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GUIDELINES FOR SETTING UP A MODERN INFORMATION PROCESSING SYSTEM IN SMALL TO MEDIUM INDUSTRIAL ENTERPRISES*

Prepared by the UNIDO Secretariat**

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* This document has not been edited.

** Based on the work of Patricia Griffith Haynes, UNIDO consultant.

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PREFACE

In the last two decades information processing technology has taken a quantum leap in revolutionizing the way in which the world's business is conducted. The reality of the current competitive rules of engagement requires industries, both large and small, to not only be knowledgeable in that technology but to apply it well.

The blurring of national and international markets that has begun to take place and will continue to intensify in the forseeable future demands an enlightened approach to information processing.

These GUIDELINES have been developed as a means of assisting small to medium industrial enterprises to achieve an appropriate and effective information processing capability. In order to realize that objective, the GUIDELINES provide the reader a working knowledge of information processing technology because computer literacy is key to the successful implementation of an effective system. Despite being directed to small and medium sized industrial enterprises, the content of this document is easily applied to other areas.

While the scope of this document does not allow finite detail, it does delineate the major steps that must be taken to set up a modern information processing capability. It leads the reader, hopefully comfortably, through attaining that capability from initial conception, discussion and decision to proceed through the planning period, determining requirements, designing and test for the " best fit" system and structuring it within the organization.

CHAPTER 1

INTRODUCTION AND DEFINITION OF THE INFORMATION PROCESSING NEEDS OF AN INDUSTRIAL ENTERPRISE

INTRODUCTION

PURPOSE

The purpose of these GUIDELINES is to help managers of small to medium industrial enterprises create the information processing capability necessary to satisfy the current and future needs of their organizations.

PARAMETERS

There are several important points that must be made in the beginning. These points set the parameters for the Guidelines and how they are to be used.

First, by the year 2000 there will be little or no distinction between what we now know as "national" and "international" markets.[1] In order to survive, an enterprise

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1. The 1992 emergence of the European Community will only intensify and polarize the world competition between the major geographic powers. This will make your job even more difficult and sensitive to the survivability of your enterprise.

must be able to meet their world class competitors in the world marketplace and best them with better products and services. Consequently, as never before, an enterprise's strategic, tactical and operational decisions must be based on the most reliable information about what is going on inside and outside of both the enterprise and its National borders.

Moreover, information technology, as we see it, embraces three distinct elements of an enterprise's emerging information technology base: office technology (sometimes called office automation), telecommunications, and information processing (data processing). Unfortunately, these technologies are not moving at the same pace; nor are institutions of higher education turning out managers equipped to successfully integrate these technologies within the available manpower setting of the industrial enterprise. Consequently, the successful Information Processing Unit Manager will have to very carefully orchestrate these three interrelated technologies within an environment of relatively unprepared and sometimes indifferent skill mix.

Second, in using these GUIDELINES, the reader must be aware of the major process and product technologies underlying the telecommunications, office technology and information processing computer hardware and software (that together make the modern information processing units possible) have a half life of less than six years. Consequently, by the time you read this publication there will be different and sometimes better technologies emerging, and sometimes actually available, to satisfy your information processing unit needs.

To effectively translate these GUIDELINES into information processing units that truly meet the information needs of the enterprises, managers must have a clear understanding of the kinds of information that are required. Then, and only then, can the information processing unit be effectively tailored to the enterprise's needs.

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Throughout these GUIDELINES, we will treat information in three distinct categories:[2]

1. STRATEGIC INFORMATION - is the kind of information needed to answer the questions about <u>what</u> the enterprise should be doing. This kind of information is focused primarily outside of the enterprise and deals with economic, political, and technological trends, as well as other more complex and frequently long term competitive data. It forms the basis for the development of competitive strategies that are needed for the enterprise to survive. And it becomes a major input to the selection of the enterprise's line(s) of business(es). For example, significant strategic information is contained in an enterprise's Business Plan or a Life Cycle Marketing Plan for a major product or service commitment.

2. TACTICAL INFORMATION - is the information that is needed about <u>how</u> to carry out the strategic approaches. It deals primarily with how the enterprise will commit its resources. An example would be a product's yearly marketing or financial plan.

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2. The time horizons identified with these categories are not fixed. In fact, they will vary depending on how the enterprise organizes itself for global competition. What is important is that industrial enterprise managers conscientiously identify the kinds of information they are dealing with and ensure that it is made available at the appropriate time. As you will see later the time costs associated with the gathering of information vary substantially with the kind of information being sought and its eventual use. For example, if one of the enterprise's sales personnel finds out from a customer that the world's largest machine tool manufacturer is selling flexible machining centers to them, and that customer cannot afford the centers under normal financing arrangements, then it is apparent that the machine tool manufacturer is going to get into the business of financing the acquisition. This piece of what would be considered operational information is, in reality, an important piece of strategic intelligence about the real price for acquiring the equipment.

3. OPERATIONAL INFORMATION - is the additional information needed to determine <u>how well</u> the resources of the enterprise are deployed to ensure efficient and effective operations. While the STRATEGIC and TACTICAL information are primarily focused on activities outside the enterprise, the OPERATIONAL information is focused internally on the enterprise's day-to-day allocation of resources. One example of operational information would be the daily or weekly production schedules.

Obviously, these kinds of information all exist at the same time. For example; While strategies are being worked out for one product/service offering, tactics are being developed for another, and, at the same time, operational requirements are being improved for the existing product/service offerings and planned for those about to emerge. The degree to which each of these kinds of information is needed depends on both the state of the product/service offerings' life cycles and the position of the enterprise within its markets. In the interest of simplicity, we will discuss these information needs sequentially as though they exist in mutually exclusive environments.

Because of the changing rules of international engagement, today's successful managers must recognize the urgency associated with the acquisition of data and the production of useful information. What many do not recognize is the speed with which changes are taking place. For example, in the early 1950s the United States did close to 75% of all the world's reported research and development.[3] At that time the monitoring of potential change could be done with relative ease simply by monitoring the activities of the U.S. Patent & Trademark Office and a few selected laboratories. And, conveniently, this information could be gathered in one language - English. Today, however, the United States is

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3. As we all know, it is the R&D that forms the beginning of the innovation cycle, which when successfully done produces new products and services that generate a nations wealth and, of course, that of the associated enterprises.

doing only about 40% of the world's research and development. This is not because the United States is doing less R&D; in fact it is doing more! But so are other countries! As a result, the entire world's R&D information base is not only increasing, (in the language of the individual country - generally not in English.), but it is also becoming more difficult to track/monitor.

Two other factors need to be mentioned in order to understand the impact of the changing R&D environment on the information managers:

(1) the collapsing product life cycle

(2) the resulting obsolescence of both the management and the general work force.

A scant two decades ago the average product life cycle was ten to twenty years. Essentially, that about encompassed the effective working life of an individual. At that time managers and operators entered their respective work lives confident that they could master both the product and process technology of their times with their secondary, undergraduate, and graduate training. And they did! But now, the product life cycle has substantially shortened.[4] In such things as consumer electronics, computers, and telecommunications it is less than four years; and it is approaching that time frame in a growing number of other areas (e.g. biotechnology, specialty chemicals, and optics). As a result, both managers and operators are finding that their basic education is not sufficient to carry them through a full work life.

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4. And, of course, so has the associated process technology life cycle shortened. While the process technology changes occur over a longer life cycle, when they do occur the change is dramatic. This is well illustrated by looking at the differences between the 1970 process technologies of the Japanese automotive manufacturers and those of the U.S. Detroit based manufacturers for the same time period.

The conditions just described are important to the Information Processing Unit Manager because quite frequently the managers he serves will be technically obsolete. This technical obsolescence makes it very difficult for them to effectively synthesize important and constantly changing strategic information. Compounding this problem is the fact that the compressed product life cycle is putting greater pressure on the innovation cycle and the effectiveness of the associated R&D. This means that both investment and market decisions are going to have to be made much earlier in the innovation cycle. As a result, the cost of bad decisions, especially those that are strategic in nature, is more difficult to recoup. In the highly competitive global markets the cost of bad decisions often results in the demise of the enterprise itself.

Clearly, the job of establishing an effective information processing unit depends on the manager's understanding of the need to acquire, synthesize, and produce the most credible information available on timely basis. It is equally important to understand the difficulties managers at all levels face and being committed to help them as much as possible. The more an Information Processing Unit Manager can make the managers he reports to comfortable with the fact that -- what was true yesterday may, based on more recent information, no longer be true today -- the better will be the long term survivability of the enterprise. Obviously, in order to foster the desired degree of management comfort, the effective information processing manager must keep sufficiently tuned into the operational needs of the enterprise to anticipate the information requirements.

