Many computing functions of this type fall under the control of this institutional officer.

Telecommunications

On March 10, 1876, a week after obtaining his patent for the telephone, Alexander Graham Bell, a teacher of the deaf, spoke his famous first words: "Mr. Watson, come here, I want you. God save the Queen." When Bell moved to patent his instrument, he did not realize that patents were to play a vital role in the telephone industry for almost the next 100 years. On March 3, 1885, Bell organized the American Telephone and Telegraph Company in New York to provide long distance service to other Bell Companies which he had organized and controlled.

The Bell operating companies moved very aggressively to acquire independent telephone companies. By 1930, AT&T owned over 200 separate operating companies, 87% of the phone stations in service, 91% of the telephone plant, and 98% of all long distance circuits in the United States. On a second front, AT&T moved to increase the number of patents held for

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74 Ibid., 31.

75 Ibid., 35.

76 Ibid., 2.
long-distance services. Because of this equipment advantage, they also enjoyed a virtual monopoly on the lucrative long-distance market.\textsuperscript{77}

Using its strong patent position and its monopoly of equipment, AT&T was able to establish the principle of end-to-end responsibility. Under this principle, AT&T was responsible for maintaining a high level of service from the calling station to the receiving station. In order to insure end-to-end quality, AT&T maintained that only AT&T manufactured or certified equipment could be on its telephone circuitry.

In 1964, Carter Electronics Inc. asked permission to add a unit which would attach a telephone to a mobile radio transmitter. This would, in effect, allow the user of the Carter Dataphone to use his car radio as a telephone. AT&T refused Carter Electronics request; but Carter, undaunted, sold its equipment anyway. AT&T then shut off the Carter Dataphone users service, where upon Carter Electronics filed an antitrust suit against AT&T.\textsuperscript{78} AT&T lost the case because their prohibitions against foreign equipment did not define the difference between harmful and unharmful equipment.

Shaken by the loss of the Carterphone decision, AT&T determined that almost any equipment could be hooked to their network through the use of a Protective Coupling Arrangement (PCA).\textsuperscript{79} Many corporations then attached microwave relay stations to networks, and others attached Private

\textsuperscript{77} Ibid., 65.


Branch Exchanges (PBX'S).

In the pre-Carterphone days, organizations often used Centrex service supplied from the local phone company. With this service, all equipment was leased from the phone company whose engineers analyzed the needs of the organization and then sold the proper equipment. This method of service often worked more for the best interests of the telephone company and not for the customer. On the other hand the PBX, being privately owned and operated, allows the customer to determine the appropriate levels of service for the organization and purchase the proper equipment, often at a fraction of the cost of phone company supplied equipment.\textsuperscript{80}

Traditionally, in higher education, telephones have been the province of the business office. The operation of the network was a fairly cut and dry operation with bills coming from the phone company and then having them reconciled by the business office. The loss of paternal "protection" on the part of the phone company has dramatically increased the complexity of operation for the phone system. This function is in limbo organizationally either in housed in the business office or in combined with the data communications and video communications within the Computing Center.

The crux of the CIO model revolves around the macro organization of the university i.e.; where the CIO fits into the overall organizational structure of the university. A secondary question is how does the CIO function organize to serve the needs of the university.

The information-handling resources in higher education are varied.

and offer a great deal of service to the university community. Because of the variety and the length of time that each organization has had to build up its constituency within the larger organization, there is a great deal of reticence to combine organizations under the control of a single individual. Senior operating officers such as directors naturally desire to report at the highest levels, not only to increase personal prestige but to insure that their organizational needs are met.

The Location of the CIO in the University Setting

The place of higher education within the public sector is somewhat unique. If one accepts the fact that education is a requirement for a functional democracy, education becomes a function of the government. This concept is ingrained into the American spirit, especially for public elementary education. In the United States, elementary education is mandatory and is generally provided by the government. This type of education could qualify elementary education as a public good. The argument changes when higher education is examined. Higher education is not mandatory in the United States. Joining the workforce is a valid alternative to higher education. This optional status makes it less of a public good. Further weakening the case is the fact that private educational organizations offer a homologous product. In instances such as Harvard, Stanford, and other private universities, the quality of the product is arguably better.

The contemporary institution of higher education functions in an environment that in many ways resembles a private sector operation.
Because of the declining demographics of the post-baby boom generation, the competition for students is increasing. Many universities have what are essentially marketing organizations, although the names of the organizations may be outreach, admissions, and the like. This marketing function places higher education squarely in a private sector posture. On the other hand, as public institutions are funded by the government and, as such, are subject to public oversight, with this oversight comes all of the other strictures of public sector administration, lack of clear cut goals, public scrutiny, etc.