There will be a natural tendency for the reader to want to apply these GUIDELINES to all types of organizations without reservation. That will not work! To be effective, the application must be, at a minimum, tailored to the specific characteristics of an enterprise in terms of:

- Its size - in terms of both employment and revenue.

- Its domestic and foreign market(s) and selected market niche(s).

- Its management and workforce skill mix.

- Its underlying process technologies and the products they support.

- Its degree of information and computer literacy.

- Its process and product life cycle(s)

- Its industry, market and major competitors.

There is an art to orchestrating all of these considerations into a cohesive Information Processing Unit. An art that requires continual honing of deductive, intuitive and analytical skills, as well as the ability to translate those into practical applications. It is not an easy task; yet the results are worth the time and effort that must be invested.

If the Information Processing Unit Manager is successful, the enterprise will have a far better chance of surviving in the international market place. If, on the other hand, the Information Processing Unit Manager neglects these considerations he is setting up himself and his management for failure!

Without a doubt, there is much more that goes into the development of an effective Information Processing Unit than can ever be presented here. The task involves a wide variety of issues that range from the behavioral aspects of a technologically unenlightened management and operational work force, to the need for the information manager to ensure that his own competence is not degraded by the rapidly changing information process and product technologies.

Consequently, the scope of these short GUIDELINES must, of necessity, be limited to the bare essentials for establishing an effective Information Processing Unit. It will be left to the enlightened self interest of those who read and understand the message of these GUIDELINES to more adequately prepare themselves through additional research on their own.

DEFINITION OF INFORMATION PROCESSING NEEDS

The identification, assessment, and evaluation of information processing needs are three distinctly different and separate exercises. While there will be a great temptation to allow overlap, it is not advisable because it will only confuse the process. Therefore, it is of utmost importance that this process be guided by a person within the enterprise who can comfortably enforce these very important distinctions. The quality of the final product, which is the basic building block of the information processing system, is dependent upon the quality of the work done in this area.

IDENTIFICATION OF NEEDS

Identification of the information processing needs of any size organization begins with building an inventory of the Strategic, Tactical, and Operational information[5] that is currently being used.

Despite whether an enterprise is currently established or is just being formed, the best approach is to build an Inventory of Information Needs based on the major functional areas of management such as planning,

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5. Please refer to the definitions provided earlier in this Chapter.

scheduling, production, raw materials, inventory, and supplies. The process begins by bringing all 'interested parties' together to contribute.

Meetings and discussions should result in lists that can be added to any existing information processing needs lists. Solicitation of information needs in writing adds another dimension. It can be distributed to those present at meetings/discussions to allow them to formalize their suggestions as well as to those not present in those meetings/discussions in order to encourage input from all areas. (Frequently the identification of information needs comes from unlikely sources, especially in the operational information area.) This is the starting point.

An inventory of the types of information your competition is utilizing must be added to the inventory developed. And finally, if the enterprise is financially capable of doing so, it is advisable to have the benefit of independent review of the results of the Inventory of Information Needs. This is especially true for the marketing, and financial functions.

ASSESSMENT OF NEEDS

Brainstorming sessions are an effective next step to determine not only the usefulness of any data currently being collected, but also the new information processing needs that have been identified. In the beginning of the process of defining the enterprise's information processing needs, it becomes difficult to separate the identification of information processing needs and the assessment of those needs. However, this total process helps people to articulate what it is they want as well as how they intend to use the information, and ultimately, whether it will tell them what they need to know.

CHAPTER 1

In the formulation of any good system, working through the "human equation" to arrive at a consensus is most rewarding and inevitably builds a cohesive team. This is especially true in the information processing area because here managers and employees working together to build an information processing system are much more willing to support it, to know how it works, to know how to adjust it for any required changes, and to know how it impacts their viability as an organization.

The assessment of the identified needs is a relatively straight forward process designed to put preliminary priorities on each need as it relates to the stated strategic, tactical, and operational objectives of the enterprise.

The assessment exercise builds naturally upon the exercise of compiling the inventory of information processing needs and should be based on criteria developed and agreed to before the assessment is initiated.

> For Example: In the production of items that require adherence to close tolerances, it is critical that information concerning exceeding production control limits be made available to the proper decision-maker as quickly as possible in order to prevent making scrap.

In this case one criteria for assessing this operational information processing need would be the response time (How long does it take for the decision maker to get the information?). While response time is applicable as a criteria for all categories of information processing needs, the amount of response time will vary with each information need and must be taken into consideration not only because of the need for timely information, but also in order to be sure to prevent overloading the information processing system. Additionally, operational information on the ability of manufacturing to hold to specifications takes on added importance if the tactical objectives are to be able to distribute the product world-wide without having a high investment in a spare parts inventory.

It is important to remember the associated costs in each stage of building your modern computer based information unit. Keeping cost in mind while compiling the inventory and assessing that inventory will help sort out those needs that are worth the investment. Inevitably an elimination process occurs. This cost association becomes even more evident as the information processing needs are evaluated.

EVALUATION OF NEEDS

The evaluation of those identified needs that have survived the elimination process is based upon the ability to satisfy those needs within the existing or available resource constraints of staff, skills, money, equipment, and facilities. The impact of satisfying each information need can be gauged by applying internal rate of return analysis or subjective, but informed, managerial decisions.

Perhaps one of the easiest ways to start to evaluate the information processing needs of an enterprise is to look at the costs associated with decision making. As the potential cost of a wrong decision increases, so must the credibility of the information to the one making the decision increase. Stated differently, the higher the risk, the more the decision-maker must be sure of the credibility of the information on which the decision is based.

> For example, if an enterprise manager is to decide on a major commitment of resources for the introduction of a major new product or service, the entire survivability of the enterprise may be at stake. In this situation the Information Processing Unit must provide an extensive menu of

internal and external information to support that decision process. On the other hand, if an enterprise manager must decide on whether or not to purchase a replacement piece of equipment for a mature product offering, then the Information Processing Unit need only provide the necessary financial and workload information to determine the internal rate of return on the investment.

It turns out that the cost of a wrong decision grows proportionately as the kind of decision moves up the scale from those whose primary nature are operational to tactical, to strategic. Similarly, the cost of the information needed to support these decisions usually increases in the same fashion as does the complexity of the information itself.

Examination of the key decisions that must be made in each enterprise and the associated consequences provides the basis for developing the criteria to be applied to the effective evaluation of the Information Processing Needs Inventory.

By working through this process, each enterprise will establish its own criteria for evaluating its information processing needs. But, in general, the criteria should at a minimum be based on the following:

1. What strategic, tactical, or operational information need does it satisfy?

It goes without saying that any information processing need must fall into one of these categories. No organization regardless of size has the time or resources to process "nice to know" type information. This may sound ludicrous but that, in fact, is really happening in more organizations that one would think. It becomes most evident when a close examination is made of the "usefulness" of the reports issued within the organization.

2. How soon after the fact (or occurrence) is the information needed?

Timeliness is the key here. If the appropriate management official does not have sufficient time to react when the information reaches him, all the resources that have gone into developing, compiling, and processing that information have been wasted. Depending on the criticality of the decision to be made it can mean the difference between success and failure of the organization. The best information in the world that has arrived too late to be useful is analogous to "the operation was a success, but the patient died".

3. How much data must be processed to provide the information being sought?

This is important primarily from the perspective of scheduling the processing and evaluating realistically how much can be achieved within an acceptable time limit. The size of the effort to process it is not the determining factor in whether the information is important or useful. It is, however, very important to determining (1) how it will be processed and (2) the best utilization of computer capacity.

4. How much lead time is required to meet the deadline for the information need?

This is another important fact in scheduling the processing of the information and in determining how it is to be processed. When the information is important to management and the lead time to process it is too long, consideration should be given to processing it outside the organization.

REQUIREMENTS DEFINITION

When all the assessment criteria have been developed and the combined Inventory of Information Processing Needs has been evaluated against that criteria, the Inventory of Information Processing Needs should be finalized. At this point the requirements definition can begin.

The requirements definition stage builds naturally on the preceding steps of Identification, Assessment, and Evaluation. It is the step that formalizes the enterprise's requirements. The formal requirements clearly delineate what information is required, who is to receive it, when it is to be received, and any special treatment of the data that is necessary. In addition, a requirements definition should relate the information processing needs to the technical aspects of getting the job done. The specifications for the appropriate software and hardware must be drafted and matched to the requirements in order to ensure procurement of the most effective technology.