Baldridge et al. have examined the differences between academic bureaucracy and governmental bureaucracy. There are several characteristics which effect the function of the CIO found in this academic model. They describe academic bureaucracies as follows: 1. Academic institutions have goals which are often ambiguous and highly contested. There may not be a clear consensus of the mission of the organization. This lack of clear definition is liable to be hotly debated. 2. Academic institutions are people-processing institutions like other schools, hospitals, and welfare organizations. Unlike these organizations, the client in academia often demands and sometimes receives a voice in the decision-making process of the institution. 3. The technology of the organization tends to be problematical; i.e., to serve the client, the institution must be adaptable and holistic to meet the needs of individual students. 4. The organization is highly professionalized with a professional staff which demands a role in the governance of the institution. 5. The academic organization is very vulnerable to the effects of the external environment; i.e., events outside the institution can have deep and lasting effects on the institution. Baldridge characterized the academic institution as "Organized Anarchy." The
overriding characteristic of this type of organization is the continual struggle for the governance of the institution. Included in this governance function is the right to determine the missions and goals of the university. This contention, which is similar to that found in public-sector elections, is often more rigorous than public elections.\textsuperscript{81}

On the other hand, the standard bureaucracy has the following characteristics. The goals tend to be clearer than those of the academic institutions. The client is served more by using more of a "materials handling model," that is much like a production line. The technology tends to be more routinized and have better defined solutions to problems. The staff is predominantly nonprofessional. There is considerably less environmental vulnerability than for the academic bureaucracy.\textsuperscript{82}

This model of the academic bureaucracy changes the role of the CIO within the organization. One of the major functions of the CIO must then be as a politician. One of the characteristics of the political process is finding consensus. The CIO must be a facilitator in the consensus-building process. This consensus builder argues for a position within the university where the CIO has the ability to see all options available to the university. One of the functions of a leader in the political arena is to actively pursue consensus. In the Bozeman model, the CIO was not in a policy-making position. But in higher education, the CIO may well be in a policy-making position. The business of higher education is information transfer and, as such, the


\textsuperscript{82} Ibid.
methodology of information transfer becomes very important to the university and its planning. Information management can even be an important strategic component of the university function. NOVA University is a leader in the field of remote learning. All of the student body at this university live off campus, and classes are offered over telecommunications lines. Clearly, this is an example of the strategic function of information management in higher education. This example can be generalized to other educational institutions.

To gain some insight into the role of the CIO in higher education, one must examine the current structure of information handling in contemporary education. To provide a test ground, the California State University system will be used since it is a significant institution within higher education, housing approximately 12% of all students of higher education in the United States.

Survey Results

A telephone survey of all Information Resources Program Designees (IRMPD), or proxies, within the California State University was conducted to examine, among other things, the formal organizational structure of the information-management function within the respective universities. During the course of the telephone interviews, those responding were asked to describe the organizational and reporting structure of the following information-processing units: Library, Administrative Computing, Academic Computing, Audiovisual Services, and Telecommunications. Based upon the results of this question, formal organization charts were drawn. These
charts were then analyzed and quantified by counting the number of units reporting directly or indirectly to a single Vice President. Each unit was given one point for each organizational unit which reported to these senior administrative officers. One additional point was awarded to organizations in which the IRMPD was located at the point of highest reporting concentration. The awarding of a point is to recognize the role of the IRMPD as a campus-wide officer. The highest number of units reporting to a single Vice President was considered to be the level of centralization for the entire institution.

Three main groupings of structures were discovered: The first and most decentralized has the computing organizations reporting to a single individual; for instance, the library and head of audio-visual services reports to the same individual, and telecommunications reports to a third person with the responsibility for voice communications and data communications split between the Computer Center and an Administrative Officer. The computing organization was most often found reporting to the Academic Vice President. Six of the organizations had the computing function of reporting to the Chief Administrative Officer. The most often reported reason for the computing reporting structure is to insure that the administrative community be properly served. In some situations this reporting structure has been more radically changed to the point that there are separate computing organizations for academic computing and administrative computing, based almost solely upon the needs of the administrative community. Examples of the various organizational structures are presented in Figures 4.1 through 4.3. The Universities of Notre Dame and Georgia are two organizations which have recently developed
administrative organizations reporting to different Vice Presidents from the academic unit, based upon fear of inequitable allocation of computing resources. 8384

Figure 4.1

Decentralized Information Management Structure

The Library Function always reports to the Academic Vice President. The reporting structure for the library is based upon its traditional role in academia. It should be noted that the library is historically allied with the

83 Harry Grothjan, Director, Administrative Computing, University of Georgia, interviewed by author, Personal interview, Los Angeles, Ca. 3 May 1988.

84 Barbra Johnson, Director Administrative Computing, Notre Dame University, personal interview, Personal interview, Los Angeles, Ca. 3 May 1988.
very function of academia. In all cases, the two computing functions also reported, to one individual. This is in recognition of the fact that there are economies of scale to be found in the operation and maintenance of the computing equipment.

The second organizational structure found is the combination of telecommunications with the computing function. The library and audiovisual services report no change. There are many commonalties between computing and telecommunications in the contemporary world. Telephone signals which, historically, have been transmitted as analog signals now use a technique known as Pulse Coded Modulation, which samples the conversation several thousand times a second and turns the telephone signal into a digital signal. Then, functionally, there is no difference between telephone voice signals and computer data signals, nor is there little difference between the contemporary digital computer and the telephone digital switchboard. Additionally, computing centers are often staffed on a 7-day-a-week, 24-hour-a-day basis, which are the same operational requirements as the telephone system. Computing centers are also very much involved in the operation and planning of the telecommunications systems by virtue of the large amount of computer-related data being transported in the campus communications network.

The third structure noted involves multiple organizations reporting to the same individual in different structures which are not noted below in Figure 4.2.

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Six of the institutions represented reported that three or more of the five organizations reported to the same individual. Of these, three organizations reported that the Computer Center Telecommunications and Audiovisual Services reported to the same individual. The similarity between telephone voice, television, and data communications noted above is the motivating force behind this consolidation of organizational units. One institution reports computing, library, and telecommunications to one individual. This individual, in turn, reports to the Chief Academic Officer. Two institutions report that all five organizations report to the same
individuals (see Figure 4.3). The ultimate manifestation of this increased level of centralization reporting is the Chief Information Officer who has all five organizations reporting to him. The CIO is used on several non-CSU campuses such as Columbia University and the University of Kentucky.

Figure 4.3

Chief Information Officer Structure

Formalized reporting structures were examined as a section of the analysis. The following represents the reporting structures of the above cited organizations:
Table 4.1  
Organizational Reporting Structures

<table>
<thead>
<tr>
<th>Organization</th>
<th>Vice Pres. Academic</th>
<th>Vice Pres. Administrative</th>
<th>Other Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Center</td>
<td>8</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Library</td>
<td>17</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Communications</td>
<td>3</td>
<td>11</td>
<td>3</td>
</tr>
</tbody>
</table>

The reporting structures of the telecommunications and library functions appear to be very strongly entrenched within the various organizations. It should be noted that the three organizations which have reporting structures reporting directly to the President of the University do not contain the library.

The location of information services within the overall organization of the university is quite important. Ideally, the information services organization should report to the Chief Executive Officer of the university. There are two reasons for this: one political and one financial. Without the direct reporting relationship to the CEO, the CIO lacks the proper organizational authority to make decisions which will have a widespread effect on the organization. If the CIO reports at lower than the CEO level, officers of the university who are higher in the organizational hierarchy could bypass rules and decisions made by the CIO. The second and financial reason for this placement is to insure that an adequate funding level for information management is maintained throughout the institution.

Baldridge et al., in their article detailing the differences between academic bureaucracies and public bureaucracies, further define governance
of the academic bureaucracy. It is their contention that there are three basic models of governance within higher education. These three models are respectively the bureaucratic, collegial, and political. The three models are differentiated by characteristics such as assumptions about the structure of the organization; the social processes of the organization; the basic theoretical foundations underpinning the organization; the view of the decision-making process; and the cycle of decision making.

The bureaucratically governed educational institution uses the Weberian hierarchical bureaucracy as the theoretical basis. This theoretical basis has obvious implications for the formal organization of the institution, more so than do the other of their structural assumptions. Socially, the organization is a unitary structure integrated into a formal system. Being a Weberian bureaucracy, the theoretical basis of the organization is a combination of the works of Weber and of classic studies in formal systems. Decisions are made using rational decision-making processes and standard operating procedures. The decision-making sequence is the standard rationalistic methodology of problem definition, search for alternatives, evaluation of alternatives, calculus, choice, and implementation. This governance structure would work just as well for academia as for private bureaucracies.

The second model is the collegial model. This sees the university as a community of peers. The society is a unitary one that is integrated by peer consensus. This model has basis both professional literature and the human relation approach to organization. Decisions are made through consensus and community participation. The decision-making process is much the same as in the bureaucratic with the exception of the fact that heavy emphasis
is placed on the consultation process. This consultation process involves peers in the decision-making process. In the private sector, this model would work well for a small partnership.

The final model is the Political Model. This model assumes that the university is a fragmented, complex, professional federation. The society is pluralistic, meaning that it encompasses different interest groups and divergent values. This model finds its theoretical model in conflict analysis, interest group theory, and community power literature. Decisions are made by negotiating, bargaining, political influence, political brokerage, and external influence. The decision-making cycle for this model would be as follows: the issue emerges out of the social context. The various interests articulate the issue. After the articulation of the issue, there is a period of time were there is conflict among the various parties over the issue. This conflict is solved through a legislative process. The legislative process is led to the implementation of the policy legislated. The final step in the process is the feedback to the organization. Leadership in this type of organization is manifested through consensus building.

It should be noted that like all models organizations do not fit neatly into the theoretical categories defined above. Institutions are to a greater or lesser degree in one category or another. They tend to move from one category to another depending on changes in the internal organization of the university. It is fair to state that organizations will take on characteristics which are in line with one particular category than others.