INFORMATION PROCESSING TECHNOLOGIES

After establishing the information goals of the enterprise, determining a general direction for information processing, and evaluating resource requirements, management must decide what technology to employ. In most cases THERE IS NO SINGLE CORRECT CHOICE. A variety of methods, equipment, and procedures may be effective in meeting the goals of the organization. The following information is intended to give an overview of technologies currently available, and the general criteria for focusing on particular technologies for implementation. The categories relating to size and capacity overlap considerably. Because of this, careful analysis should be employed when making choices. Any enterprise must evaluate and analyze its particular requirements in order to match organizational growth with the most likely predictions of technological advancement.

COMPUTER SYSTEMS

The following descriptions provide a general idea of the intended scope of typical computer systems.

SUPERCOMPUTERS

In the realm of computing, these are the giants. These systems are used in military forecasting, analysis of large scale weather systems, geological data analysis, and specialized scientific processing. These units are often accompanied by liquid or gas cooling systems, specialized power conditioners, and customized processing boards. Installation requires special environmental conditioning and highly trained technical personnel. Nearly all software for supercomputers is specialized for tasks uniquely identified by the user organization.

MAININFRAMES

Mainframe computers are designed to serve the needs of large scale businesses and government organizations. They are capable of efficiently utilizing numerous large storage devices, providing high speed peripherals for printing and communications, and accommodating simultaneous access by several hundred users. Again, specialized installation procedures and personnel/skills are required. Software for these systems is more generic, but often entails local customization for optim m performance.

SUPER-MINICOMPUTERS

These systems provide many of the same services as mainframe computers. The difference typically lies in processing speed, the number of users able to obtain simultaneous access, the quantity and size of peripheral storage units, and the amount of expansion which can be accommodated. Installation is normally in a controlled environment. Software on these systems differs very little from that of minicomputer systems, with gains coming primarily from sizing.

MINICOMPUTERS

Minicomputers were the symbol of the computing revolution of the 1970s. Even as we approach the 1990s, minicomputers offer continuing advantages to a wide range of organizations, regardless of size. They differ from larger systems in that they typically are designed to accommodate fewer simultaneous users, smaller scale storage systems, and a narrower range of directly attachable peripherals. Installation of minicomputers is split among noncontrolled and controlled environments with fewer requirements for specialized power conditioning. Standardized software products are often available from a wider range of vendors, providing a competitive market from which to make selections.

MICROCOMPUTERS

As mini-computers represented the computing revolution of the 1970s, the micro-computers played the same role in the 1980s. Ranging from systems designed for single user, small scale, home units to sophisticated, high powered, engineering work stations, micro-computer systems have changed the way in which the world views computing. Rarely requiring any specialized installation techniques, environmental conditioning, or scarce technical personnel, these systems are frequently user installed and often moved from one location to another. The software products for micro-computer systems approach the status of commodities. Specialized software application developments, however, are still likely to entail considerable time and expense.

NETWORKS

While networks are not a class of computers, they have so significantly affected the methods of information processing, that they need to be considered in any decision regarding the selection of a computing system. Networks range from simple cabling schemes to connect 3 or 4 users, through Local Area Networks to connect upwards of several hundred stations at a facility, to Wide Area Networks which may connect thousands of stations around the world. Not only do such networks connect users, but they allow for resource and process sharing between similar and dissimilar systems. Networks covering Personal Computers, Specialized Workstations, Minis, Mainframes, and even Supercomputers can be designed to meet the needs of a complex organization, or to pool the resources of hundreds of mixed sized entities and provide a competitive position in changing market environments.

PERIPHERALS

Computers, in and of themselves, provide little more than 'raw power'. To be useful, methods must be available for data storage, input, output, and communications. Fortunately, advances in the computer industry have provided for such a wide range of peripheral equipment, that it is hard to imagine a set of organizational requirements which cannot be met by standard products. Admittedly, applications in visual and voice recognition, real time data analysis, and scientific research may require significant financial resources, but the techniques to address a wide range of even the most demanding requirements are available. THE REAL DIFFICULTY IS IN MATCHING THE PROPER CHOICES AMONG THE RANGE OF COMPONENTS AVAILABLE. It is imperative, that the people assigned the responsibility of designing information systems be aware of current technological advances. This is true of company personnel as well as consulting organizations. Outlined below are general categories of peripheral equipment to be considered in the design of information processing systems.

STORAGE SYSTEMS

In the earliest computer systems, storage and memory were equivalent. Computer memory systems were actually composed of sets of small magnetic cores. When the power was removed from these systems, the memory remained in a known state. Modern systems, with very few exceptions, depend on volatile memory to provide the functions formerly assigned to "core memory". When power is removed from these systems memory, with the exception of a few critical firmware components, the entire memory is lost. The programs and data needed for information processing activities are stored on peripheral devices. The same is true for the storage of historical data (archives) and critical backups. In today's market, there are many types of systems available to provide storage.

DIRECT ACCESS STORAGE DEVICES (DASD)

For nearly all information processing systems, DASD devices are disk drives. Units consist of both removable and non-removable disks, having multiple platters of magnetic media. The units in which they are housed contain specialized circuitry, motors, and articulating arms to provide access to the stored data. They are normally attached to the computer system by high speed channels which make use of special interfaces and memory access to allow random access to the data on the disks. Storage capacity and throughput (access speed) are the major criteria in the selection of DASD devices.

TAPE SYSTEMS

Magnetic tape systems also come in a variety of types, ranging from small data cartridges to high capacity reel systems. These units provide excellent storage choices for backups and archives. Conceptually, the key difference between tape systems and disk systems is that the tape systems are unsuitable as direct access (random access) devices.

OPTICAL SYSTEMS

While most optical storage systems could be classified as DASD devices under the strictest definitions, there are key differences which demand separate consideration. Optical systems are currently marketed as Read Only (previously stored information), Write Once Read Many (WORM), and a very few Read/Write systems. It is only the Read/Write systems that can be thought of in the same manner as standard DASD devices. WORM optical systems seem destined to have a major impact on organizations which have large quantities of relatively stable data. Whether the Read/Write systems will have the same impact is not yet clear.

INPUT

How will data be brought into the information processing system? A wide range of methods are available. For our discussion, we will bypass the earlier 'card systems', now considered more of an historic curiosity than a valid choice for business systems.

DUMB TERMINALS

In the majority of systems designed over the past 20 years, data is entered at keyboard units. Typically, these units have been attached by direct cabling to modem devices to mini-computers or mainframes. Operators key from documents, normally assisted by screen formats generated from applications residing on a 'host' computer. Processing at the host may be continuous (occurs as it is keyed in) or by batch processing (compiled and processed intermittently as groups.) Little, if any, manipulation of the data occurs at the point of data entry. These devices, because of their limited capabilities, have become known as dumb terminals.

SMART TERMINALS/MICROS

As data input requirements expanded, and the need for more accurate data was recognized, 'smart terminals' were developed. These 'smart terminals' offer a limited amount of local data input validation, increased buffering, and enhanced communication capabilities. In many cases, these units are simply specialized microcomputer systems. In fact, many of the current distributed input systems rely on commercially available workstations with project specific software for the data input functions.

POINT-OF-SALE (POS) SYSTEMS

Many commercial activities result in customers passing through a specific processing point to acquire products and services. Typical examples are grocery stores, gas stations, and postal services. In years past, a 'cash register' served the needs of these enterprises, with the proprietor bearing the burden of daily, weekly, monthly, and annual accounting procedures. In today's market, the cash register is enhanced by specialized computing equipment which provides interfaces to accounting, inventory, and performance tracking systems. The variety of customization possible with these systems allows for adaptation to a wide range of commercial, government and scientific applications.

SCANNING AND SENSING SYSTEMS

Just as the 'cash register' systems have changed, so have the methods for inventory control, material handling, and component identification. Systems are now available which take advantage of special markings on packages, or which read inputs from forms completed by customers and clients. These are often coupled with POS systems (see previous paragraph) to allow electronically "scanned' input of merchandise purchases. Applications have been developed ranging from the scanning of registration tags on vehicles for automatic toll booths to the monitoring of prison parolees through the sensing of special collars. It is not likely that the pace of developments in this area will decrease over the next decade.

SPECIALIZED SYSTEMS

Many enterprises find economic advantage in the development of specialized data input systems covering requirements unique to their business. Capturing real time meteorological data for use in decision based systems may be of benefit to manufacturing facilities which can alter energy requirements according to current environmental heating conditions. Similarly, continuous tracking of currency exchange rates would have obvious advantages for international commodity traders. Other systems designed to utilize voice recognition and image processing techniques are beginning to appear in commercial data processing environments. To meet these types of information needs, systems can be developed which accept input from nearly any source which provides identifiable discriminators.