In another study on professional diversity in higher education, Baldridge et al. examined the autonomy of faculty in various types of university structures. Using faculty autonomy as an indicator of centralization/decentralization, several conclusions about centralization in different types of universities can be drawn. The study found that Public Multiversities i.e., those institutions which granted Ph.D. degrees- that were organizationally very complex and had a large number of students, had the highest degree of professional autonomy. Professional autonomy can be used as an inverse indicator of centralization; for instance, the more professional autonomy a faculty has the greater degree of decentralization in the organization. Faculty members in public comprehensive institutions had far less autonomy and were, therefore, more centralized. The more decentralized institutions tend toward the collegial and political models of governance than the more centralized comprehensive institutions which are governed by the bureaucratic model. 87

The evolution of the information function in the contemporary university has been without a unifying direction. This lack of direction has led to an organizational structure which is a mass of conflicting ideology and function. To be successful, the CIO model must be implemented in such a way as to resolve these differences in ideology and function or, at the very least, reconcile them to the point of being able to deliver a consistent commodity of information.

CHAPTER V

THE IMPLEMENTATION OF THE CIO MODEL IN THE UNIVERSITY SETTING

The CIO model has proven to be an effective management model within the private sector. With some modifications, the model can also be an effective model in the public sector. With even more modifications, the CIO model can work within the context of higher education. As with all management models, the CIO model must be able to deal with the environment within which it must operate. Therefore, these environmental constraints will be examined. Effective solutions to these constraints are critical to the success of any model. After the solutions to environmental constraints have been found, a thorough examination of an effective implementation of the CIO model will be discussed. This model, which will be described in detail, will examine the functions of the various activities needed; for the management of information will also examine the staffing demands and the operational requirements of each of the functions.

To examine the environmental constraints which are placed upon the CIO's function, a review of the original definition of the CIO is in order. Synott defined the CIO as follows: "The Senior executive responsible for establishing corporate information policy, standards, and management control over all corporate information resources."\(^{88}\)

Several organizational ramifications arise out of this definition. The first of these ramifications is the prescription that the CIO must be a senior

\(^{88}\)Synott and Gruber, 66.
The best way for the CIO model to function is for the CIO to report to the CEO at the level of Vice President. This would allow the CIO the maximum authority in university administration and for resource allocation. The concept of the CIO as a Vice President of the university is not a concept whose time has come. Based upon the examination of the California State University system, the majority of the Information Resource Management designees are Computer Center Directors with added responsibilities. The Computer Center Director generally reports to either the Vice President for Academic Affairs or for Administrative Affairs. This is not a position from which to address the strategic planning of the university or to make university-wide policy. There are several methods which can be used to make the CIO have the necessary authority for the proper operation of the university's function.

The first and most direct way for the CIO to gain authority is for the CIO to report directly to the President of the university at a functional level with responsibilities less than those of a Vice President. By having this senior position within the university, the CIO would have much of the same authority as a Vice President, but without the organizational structure
normally associated with a Vice President. The CIO would then speak with the backing of the President. The major drawback of this reporting structure is the lack of institutional prestige for the CIO.

The second way of gaining institutional authority is for the CIO to have an advisory council which consists of officers which report to the President of the university. This advisory board could give the CIO direction in policy development, resource allocation, and implementation of policy. A committee of senior university officers would have two effects. These senior officers would have the overall perspective of the university. This high-level perspective of the university would assist the CIO in the allocation of resources and the development of policy for the information function. The second effect of the senior committee would be that decisions would have a stronger force because of the stature of the members of the committee who are guiding the CIO.

The third method of gaining institutional authority is to have the CIO become a member of the President's cabinet. Although being a member of the President's Cabinet was not included in the Synott definition, it has two major benefits to the CIO: it does allow the CIO a broad perspective on the university and does allow access to institutional decision makers on a regular basis. Even though the CIO is in the President's Cabinet, it does not, in itself, convey authority; it does convey some political positioning which can be used in the enforcement of policy. Because of the close working relationship of the CIO to the senior officers of the university, the power of the CIO has increased.

To restate the case, to be most effective, the CIO should be a Vice President of the university. If the CIO as Vice President is not acceptable, the
alternatives in priority order would be as follows: 1. The CIO should report directly to the President. 2. If the CIO does not report directly to the President, he should be advised by an advisory committee consisting of Vice Presidents. 3. At the least, the CIO should be a member of the President's cabinet; any position lower than this would relegate the CIO to just another staff officer.

The university environment is one which has many sets of boundaries. The contemporary university consists of areas which are administered by Vice Presidents, schools or colleges which are administered by Deans, and finally Department's which are administered by Department Chairs. Each of these units has its own organizational structure and own set of rules. Each of these organizational structures also has potentially conflicting informational needs. The task the CIO has to cut across these organizational boundaries is a difficult one. Two methods of control can be used to insure that the CIO function effectively cuts across organizational boundaries: 1) the standards development and enforcement process; and 2) the administration of university-wide functions.

The CIO is charged with the development of standards for information-management resources and the enforcement of these standards. Because of the conflicting needs of the various organizations, policy setting and administration are both critical and difficult. The CIO needs to consult with the various groups and develop standards which are workable, consistent, and enforceable. In addition, these standards should include the criteria for the selection and operation of equipment and for the training of the user.

Two methods of insuring standards can be used. The first consists of having the CIO review and sign all new requests for information-related
equipment. This would give the CIO and his staff the opportunity to insure that all purchases adhere to the standards and to insure the workability of the proposed equipment in the information environment. This method would fall short because CIO would only see equipment requests as individual pieces without regard for the totality of the organizational plan.

The second effective method for insuring the adherence to standards is through the use of support. These standards would include minimal hardware configurations, software specifications, and interface protocols. Once the standards are set, the CIO function would then assume the responsibility for insuring that those who follow standards would receive assistance in problem solving while those who did not follow standards would receive lesser levels of service. Those who completely followed the standard would receive unlimited support. Those who had followed the standard but who had not kept up to date would get less support. Finally, those who had not followed the standard would get little or no support.

Another model which serves to define the scope of the CIO role is the administration of university-wide resources. University resources are those resources which are vital to the operation of the university but are in generalized use throughout the organization. These resources include university database and the university communications system. The university-wide database consists of that data which describes those entities which can interact with all members of the university. This includes student data, course data, financial data, and the like. This data is of such import to the university and in such common usage throughout the university that it must be administered centrally to achieve universal consistency and reliability.
The second university-wide area is the communications system of the university. The communications systems of the university consist of the voice, data, and video distribution systems which link the various members of the university together, allowing for transfer information from one part of the university to another. Because of the universal requirements of this system, the responsibility for the administration of it must cross organizational lines. 89

The planning function is the most difficult function for the CIO because of the great diversity of demand on information technology within the university. This diversity can be greatly reduced by limiting planning to two areas: the development of standard and operation of common university-wide resources. Limiting the planning function to these areas insures that the organization will exist in a stable environment which has a planned and orderly progression of functions. It becomes the responsibly of other organizations to meet the standards which are made as a part of the planning process.

This generalized planning would also consider all information-handling equipment for which the CIO was responsible. This equipment should be handled with the goal of providing maximum accessibility to information. In larger universities, the increased number of sources of equipment makes it impossible to plan for information processing on a micro level. To attempt to impose too many restraints on university officers would be counterproductive and would inhibit their functions as innovators.

Although Baldridge calls the university community "structured anarchy," there are many segment of the university community which are very bureaucratic. Several examples of this mechanistic organization can be found in the university community where there are very consistent sets of inputs and a well codified and understandable decision-making rules. Students applying for admission to or graduation from the university are examples of this type of mechanistic technology. Students must meet certain well-defined minimum standards for either action. The retention of faculty is yet another example of this type of technology. The tenure process is very formalized and subject to a very strict set of rules. Although the degree of centralization varies from university to university, the CSU system tends to be a very centralized system. The overlaying of the organic information-management organization on the superstructure of the mechanistic university administration is one of the major challenges facing the CIO.

Although there may be a high level of flexibility in the organizational structure of the CIO function because of constantly changing requirements, the CIO must present a consistent face to the users of its services. There are several methods for achieving this appearance to the university. First, the community should only interact with one information specialist on a consistent basis. The appropriate private sector model for this type of service delivery vehicle should be outside sales. Ideally, the outside salesman should become familiar with the needs, personality, and even the vocabulary of the organization which he is servicing. The information technologist who is working with members of the university should develop the same rapport with his users as a good salesman.
A second method for overlaying an organic structure on a mechanistic structure would be to separate the relationship between control and decision making. The control of the CIO organization would remain vested in the CIO and his immediate subordinates. The decision-making responsibility should be transferred to those individuals who are actively working with the users, whenever possible. This solution would present upper management with the control mechanism it needs, but it would allow for flexible decision making of the organic structure. Those working in the information handling areas would have the decision-making power and the ability to work independently. It should be added that this decision making ability on the part of the professional staff is a good method of increasing the job satisfaction of the professional staff. This is characteristic of the organic model. The maintenance of control at the centralized CIO level allows a constant interface with the institutional power structure.

The CIO model proposed below will work well for organizations which are highly centralized like the CSU system but will work even better for organizations which are more decentralized. The CIO's responsibilities should include the following functions: graphics, audio-visual services, telecommunications (voice, data, and video communications), academic computing, and administrative computing. It should be noted that the library is not considered part of the overall scheme developed here. Although the library is a major processor of information in the university, it is mostly

concerned with the acquisition and systemization of information rather than the storage and transmission of information. The function of the information-management organization would provide access to the information and not be more concerned with the content of the information. The function of the library, on the other hand, would be more concerned with the content of the information rather than access techniques to the information.

The relationship of these information-handling functions to the rest of the campus would be in a structure that resembles the relationship of the federal government to the states. The central authority would provide those functions which are necessary for the smooth operation of the whole. In those areas were the welfare of the whole is concerned, the CIO has the ultimate authority. All others rights and responsibilities would be delegated to organizations which use information technology. This federal structure is the key feature of the model which will be explained below.