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OUTPUT

While it is actually the ability to make decisions based on the computer that has changed the business environment of the late 20th century, it is the physical form of the output that is the most visible result of the financial resources invested in an information system. Methods of output include printed materials (using a myriad of technologies), transparencies, photographs, monochrome and color screen images, projected images, synthesized voice, etc.

DISPLAYS

Although normally thought of as an integral part of many of today's computer systems, display systems simply represent another form of output from an information system. Available systems include low and high resolution monochrome and color units, LCD, and plasma displays. Nearly all commercial needs, and many specialized scientific requirements can be met by 'off-the-shelf' components. For extreme environmental conditions specialized displays can be fabricated according to the enterprises requirements.

PRINTERS

Probably no other category of output devices has received such a boost from recent technological advances as printers. Printers were once a common set of oversized, ink stained, monoliths which provided uppercase output only. Now they range from battery powered ink-jet systems to large scale pageprinters. Color output, high resolution graphics, double-sided printing, mixed text and graphics, - all are available from a variety of commercial vendors. As with other components of an information processing system, an enterprise will do well to require a careful analysis of their printing requirements. Without such an analysis, the temptation to match the highest technology to every situation may produce poor results. Just as a fine piece of porcelain would do a poor job as a hammer, so too would a 600 pound, high speed, laser printer provide poor service in producing point-of sale receipts.

OTHER TECHNOLOGIES

While the output side of information processing systems is less likely to require customized equipment, an organization should not overlook emerging technologies for adaptation to their needs. For example, a recent publication talked about a dozen computer companies that have put together an international organization whose objective is to make computer systems and software from different manufacturers compatible. Achievement of that objective will increase the efficiency of all information processing units that have different manufacturer's products. This international organization is supporting the adoption of a common applications environment for the whole computer industry. It is based on a concept called 'object management'. This applications environment treats various kinds of data and applications as if they are building blocks that can be mixed and moved across operating systems. In this way complex applications can be created quickly and easily. Members of this organization include some of the most prominent manufacturers in the computer hardware and software fields.

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SPECIALIZED REQUIREMENTS

For specialized requirements, systems can be designed to provide synthesized voice output, visual images, braille pages, control of indoor/outdoor lighting systems, etc. Those responsible for designing information systems, whether enterprise employees or outside consultants, should investigate and report on the possible uses of emerging output technologies.

COMMUNICATIONS

Rarely will the information processing requirements of an enterprise be met by single-site, self contained facilities. In almost all instances communication equipment will be required. These requirements may vary from simple links between local components to complex international networks. A description of all available equipment and services is far beyond the scope of this document. In general, however, classes of communication devices and services include:

MODEMS

A modem (MOdulation/DEModulation) allows one piece of computer equipment (for example, a data terminal) to communicate with another component of the computer system (for example, the host computer). Modems range from small units allowing low speed access across telephone lines, to sophisticated units designed for dedicated high speed communication links. In general, modem equipment exists in today's market to meet nearly any combination of requirements.

MULTIPLEXORS

These units, typically connected by the use of communication lines and modems, allow for several devices to utilize a single communication line. As an example, 30 to 40 data entry terminals may be connected to a multiplexer, share a telephone line by means of modems, and may be demultiplexed to access individual ports on a remote host computer.

WIDE AREA NETWORK (WANs)

Wide area networks are generally provided by private companies or government service organizations to allow users to access one or more remote automation facilities. To accomplish these services, concentrations of equipment (typically called nodes) are established to handle line switching, packet regeneration, error correction, billing, and routing. The range of specialized equipment necessary to perform these functions varies from simple switches to customized mainframe computers. The local, national, and international communication channels may be implemented using all combinations of dedicated cabling, telephone trunks, infrared, microwave, and satellite transmission. It is rare that any but the very largest organizations will seek to implement private WANs. Procurement of such services from existing vendors in this area of specialization is more customary and more suitable for small to medium enterprises.

LOCAL AREA NETWORKS (LANs)

LANs have become a major part of information processing systems over the past few years. They generally consist of a centralized wiring system, communication taps for access by user equipment, shared 'servers for file storage and database processing, and attachments for remote communications. There are many successful LAN providers in the world, making use of both proprietary and open systems although proprietary systems are, justifiably, being abandoned by competitive organizations. While most organizations think of a LAN as a method of connecting only personal computers, requirements for large scale systems of supercomputers and mainframe are well within the scope of LAN implementations. The analysis, design, and implementation of Local Area Networks is another area where the enterprise's management should demand a full accounting of the methods used and the alternatives investigated by in-house personnel and private consultants.

MISCELLANEOUS

The areas covered previously represent the bulk of the concerns of most information processing professionals. Unfortunately, an organization will need a considerable investment in less glamorous categories of equipment and services. Printouts of several thousand pages don't separate themselves. Specialized equipment is required. Magnetic tapes and disks can't be left lying about in hallways. Storage and inventory systems will be needed. Computer equipment always seems to attract an inordinate amount of dust. Someone will need to clean the equipment with the proper solutions. Even housing for computer systems takes a considerable amount of planning. Special raised floors, air conditioner, dehumidifiers, static protection, halon fire extinguishing systems, and complex electrical installations may be needed. The space needed for the equipment may demand special furniture or remodeling of facilities. But the most important thing to remember is:

> DON'T LET THE PEOPLE DESIGNING INFORMATION SYSTEMS DO LESS THAN A COMPLETE (INDEPENDENTLY REVIEWED) ANALYSIS OF ALL REQUIREMENTS!

An organization can always decide to eliminate items and ideas from an implementation plan. It is extremely important, however, that management knows the cost of such decisions. Without careful analysis of all requirements, management may find that decisions made with less than complete information result in "...snatching defeat from the jaws of victory."

SUMMARY

In this chapter we have established the purpose of the GUIDELINES, set parameters, and categorized the kinds of information critical to the success of any industrial enterprise. We have laid out the step-by-step process of defining the information needs of the enterprise - identification, assessment, and evaluation - and provided a ready reference of information processing technologies.

CHAPTER 2

TAXONOMY
of
INFORMATION PROCESSING

INTRODUCTION

The taxonomy of information processing in an industrial enterprise has changed over the past several decades from very limited and specialized applications to very narrowly defined functions, such as payroll, to today's pervasive information environment which encompasses almost every enterprise function. Indeed, the limits of the applications of new information processing techniques are now a function of the enlightened imagination of information and functional managers

Those enterprises that have found success in the international arena have carefully defined their information needs for all of their functions. Additionally, depending on the enlightenment of the enterprise management, the information processing activities have probably gravitated from a single centralized source to a more distributed family of functional information processing units located throughout the enterprise. As the size of the enterprise increases along with an increase it management's skills in the information fields, we frequently see a greater degree of decentralization[1].

Unfortunately, the is no useful rule of thumb defining when it is best to either centralize or decentralize the information processing activities. Many factors influence the decision. They include the degree of computer literacy of the top, middle, and operational managers and the competitive pressures of the enterprise' markets. Historically, if we were to watch a typical enterprise grow, we would see its information processing taxonomy grow from the functions of accounting (payroll) and budgeting to purchasing and manufacturing, then to marketing and research and development. Yet, there are wide variations regarding the timing of the decentralized growth. Today the rate of migration of information processing throughout the enterprise is directly related to management's enlightenment and the enterprise's needs. Sometimes it is centralized. Sometimes its decentralized.

TAXONOMY

If we were to examine some typical information processing applications, we would find that they could be conveniently separated into the broad Strategic, Tactical and Operational categories. In the succeeding paragraphs we will briefly discuss each of these categories

STRATEGIC - This kind of information is concerned with what is going outside the physical limits of the enterprise itself. It focuses on the kinds of information that top management needs to continually assess how well the enterprise is currently competing within its defined markets and what the enterprise should do to defend these markets and capitalize on new market opportunities.

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1. This increased decentralization is also accompanied by a significant decrease in computing costs as minis & micros (PCs.) become more cost effective than a mainframe for the small and medium sized enterprise applications.

CHAPTER 2

The strategic information is a very specialized kind of information tailored to the specific needs and capabilities of the enterprises top management. In all but the most enlightened and well financed enterprises this information is collected and processed outside (e.g. by consultants). It draws upon data from such diverse sources as:

Market

- o Size & Trend(s)
- o Barriers & Segmentation
- o Seasonality & Cyclicality
- o Geography
- o Entry Barriers

Customer

- o Demographic & Psycographic characteristics
- o Media habits
- o Buying power
- o Brand loyalty

Social & Political

- o Government attitudes towards products.
- o Environmental considerations
- o Press treatment
- o Unionization
- o Education

Technology

- o Trends associated with both product and process technologies.
- o Skills needed to adapt new technologies.

- o Ability of competitors to absorb technology.
- o Changes in the technological life cycle of the enterprise and its competitors product & service offerings.

TACTICAL & OPERATIONAL - Information of this kind is associated with how the STRATEGIC information is formulated into new TACTICAL & OPERATIONAL requirements and procedures. Most often this kind of information is gathered and processed within the enterprise and is a part of the day-to-day evaluation of how well the enterprise is operating. In smaller enterprises or start up firms information processing normally begins in a centralized environment. Then as the enterprise prospers and its management becomes more computer and information literate, we find that the functional information gets processed within the individual functions themselves. It is then made accessible (frequently through electronic means - micro to micro computer) to all of the enterprise's managers and staffs who have a need to know.

Because applications throughout the budget and accounting functions are so well documented in the literature, we will not address them here, but turn instead to some of the more recent applications in the manufacturing and marketing functions.

Manufacturing - For purposes of this discussion we will break the manufacturing function, (the process of converting resources into a marketable product), into sub-functions where one would expect to find varying applications of information processing:[2]

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2. As the enterprise moves towards flexible computer integrated design, management and manufacturing the information needs intensify in all functional areas. The driving force here is the shrinking product life cycle and the resulting need to provide quality low cost products to the market place in a timely fashion. In particular, the quality in manufacturing is a function of being able to repeat the various manufacturing tasks with precision. Thus far most high quality operations have been accomplished by substituting information processing for touch labor. Good examples of this on the shop floor are numerical con-

o Process Planning - where manufacturing engineers convert the design specifications into a sequence of operations that take the product from operation to operation in a sequence that minimizes the amount of time and maximizes the quality.

o Scheduling - where raw materials, components, equipment and manpower requirements for a number of usually different products are optimized in a schedule that generates the required units within cost constraints and in time to meet delivery commitments.

o Control - where production schedules are tracked on a moment by moment basis and adjusted to ensure that resources are optimally balanced to the scheduled work in process and that, where necessary, changes are made in a manner that will not confound the process.

o Inventory - where incoming raw material and components are screened to ensure that quality characteristics are met; and inventory volumes are maintained at the minimum essential levels necessary to support the product's progress through the manufacturing processes. The in-process inventories are monitored to ensure there are no unnecessary slow downs between operations.[3] And finally, the finished inventory is monitored to ensure that enough good units have been produced to meet delivery schedules.

o Quality - Throughout the entire manufacturing process there is a quality program that constantly gathers and analyzes data from each operation to ensure that the finished specifications are within acceptable tolerances when compared against the design process

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trolled machine tools and robots and computer aided design in the product design functions.

3. The Japanese have made great strides in this area with their application of "Just in Time" manufacturing.

specifications. This program also follows the amount of rework required and the scrap generated in order to pin point operational problems before they get out of hand.

Next we'll look at the Marketing function (the process of identifying prospects and convincing them that they should purchase the product), and examine some of the more important sub-functions that normally have an information processing need.

o Market Research - Using mathematical and statistical models along with accepted survey techniques, this activity identifies populations that are most likely to purchase the enterprise's product or service offerings. This function requires extensive information processing capability to create, manage, and analyze very large databases.

o Promotion - Based on the populations identified by the research efforts, the promotions section develops copy, graphics and specialized catalogues that will cause the prospects to make a purchase and become customers. This activity requires modern desk top publishing capabilities, computer generated art work systems and very large mail list databases.

o Sales-Telemarketing - Using the advances in telecommunications this activity either contacts prospects to convince them to buy or takes orders. Requirements for large on-line databases combined with word processors and telecommunications are common in this activity.

o Sales-Field - This sub-function manages the field sales staff. This is also database and telecommunications intensive. Additionally, there are usually applications for linear programming and correlations and regression analysis to determine how well sales representatives are doing and how equitably the sales districts have been allocated.

o Sales-Retail - This sub-function selects and monitors the retail outlets for the manufactured products. It requires tremendous analytical and telecommunication capabilities. Like the other sales functions the results feed directly into the determination of manufacturing requirements. They must, therefore, provide timely and accurate input. Additionally, all of the sales sub-functions are unmatched sources of strategic information. Consequently, they must be integrated into the strategic information systems.

o Sales-Wholesale - These activities are identical to Sales-Retail but deal with the wholesale activities of the enterprise.

It, no doubt, is obvious by now that the taxonomy of information processing in small and medium sized industrial enterprises is really quite logical. As the information needs of an enterprise increase, the application of information processing technologies will follow and new taxonomies will emerge. In fact it is probably more accurate to say that, like the telephone, information processing of one sort or another will soon permeate every function of the enterprise. As such, information processing is, in truth, no longer just a technology to improve the internal operations of the enterprise. It has become so important to the long term survivability of the enterprise that it is now a competitive weapon. The enterprise with the best information processing will have the advantage!

SUMMARY

This chapter discusses the taxonomy of information processing in relation to strategic, tactical and operational information. It traces the expansion of areas of application of information processing technology and points out the value of this application to the market, customer, social environment and political environment as a means of improved management and better market positioning.

CHAPTER 3

INFORMATION TECHNOLOGY ASSESSMENT: TRENDS

INTRODUCTION

In any field of endeavor that is dynamic, the informed professional must exert a substantial amount of energy in staying abreast of new developments or suffer the consequences. As true as that is in most fields, it is even more so in the information arena. As we discussed in the introduction to these guidelines, major process and product technologies underlying the telecommunications, office technology, and information processing computer hardware and software have a half life of less than six years. There are some in the field who feel that even that is a conservative statement. The more liberal elements of the profession believe that the technology is changing every three to five years. As you can imagine, the rate of the technology change presents a number of problems for enterprises procuring these products.

The major technology trends in the information arena are focused on telecommunications, computer hardware and software. The technologies in these areas are moving at a pace that will make most Information Processing Units technologically obsolete within three to six years from their creation.[1]

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1. These are turbulent times for those organizations that are developing Information Processing Units. Not only are the costs for computing associated with micro computers dropping at a rate six times faster than those associated with mainframes, but also

CHAPTER 3

Regardless of the pace at which the technology moves, obsolescence need not be a major concern for those who have initially matched their information processing units to carefully established needs and selected reliable products based on proven technology and well thought out operational plans.[2] Unfortunately, this is often the exception rather than the rule. Many Information Processing Unit Managers have been caught up in their desire to provide their management with the very best technology available. As a result they lose sight of the real operational needs and frequently purchase equipment at the cutting edge of the emerging technologies. These products turn out to be far beyond the anticipated needs and usually generate an unacceptable amount of downtime. Moreover, even though these information managers are, indeed, always at the cutting edge of the available technologies, they keep their Information Processing Units in constant operational turmoil, frequently incurring enormous training costs through turnover and retraining for the new technologies.

In contrast, prudent information managers who serve their enterprises well recognize that they could chase the 'technology genie' forever and spend far more than what is necessary to meet their established operational needs. Instead, these information managers carefully watch the telecommunications and computer hardware and software trends as well as the market information associated with their own enterprises' success. They also monitor their enterprises' world wide markets and those of their competitors to anticipate changes in the information needs of their executives. Armed with this information, technology, and market

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the development of the single unified market in the European Community is, at this writing, changing the applicable telecommunication standards. As a result, the 1990s will witness a probable restructuring of the entire computer and telecommunications industries. One will have to expect a confluence of these events with the introduction of the High Definition Display Technology (HDDT) and the underlying process and product technologies.

2. An important need that must be considered in the creation of all Information Processing Units is the upward compatibility of the selected hardware and software.

trends, they are well positioned to systematically gauge their enterprise's strategic, tactical, and operational needs for information in light of changing technologies and competitive positions.

TRENDS

Clearly, the trends associated with information technologies are volatile! Yet, it is equally clear that as time passes a steadily increasing amount of data can be processed by emerging technologies at lower and lower costs per unit of data.[3]

At the time of this writing, it is quite clear that we are at a juncture in the many information trend lines. This juncture has created considerable uncertainty about what new telecommunications and hardware and software will be introduced next and who will be able to economically use it. While it is quite clear that more and more power is going to be made available, particularly at the micro computer (P.C.) level, it is not so clear that the needed software will also be available. What is most likely is that the software needed to fully exploit the available hardware power will lag the hardware introduction by at least a year or two. Additionally, it is not clear that the existing computing platforms will be able to effectively and efficiently coexist with the new hardware. For example, in the micro computing arena we have witnessed a growing downward incompatibility with the introduction of each new piece of technology. This incompatibility will, no doubt, extend to the peripherals as well.