A precursor to this model was developed by Robert Zmud and several others. The Zmud model calls for "entrepreneurial information-related behaviors by business units" with centralized planning and control. The major difficulty with this model is that it ignores the fact that there are certain functions which are central to the operation of the university the functions which must be delivered in a uniform manner throughout the organization. It would be the responsibility of the information management organization to provide the universal-organizational functions as a part of

the information infrastructure. These functions would include such things as telephone services, television transmission throughout the university, certain administrative computing functions, common academic computing, consultations, and the like. This common level of service would be provided to all members of the university community. Unique functions needed by various departments or units within the university would be provided by the unit needing the function. The unit would be free to develop a given capability or to even contract with the information-management function for required service. A case in point would be student instructional labs. Two levels of laboratories would be developed. The first level would be general purpose labs available to all students. These general purpose labs would be maintained and operated by the information-management group. A second type of laboratory would be developed for specialty uses such as music, art, and advanced mathematics. This laboratory would be developed by the department or school which needs the service. This department would be free to provide the service or contract for the service. It should be noted that if the department provides the service, it must follow the university-wide standards or provide all service from its own resources.

Other organizations with specialized needs would be free to develop or contract for services. The range of services provided by the information-handling group would range from simple machine maintenance to the complete operation of a functional area. The information-handling function would naturally provide many of these services because it is already on site and has the best knowledge of the overall university environment.

A major function of the federal government vis-a-vis the state is the role of regulator. This role is replicated in the CIO function. The CIO must
regulate those activities that are required for the smooth operation of the university. As a regulator, the CIO is invested with a high level of university-wide authority.

The CIO organization would consist of the following six organizations: Management, Operations, User Services, Contract Programming, Audiovisual Services, and Communications. Each of these organizations would be arrayed under the CIO in the traditional hierarchical management structure as illustrated in Figure 5.1. Each area would be headed by an individual who would hold the title of Director. The Directors would be responsible for the day-to-day operations of their specific areas. It would be the CIO's responsibility to coordinate the overall function of the organization.

Figure 5.1
Chief Information Organization

The CIO, in conjunction with his various directors, would develop the
overall information plan for the university. Each area Director would
develop a university-wide plan for his function. These plans would then be
integrated through group processes into the information plan for the
university. The CIO would be responsible for the development of the groups' 
strategic vision and for insuring that proper coordination takes place in the
development of the plan. This collegial planning process would insure 
cooperation and a degree of consensus in the direction of the organization for 
the next year. Planning would be carried o  to cover two distinct time frames. 
There must be a long-range plan which would address the three-to-five year 
needs of the university. This long-range plan would be strategic in nature. 
The tactical plan would cover a period of one year. This one-year plan would 
be the second planning level.

It would be the responsibility of each Director to meet with the users of 
his service on a regular basis to develop an understanding of the their needs 
and cumulatively the  needs of the entire university. The Director would 
then be responsible for the integration of these often competing sets of needs 
into a plan for his particular area. The Director would perform an important 
function of communicating with the users of information technology.

A Director must be a combination of a good technician and a good 
manager. The Director must be technically competent enough to be able to 
understand not only the substance of decisions but also the ramifications of 
decisions. Also, the Director should have the interpersonal skills to be able to 
work with users of information services as well as with members of his own 
technical staff. Within the CIO, operation the Director performs the 
important functions of middle management.
The organizational function which would have the most day-to-day contact with the general university population would be User Services. As mentioned earlier, information technologies appear to be overwhelming to the typical manager or employee of an organization. It is the responsibility of the User Services group to make this technology usable for the employee or student. The User Services group would be divided into three main groups: Help Desk operators, consultants, and laboratory managers. Each of these functions would require a different type of employee to preform the operation correctly.

Information systems are very complex. Problems occurring within a system are often difficult to understand from the perspective of the typical user. The Help Desk would assist these users in the initial solution of their problems. A person with a problem would call the help desk for assistance. This call would probably come in the form of a telephone call. The Help Desk Operator would attempt to solve the user's problem immediately. If the Operator is not able to solve the problem, the Help Desk Operator would pass the problem on to a specialist within the CIO function for resolution. The Help Desk Operator would also be responsible for the tracking of problems passed on to specialists to insure that the problem has been resolved in a timely manner.

A secondary responsibility of the Help Desk would to allow students, faculty, and staff access to those resources which are secured. This is largely a clerical function, but it must be completed in an expeditious manner. The intention of the Help Desk is to allow the user to have a one-stop place to gain access to information-processing facilities.
The Help Desk would be supervised and staffed by employees who had a very high level of technical ability but, equally importantly, a high level of interpersonal skills. Interpersonal skills are important because users reporting problems with information equipment are often frustrated and in need of special handling.

Backing up the Help Desk would be a cadre of user consultants. These consultants would be experts in various information related functions such as database management systems, statistical packages, and other software programs. The primary function of these consultants would be to give in-depth assistance to users of information systems needing assistance in the use of these types of systems. Referrals to the consultants would come from referrals by the Help Desk. Consultation would take place either in the user's office or the consultant's office. These individuals would be well trained in their particular specialty, but at the same time they would have a reasonable level of interpersonal skills.

These consultants would be responsible for the development and delivery of instruction related to their specific areas of expertise. The predominate form of instruction would be classes offered to all members of the university community on a periodic basis. Consultants would additionally work with the audiovisual group to develop multi-media training material for spot training of various users. These spot-training courses would concentrate on one part of a topic taught in the regularly scheduled classes. Faculty and professionals who do not respond well to traditional training methods would have their needs met by specifically designed training material. These small training presentations would be designed to meet the rather specific ad hoc training demands of this segment
of the user community. Assisting the Consultants in the development of materials would be an Instructional Methods Specialist.