In the longer term the information manager must watch the trends underlying future technologies. For example, he must develop information sources[4] that will allow him to credibly

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3. Between now and 1995 we expect the index for computing costs to drop six times faster for micro (P.C.) computers than for mainframes. And, because the costs for micros have been far less than mainframes to start with, the actual cost per computation for the micro could approach more than 1000 times less than for the mainframe.

4. These sources for following trends vary by country and information need. In some cases it may be necessary to get third party consultants to develop specialized monitoring systems to keep

gauge the potential impact of such longer term technologies as:

(1) the new architectures growing from applications of superconductive elements and other new engineering materials that may obsolete the existing computing base;

(2) the growth of both optical and magnet-optical technologies which currently offer promise to revolutionize the media for storage devices;

(3) the growth of the Intel i486 chip architecture[5] which may blur the differences between the role of the mini computer and the micro; and,

(4) regardless of which of these technologies is finally commercialized, there will still be the question of how and when the necessary operating systems and software will be developed to support these new hardware offerings.

Compounding these software and hardware trends are the trends associated with the personnel skills needed to manage and run the new Information Processing Units' configurations. What we are now witnessing is the beginning of a new trend where the training costs associated with the new hardware, operating systems and applications/programming software are approaching the cost of the equipment itself.

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abreast of the technologies. In other cases it may be acceptable to keep up to date by attending the various "computer exhibitions & shows" throughout the world. And in other circumstances a simple Standard Dissemination of Information (SDI) from a local library may suffice.

5. There are also others like Motorola's entry which, at this writing, is a faster computational chip.

Last, but certainly not least, are the trends associated with the ever changing telecommunications technologies and product offerings including local area networks and long line communications. Because both of these technologies and the associated emerging standards have a profound impact on the Information Processing Unit's configuration, they must also be constantly appraised.

As all the technologies mentioned improve and their standards for inter-connectivity and compatibility become accepted, the nagging problems of data and information security will remain to plague the information manager. Even now it is possible to intercept computer to computer transmissions in all but the most secure environments. It is also possible for a disgruntled employee to corrupt almost anyone's stored data/information through the introduction of simple and complex "viruses".

In assimilating all of this, it becomes evident that, in order to effectively balance the enterprise's information needs with the appropriate technologies, information managers must:

(1) continuously re-evaluate their information needs,

(2) frequently evaluate the current configuration of their Information Processing Units,

(3) buy the best technology they can afford to accommodate their needs and

(4) monitor the trends!

Information Managers must also discipline themselves to commit to a new technology only when it is clearly cost effective from a strategic, tactical, or operational point of view. To effectively accomplish this, the information manager must keep track of a number of world wide trends associated with the acquisition, processing, and delivery of data and information. <u>There is only one way to do this - the information manager must personally read extensively in the field and tailor networks of people and activities that are relevant to the enterprises information needs.</u>

CHAPTER 3

The technologies and the associated trends that underlie the effective and efficient operations within an Information Processing Unit will, for the foreseeable future, be in a constant state of flux. Product life cycles for both hardware and software offerings will continue to collapse, making it even more difficult to interpret the trends. Band width offered by replacing the existing copper twisted pair with fiber optic cable will explode the capacities for the networking, telecommunications, and display improvements.[6] The introduction of fiber optics as well as the other pacing technologies will probably be controlled by each nation's regulatory efforts and standards.

In addition to what has just been discussed there are several specific issues that impact the small and medium sized enterprises that are either moving toward establishing information processing capabilities or thinking about it.

COSTS

One of the growing trends we see in reducing the cost of acquiring and operating the computers required in an Information Processing Unit is downsizing. Downsizing in this sense means moving from large mainframe computers to smaller more powerful and more flexible computers. In the recent past downsizing has had a rather bad stigma. But an increasing number of information managers recognize that applications development on micro computers takes substantially less time and that the micro disk access times are as fast or faster than the mainframe drives. As a result, they are networking their microcomputers (PCs) creating greater processing power than larger mainframes at substantially

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6. The emerging Flat Panel Display Technologies (FPDT) will soon revolutionize the display environment by producing optical clarity of the display never before seen. This will be done with less power and space. Literally, the display will be only inches deep and up to at least 40" x 40". Additionally the chip technology that supports this display technology will be an important precursor to the optical computing using photons instead of electrons. The speed of light instead of the speed of current flow.

lower costs. Admittedly, careful attention must be paid to the selection of hardware and software. Nevertheless, more and more information managers are finding it worth while. Some system integrators are now opting for this kind of PC configuration instead of a mainframe.

A nascent trend in data communications networks involves the computer building designed specifically to house, maintain and refresh various configurations of computers. Enterprises move their entire computer centers and associated communications equipment into one of these buildings or what may be better termed a shared facility.[7] Through this kind of sharing, enterprises are able to reduce their costs by sharing the overhead and operational costs and by gaining protection from power outages and security intrusions. These shared facilities can literally be self sustaining with their own power backups that really work, and unique access to telecommunication needs. For some individual enterprises to replicate this kind of facility for their own exclusive use would be cost prohibitive. This configuration is especially attractive in areas where the electrical supply is unstable and where the necessary skills are scarce.

TECHNOLOGY

The Reduced Instruction Set Computing (RISC) Microprocessor will continue to get attention. As companies like Intel Corporation continue to offer improved chips like

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7. A shared facility is, as it sounds, a complete computer facility that is designed to service the specific needs of a number of industrial enterprises. It is owned by a third party and its processing capabilities are created by the third party to specifically satisfy the needs of those enterprises who are sharing. The enterprises pay the third party for their use as it is needed. This moves the enterprises costs to the variable side of their accounting records and avoids the necessity of any of the sharing enterprises to borrow or spin out of their cash flow the capital necessary for the creation of the facility.

the i860 - 64bit instruction set, we will see them as coprocessors and in add-in boards for specialized applications.

In the microcomputer world the 486 and x86 chips are going to offer extraordinary advances in computational power. As more of the protected mode is made available for use, background computing and true multitasking will be widely available. While major original equipment manufacturers, (OEMs), will attempt to capture greater market share, the clones will not be far behind. Problem! As the computational speeds leap beyond the 80386/33-MHz the problem is going to be to get the information to and from the screen, disks, and periphials. This will create a serious bottle neck. That means the performance limiting factor will be getting the information to and from the bus.

The interest in both the Micro Channel Architecture (MCA) bus and the Extended Industry Standard Architecture (EISA) have demonstrated the need for a 32-bit bus. While the EISA provides downward-compatibility with the established PC AT buses and add-in cards, it is not clear that that kind of compatibility is important to the majority o. the 32-bit bus users. MCA on the other hand will have its architecture extended to proprietary mainframes and minicomputers. Regardless of how information managers intend to configure their Information Processing Units, they need to keep abreast of these developments.

In another development, the lower operating voltage of Random Access Memories, (RAMs), from 5v to 3.3v offer impressive improvements in computational speed and lower power consumption. According to some, this shift, which is just beginning to hit the market place in 1990, may be expected to be common place by 1995.

As a result of the demand for high speed Local Area Networks, (LANs), information managers should watch for developing trends in gigabits range of transmission. The major competitors in this area are the IBM 16 bps Token Ring Network, the Fiber Distributed Data Interface (FDDI) LAN standard from Scientific Computing Corporation and Ultra Net Technologies Incorporated. The former is now available and will support up to 254 work stations as well as function as a backbone network. Progress in these areas will make distributed microcomputer applications even more attractive than they are now.

STORAGE

By 1991 it is expected that 48% of all computer systems shipped will have parallel processing architectures. This trend will be important for information managers in the financial and heavy database use applications. While the current preferred systems are provided by Cray Research Corporation, Alliant Computer Systems Corporation, and Convex Computer Corporation and can handle 80 to 256 Megabytes per second between the Central Processing Unit, (CPU), and the main memory, others will, no doubt, join the industry and thus drive down the costs in the mid to late '90s.

The re-writable magneto-optical disk drive is the latest trend in mass storage devices. Currently these come in 5.25 inch 600-Megabyte drives. This moves the application of optical technology from the archive to the day to day operations. However, while this looks like a very attractive opportunity, informed managers need to look at how well the media stands up in the intended environment and for how long. A very modest change in the physical characteristics resulting from temperature, humidity, or other environmental extremes could be catastrophic. The trade-off between the current storage media and the need for refreshing the optical base every 5 to 10 years needs to be carefully weighed.

Facsimile (FAX) machines will continue to be the fastest growing business communications technology. Applications will grow from the current business to business communications to consumer order taking applications. Within the Information Processing Unit, applications will include computer based electronic mail as well as intelligence gathering. Information managers will soon have to handle networks of integrated FAX machines in the same fashion as they now handle the interconnection of micro and mini computers into Local Area Networks. And, from a cost containment point of view, these "FAX LANs" will require careful monitoring since it is the receiver who pays the costs for communications and paper.

In a related FAX issue the information manager needs to carefully watch for two things: (1) shortages in the FAX paper, and, (2) the forthcoming Group IV family of FAXs which will become available through the high speed ISDN communications. Not only will the FAX printing quality improve, but with the concurrent introduction of the ink jet printers the FAXs will be able to use just plain paper rather than the comparatively more expensive FAX paper used today.

For the first three years of the 1990s information managers need to watch: (1), the growth of better than 33% in technical computers and work stations, (2), the Japanese dominated optical storage media and FAX machines, (3), the blurring of application differences between general purpose computers, (4), for greater acceptance of ink-jet printers, voice messaging, portable computers, and, (5) for revolutionary improvements in the telecommunications offerings for corporate applications.

Another pair of trends to watch is the growth of the 2 inch diskettes and Digital Audio Tape (DAT). The latter will have profound implications in the data intensive applications. In spite of these new developments, the installed base for 5.25 inch diskettes will keep the demand for these diskettes strong and the prices relatively low.

CHAPTER 3

TELECOMMUNICATIONS

Voice, data, and video telecommunications are technically available today. However, their introduction is being held up by the bandwidth requirements and credible standards. When these roadblocks are removed, and they will be within the next 5 years, local telephone companies will begin to offer a whole new family of information gateways. While this trend is just beginning to evolve, once it starts to move, it will move very rapidly and will introduce new telecommunications opportunities to the information manager.

Progress in information technology is now dependent on three underlying technologies: integrated circuits, photonics (light wave technology) and software development. Perhaps the most powerful of these is photonics and its implications for optical computing and optical switching. Information managers need to watch for these developments in beginning in the early 1990s.

STANDARDS

Instead of standardizing the essentials for information technology, the various standards setting groups will develop followings that will pit one against the other. For the information manager this will create a world of uncertainty in both the telecommunications and computer hardware area. For example, witness the competing "standards" supported by various devotees of UNIX International and the Open Systems Foundation and, in the United States, the Government Open Systems Interconnect Profile (GOSIP) and the Transmission Control Protocol-Internet Protocol (TCP-IP). The uncertain impact of these standards on the International Standards Organization, (ISO), and the upcoming EC-92 will compound the difficulty of the information manager.

CHAPTER 3

SOFTWARE

With non-American programmers demonstrating excellent quality work at a much reduced cost, information managers will need to watch foreign offerings for a means of significantly reducing their software costs. Moreover, as new hardware innovations are introduced outside of the Americas expectations are that they will combine with high quality but less expensive software to make non-American offerings very attractive to the cost conscientious information manager.

With this mere sampling of continuing and emerging trends of interest to an information manager, it should be clear that the direction of information processing technologies and their associated trends will continue to be difficult to predict. Consequently, it will be necessary for the information managers, on their own, to effectively develop a comfortable level of literacy about those trends that impact on their current and anticipated information processing needs. There is no easy way to do this. While the literature is replete with information on the trends just mentioned, the information is not organized in a fashion that allows easy assessment. Additionally, as new technologies are introduced each year that either replace or augment the existing ones, the trends can take unexpected turns in a matter of a few months - photonics is a good example.

To survive, today's information manager must diligently practice the art of information gathering and assessment in order to prevent his career from quickly becoming as redundant as the information technologies he has become wedded to.

PROTECTING THE INVESTMENT

It goes without saying that no organization can really afford to completely change the information processing technology it uses every five to six years. That is unless the price tags on its products are large enough to support the necessary profit margins. Even then the disruption factor would be significant, not to mention the associated training costs. And for smaller and medium sized enterprises producing more reasonably priced products with respectable profit margins, it would be impossible. The only answer is to develop a strategy for protecting the enterprise's investment in the technology it acquires. One approach to doing this is to set up a systematic procedure for the procurement of information related products in such a way that it provides for "Technology Refreshment".

TECHNOLOGY REFRESHMENT

The concept underlying "technology refreshment" embraces a method of investing information dollars no and still making provisions for having the most modern and cost effective hardware, software, interconnectivity, maintenance, training, etc. available in the future.[8]

Using the technology refreshment concept, contractors (equipment & software providers) are asked to propose substitute iteus whenever the contractor or the i dustry is offering replacements or substitutes for the items already purchased. The purchaser may accept those items as substitutions for the items on hand or reject the contractor's proposition. In general, an enterprise would accept the refreshments if they met the following minimum essential criteria.

(1) The substitute item must meet or exceed all the requirements and specifications laid out by the enterprise in it's initial procurement.

(2) Substitute items must be fully compatible with the enterprise's installed system at the time the substitution is proposed for use.

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8. Organizations in the United States Government are currently employing this concept in the procurement of information processing systems.

(3) The substitute item must have both capacity and performance characteristics equal to or better than those characteristics of the component that is to be replaced. The criteria used for selecting the contractors equipment will be used to determine the acceptability of the substitute items.

(4) The substitute item must offer the same or increased function as the item it is to replace.

(5) The price of the item must be equal to or more cost effective than the item it is to replace. This must be based on the same evaluation applied to the original item.

BENEFITS TO THE ENTERPRISE

This procedure ensures that the contractor will warrant and guarantee that any item substituted or modified is at least equal to the replaced item in terms of performance, operability, maintainability and the overall systems performance and in no way degrades any capability of the system accept as may be mutually agreed to by the enterprise and the contractor.

In summary, the technology trends associated with the creation and effective operation of an Information Processing Unit are associated with:

(1) Hardware and the compatibility and capability of new offerings.

(2) Operating systems that will be compatible with the existing inventory.

(3) Software applications that will run reliably on existing and future hardware and be compatible with the existing form of data entry.

(4) The changing skill levels needed to effectively and efficiently operate the enterprises inventory of hardware and software as well as the ability to understand their implications in regard to improved information delivery.

(5) New engineering materials used in the development of hardware and telecommunications offerings (e.g. fiber optics, superconducting materials), and new architecture used in the development of software (e.g. the application of Reduced Instruction Sets to new operating systems)

(6) Regulatory and standards changes promulgated by different nations and especially those emerging from the European Single Unified Market.

As mentioned earlier, there is no one best way to monitor all of these trends. To some enterprises there are selected trends that are more important then others. The managers of the Information Processing Units, themselves, must undertake the very difficult task of developing the means for credibly monitoring those trends that are most important to their individual needs and then communicating their potential impact on the Information Processing Unit to upper management.

SUMMARY

This chapter emphasizes the importance of staying current with changes in the process and product technologies underlying the information processing field. It discusses the role of technology change, major trends, and methods of protecting the enterprise's investment in technology.

CHAPTER 4

POSITION OF THE INFORMATION SERVICE IN THE ORGANIZATION STRUCTURE OF THE ENTERPRISE

INTRODUCTION

Determining where to position the Information Processing Service would have been a very easy task twenty years ago. Most of the identifiable savings associated with the introduction of computers was in what was then the very labor intensive functions of budgeting and accounting. Both hardware and software applications were exclusively designed to provide the enterprise with savings in these areas. Then, opportunities became obvious in the planning and forecasting functions which significantly increased the ability of enterprises to improve their strategic maneuvering.

As management became more computer literate, other functions were found to be ripe for computer applications. These opportunities continued to multiply far beyond the ability of accounting and budgeting programmers to adequately handle. The functional managers of Quality Control & Assurance, Production Scheduling & Control, Inventory Control, Shipping, and Research & Development created demands far beyond the ability of a centralized information processing unit to satisfy on a timely basis.

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As a result of the changing applications the once centralized information processing units became surrounded by satellite information processing units in various functional areas. Each served unique and important functional information needs. And, as time passed, it became apparent that each of these functional information processing units not only provided unique and essential information to their own functional managers, but they also supplied critical information needed by the enterprises top management in their efforts to maintain a competitive edge. It didn't take long for a clear need to emerge for the creation of an information processing capability that took into account both these functional needs and the needs of top level management. At a minimum this new capability accommodated the various functional and top level management needs in a fashion that allowed them to be effectively integrated into a responsive information system.

Information processing gradually migrated from purely debit and credit budgeting and accounting applications to encompassing the diversified needs of all the other function managers. Unfortunately, this migration was not accomplished in a consistent, systematic way. Consequently, we find today there is no clearly defined criteria that can be universally applied to determine the best organizational placement of the Information Processing Unit.[1]

There are those who believe quite strongly that the placement of an Information Processing Unit should be based on a pure cost benefit analysis which assigns applications to those areas that offer the greatest financial return. Then again, there are those who believe just as strongly that the information processing unit belongs in the area that offers the best long term strategic advantage. The optimal placement lies somewhere in between these two extremes.