The second portion of the CIO structure would be the Operations division. The Operations Division of the organization would have the responsibility for the day-to-day operations of information-processing equipment. This group would have the responsibility of insuring that information would be there when it was needed. This group would work on a 24-hour-a-day, 7-day-a-week basis. The Director of Operations would be responsible for the operation and maintenance of all equipment operated by the CIO function.

The operation and maintenance of equipment implies two discreet functions. The first is the operation of equipment. Operation of equipment typically, as stated above, takes place on a 24-hour-a-day, 7-day-a-week basis. Assisting the Director of Operations would be Shift Supervisors whose responsibility would be to insure the smooth operations of the equipment which would be under their jurisdiction during a specified period of time. The Shift Supervisor would also be responsible for the scheduling of staff to insure that all equipment was manned when needed.

The second portion of the operations requirement is maintenance. This maintenance would consist of two parts. The first and most obvious part is the physical maintenance of equipment. A large information organizations must, because of necessity, have a number of equipment technicians who repair equipment when it is broken. This group of technicians would be headed by a lead technician. The Lead Technician would be responsible for the scheduling of staff and for insuring that proper replacement parts were available when needed.
The second maintenance component would be what are called Systems Programmers. Many pieces of information-management equipment come equipped with software. The Systems Programmers would be responsible for the maintenance and updating of this associated software.

The common university-wide asset of student and financial data is so important that it should be administered centrally. A group of professionals should be maintained to insure the proper protection and use of this data. Data that is centrally maintained is contained on a large mainframe computer and is extremely difficult to access and to manipulate. The Professional Programming Group would be responsible for insuring adequate access and protection to the data.

A large portion of the university community has neither the time nor the ability to develop interfaces with information. This interface development function is vested in a third functional area: administrative computing or contract programming. Traditionally, contract programming is divided into three areas: student records, financial, and miscellaneous systems. The student records section is responsible for data regarding students from the time of application until the time of graduation; the student is then transferred to the alumni-relations system. This student records section includes the area of admissions, records, financial aids, and curriculum management. The financial section consists of databases which contain information about the financial situation of the university, payroll, general ledger, accounts receivable and the like. Miscellaneous systems include alumni relations, library automation, and the like. Each of these functional areas would be headed by an Assistant Director who would be responsible for developing the workload and insuring the quality of the work
completed by the user groups.

Members of this area would be specially trained in both information management and the functional area they are serving. It is important that these contract programmers develop an affinity for the areas they serve. Staff members in this area must feel that they are actually working members of the organizations in which they serve. With this high level of identification, employees become identified by their constituent group as a member of that group rather than as a member of the centralized information-processing organization. This identification of the staff member with the constituent group is an important part of making a responsive organization and also for making an organic organization work within the context of a mechanistic organization.

Communications is the area which holds all of the other information-managing organizations together. This group would be made up of specialists in voice, data, and video communications. This group would be responsible for operating the system and insuring that maintenance and other system-related tasks were preformed on time. Although the main responsibility of the Director for Communications would be to keep the existing communications systems operational with a minimum amount of down time, there would be a significant planning function. The demand on communication facilities should be closely monitored to insure that these facilities are not in danger of being over-utilized. If the threat of over-utilization is found, then the Director should develop capacity to meet this demand.

Audiovisual services is responsible for the creation, management, and storage of information in non-computer-related media. This definition is
exclusive of the traditional paper-based media which is the responsibility of
the library and special collections materials which are also a part of the library.
The major areas of responsibility for this area are film and video production
and delivery. The group which contains a broad spectrum of employees must
be responsible for the curriculum-directed production services of the
university.

This group would be divided into three subgroups: repair, production,
and management. The repair group would be responsible for the
maintenance and repair of all audiovisual equipment such as cameras,
projectors, and the like. This group of technicians would also be responsible
for insuring that adequate equipment was available for the production staff.

The production staff would be responsible for the development from
conception to finished product of instructional materials. This group would
be centralized because of the high costs involved in the production of this
type of material and the relative rarity of the need for this type of service by
the typical instructional unit of the institution. This creative branch would
have a large variety of talents.

An important part of this structure would be a technical writer. This
technical writer would be responsible for the preparation of a newsletter
which would be used to disseminate information about the various activities
occurring in the organization. The technical writer would also have the
responsibility of reviewing all technical publications of the office.

The final segment of the audiovisual group would be the
management. This group would be responsible for the scheduling of the
facilities and the curriculum collection for the organization. The curriculum
collection would be in high demand, and scheduling would be in great
demand. Because of this great demand, care would have to be exercised to insure that materials are not overbooked. The final function of this management group is the maintenance of the collections developed by the rest of the Audiovisual Department.

The management portion of the CIO office would be responsible for the day-to-day operations of the organization. This group would consist of a business manager who would be responsible for insuring that funds were used in an appropriate manner and that the office would work in a timely manner. Several clerical positions would be needed to assist the business manager.

Although this group would be, for organizational purposes, aligned in traditional hierarchical manner, it would function in a considerably different manner. This entire group would use the hospital function as a model. If one were to look at the functioning of a hospital, one would see the similarities in the manner services are provided. For example, take an emergency situation. The patient is first seen by the emergency room staff (User Services) who either solve the problem or make a preliminary diagnosis. If the problem is serious, the patient (user) is passed on to a house physician in a ward (consultant). It is the role of the house physician (consultant) to insure that the patient's complaint is solved. To solve the patients complaint, the house physician (consultant) can call on any of the other house staff who have more expertise or can, in certain cases, call upon specialists who make up the staff. The information-management organization would function in a similar manner. This is the model to which Drucker was referring in his hospital analogy.92

92 Drucker, 54.
The structure and function of the CIO would be large and complex. This is in keeping with the information function within the context of the university. To adequately meet the needs of the contemporary university, information management must be diversified. Each must be manned with specialists or workers who are experts in their chosen field. These experts must be tied together with a commitment to provide high quality service to the university community.

Indeed, the key function of the Chief Information Officer in higher education is to provide services to users of information technology in an efficient and effective manner. While the CIO is a policy maker, the responsibility of service delivery must remain primary. To be able to adequately provide service the CIO must organize his staff in such a manner as to be able to quickly and efficiently meet the constantly changing demands of the contemporary university.
CHAPTER VI

CONCLUSIONS

The concept of the Chief Information Officer as a senior officer, who has organizational wide responsibility for the management of information technology, is little more than five years old. In its short life span, this concept has done much to change the management of information in organizations. In the private sector, the CIO is a well-established concept, at least among the larger corporations in the country with more than 50% of the Fortune 100 manufacturing and service having CIO's. Most CIO's currently come from the ranks of computing and are perceived as having little knowledge of the organization's overall function. To be effective, the role of the CIO will have to change; and the CIO will have to gain more access to management circles so that the promises of information management can be brought to bear on the problems of corporations.

A fruitful field of study is the effect of information technology on the operation and structure of business. Several generally accepted theories of information management within an organization have been developed and are in current use in the analysis of business structures. The common thread among these theories is the conclusion that information will become central to the function of the organization. These theories have two points of origin. One theory, was developed by Nolan, uses computing as a base and looks at information strictly from the point of view of data manipulation. A second theory looks at businesses from the point of view of critical resource management. The culmination of this theory is information is or will soon
become the critical resource of business.

Information management has changed the very structure of businesses. Because of increased information and more rapid communication abilities, the role of middle management has decreased. The decrease in the number of middle managers has led to a flattening of the organizations structure of most entities. One result of the flattened organizational structure is the decentralization of decision making within the entity. The decentralized decision-making ability has also been enabled by the greater availability of information. The increase in information has enabled workers to deal with inputs which are much less routine. Many organizations are also faced with an input structure which is less routine and have adopted decision-making strategies which are also less routinized. This decentralized decision-making process has led to organizations which are much more organic in nature.

The CIO function is transferrable to the public sector with some modifications. Because of differences in the operational environment between public and private organizations, some changes must be made in the role of the CIO. The differences between the operating environment of the public and private sectors evolve out of service to the public. These factors include more goal ambiguity, less direction, greater complexity, more accountability and a larger number of external linkages. The CIO should not be a policy maker, but he should be employed in a more functional position.

In the public sector, the CIO should not be a policy-making officer. In the Synott definition, the CIO must be a pro-active change agent. This implies that the CIO must be a technologist. If the CIO is a technologist, he may not be able to adapt to the political needs of the moment.
By contrast, while higher education is not a truly public organization, it is in many respects a private sector function which happens to be funded by the state. In this model, the CIO should assume a higher function within the organization, because the technology with which the CIO works can allow the institution to use information technology to its competitive advantage. Information-technology management and the university have had an association dating back to at least the 14th century. The association of the two functions has become stronger and more intricate over time.

The role of the information-management function in the contemporary university should be to provide a central core of services which are necessary for the day-to-day operations of the university, and they are at the same time necessary for the long-run good health of the institution. This centralized unit should help other units to develop those information-management functions which they may need.

The information-management function should be made up of specialized groups from which individuals are drawn on a regular basis to solve specialized problems. The combination of a traditional hierarchical relationship of the overall university and the matrix management structure within the CIO function provides one to the greatest challenges to the CIO. By providing the institutional information infrastructure functions, the CIO can cut across lines of authority and carry out those functions which are absolutely vital to the function of the university. To provide a higher level of flexibility to meet the constantly changing demands of contemporary information management, the matrix structure in the CIO's area can exist within the larger more hierarchical organization.
Using this methodology, the information management group of the university can truly help higher education to fulfill Washington's prescription, as stated in his farewell address to educate a politically aware electorate: "Promote, then, as an objective of primary importance, institutions for the diffusion of knowledge. In proportion to the structure of government gives force to public opinion, it is essential that public opinion be enlightened."\textsuperscript{93}

\textsuperscript{93}American Historical Documents v. 46 (New York, B. F. Collier & Sons Company, 1910), 243.
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