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1. The Information Processing Unit today is as systemic to the enterprises needs as the telephone. Information processing, like the telephone, must be dispersed throughout the enterprise to those who can best use it.

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Building on the foregoing, the placement of an information processing unit within the enterprise needs to be based on a systematic assessment of the enterprise's unique operational demands and strategic and tactical requirements. As mentioned earlier in these GUIDELINES, such as assessment must consider the characteristics of the enterprise's industry and markets, the computer literacy of its managers, first line supervisors and employees as well as the basis on which the enterprise competes (e.g. price, quality, service).

While each enterprise will be different, the logical placement of an information processing unit is not too difficult to determine. For example, consider a successful small to medium size enterprise with less than 500 employees and less than $100.0 million in revenue and an internal rate of return of better than 27%, operating in the durable goods sector of the manufacturing industry. Here, one would expect to see a centralized information processing unit built around a mainframe computer located in the Comptroller's functional area. Additionally, there would be enough satellite information processing units built around a network of mini and micro computers to satisfy the information needs of the individual function managers and their supervisors. The probable emphasis would be in the manufacturing function where there would be extensive local area networks supporting the automated aspects of manufacturing. The satellite units would be tied into the mainframe, and the mini & micro computer LANs, in turn, would be tied into the satellite units. This configuration would provide a well integrated system for managing the automated aspects of the manufacturing operations. It would also provide real time status information through the mainframe which would satisfy the tactical and strategic needs of top management.

With this arrangement, each of the functional managers would have their own LANs and stand alone micro computers to handle their operational needs (e.g., communication, analysis, mathematical modeling, record keeping, and intelligence gathering).

It should be clear by now that we have avoided the temptation to lay out definite criteria for positioning an information processing unit within an enterprise. This has been very deliberate! We believe very strongly that the technologies underlying the creation of an information processing unit are moving too fast for us to suggest that it should be contained in any one functional area. New applications, being developed every day, add to the pervasiveness of this capability and support the analogy that computers (micro information units), like telephones, belong on every one's desk!

What is important to the enterprise is how effectively its management is able to interconnect the mainframe, mini, and micro computers, or any combination thereof, into a cohesive, distributed information system that encompasses the entire operational, tactical and strategic information needs of the enterprise. The ability to do this effectively is key to measuring the success of an information manager. Unlike a scant five to ten years ago, it matters less today where one positions a single centralized information processing unit than it does how one successfully integrates satellite information processing units distributed throughout the enterprise. The ability to connect all units in a fashion that is responsive to the operational, tactical and strategic information needs of the enterprise is critical to the success of the information system.

IMPACT OF TECHNOLOGICAL CHANGE ON ORGANIZATIONAL PLACEMENT

The technological changes that have taken place in recent years have resulted in a significant impact on the placement of the information processing unit within the organizational structure. In this decade and beyond the most efficient and effective approach must be the result of integration of the following:

1. Office Automation

2. Telecommunications

3. Data Processing

Historically, these elements have existed within organizations as distinctly separate functions. They were performed by different sections of the enterprise, came under the control of different managers, and any associated equipment was purchased from separate vendors.

The separate servicing and management of these elements continued well into the late 1960's. However, as information technology continued to improve throughout the 1970's and early 1980's, management became more aware of the need to integrate word processing (office automation) and telecommunications with data processing. Cash, McFarlan, and McKenny in their Corporate Information Systems Management (Irwin, Homewood, Illinois 1988 Second Edition) cite three very important reasons for this.

> "First, all three areas now require large capital investments, large projects, complex implementation, and extensive user training. Further, significant portions of all three services increasingly may be purchased from a single supplier. The managers of these activities, however, have often had no significant prior expertise in handling this type of situation. A special problem for office automation is the move from multiple vendors with small, individual dollar purchases to a single vendor that will provide integrated support. The size of the purchase decisions and the complexity of the applications are several orders of magnitude larger and more complex than those faced a decade ago. For telecommunications the problem revolves around breaking the psychology of relying on a purchased service decision from a public utility and instead looking at multiple sources for large capital investment decisions. Both cases involve a sharp departure from past practices and require a type of management skill that was added to the data processing function 15 years ago.
>
> The second link to data processing is that, to an increasing extent, key sectors of all three components are physically linked together in a network. For example, in one manufacturing company the same WATS line

is used over a 24 hour period to support on-line data communications, normal voice communications, and an electronic mail message switching system. The problems of one component therefore cannot be addressed independently of the problems of the other two.

To complicate the situation today, a dominant supplier for each of the three components will attempt to market his product as the natural technological base for coordinated automation of the other components. For example, IBM is attempting to extend its data processing base into products supporting office automation and communications; AT&T is attempting to extend its communications base into products supporting data processing and office automation; Xerox is attempting to expand its office automation effort into communications and data processing.

Failure to address these management issues (associated with consolidating these three activities) constructively poses a great risk to an organization. In the past several years most U.S.A. organizations have consolidated at least policy control and, in the majority of cases, management of the components in a single unit. The key reasons for this include:

1. Decisions in each area now involve large amounts of money and complex technical/cost evaluations. Similar staff backgrounds are needed in each case to do the appropriate analysis.

2. Great similarity exists in the type of project management skills and staff needed to implement applications of these three technologies.

3.Many applications require in-tegrated technological networks to handle computing, telecommunications, and office automation."

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CURRENT ENVIRONMENT

At this point in time when technological change is the order of the day, industrial organizations as well as others are trying to cope with an unprecedented proliferation of computer equipment, software, communications, and the overwhelming "information power" that is the result of all this information technology. It is no longer possible for an isolated group of innovative individuals closeted somewhere within the management hierarchy to have total control of the information systems of the enterprise. The end users are more computer literate than ever before and system professionals are being challenged by this group whose knowledge, skills and abilities in the information technology field is increasing daily.

Recognition of these conditions dawns on management with varying degrees of swiftness. However, management is inevitably faced with the decisions associated with establishing how information will be made available to those who need it. Whether the ultimate decision is to make information available by remote access from a centralized unit or by distributed processing, it is in management's best interest to invest a substantial amount of time in making that decision.

In the early 1960's when the cost of computer hardware was the largest dollar investment an organization made for information processing, the information processing unit was centralized. The physical size of the hardware alone was a strong contributing factor to the attractiveness of putting everything in one location. When the stringent environmental requirements were added to the equation the organizational placement was a predetermined issue.

As the cost of information processing hardware decreased and innovative changes were made that affect not only cost but size and environmental restrictions, more cost effective organizational alternatives became available. At one end of the organizational scale is the large centralized information processing service that provides information to its users by remote access through telecommunications links. At the other end of the scale is a relatively small information processing service group that ensures the integrity of the system while most of the data is distributed to the organizational users. As you can imagine, there are also a number of combinations of the two extremes in existence.

This surfaces a very important point that must be reinforced. While these Guidelines are designed to assist industrial enterprise managers in making decisions regarding information processing units within their organizations, there are no absolutes. As you can see, the variety of factors that must be applied in making the appropriate decisions vary with country, culture, climate, market, competition, organization size, and so forth. Ultimately, each information processing unit is tailor-made to the organization it serves. How good a "fit" takes place is strictly dependent upon the quality of the management decisions that support its existence and development. The function these GUIDELINES serve is to stimulate managers' thinking and provide some criteria that will help structure decisions in a logical manner.

CRITERIA FOR DECISION MAKING

Determining how information will be made available within the organization must be based on a sound, logical approach to the issues. Basic to that decision are the following:

1. Criticality of information to the enterprises survival and profitability.

   Examination of the enterprise's strategic, tactical, and operational information needs and relating those needs to the survivability and profitability of the enterprise should result in an ordering based on importance. Developing a matrix that weights those needs by the ability of either centralized or decentralized information processing to respond to those needs should be an acceptable starting point.

2. The relative speed with which the organization must react to market fluctuations and competition.

Application of this criteria to the organization's strategic, tactical, and operational information needs must be matched with the results of the previous exercise.

3. Size of the Organization

The size of the industrial organization frequently dictates the level of sophistication of the technology required. However, this is not always the situation. There are some industrial enterprises that are highly specialized, produce complex, expensive, time-sensitive products, and would, as a result of these parameters, not fit the prior generalization. Small single site enterprises obviously have much different organizational placement requirements than medium size enterprises with several locations.

4. Financial Ability to Procure Technology.

Applying this criteria involves the examination of the enterprise's current and projected financial power as well as investigation of all avenues of financing the technology determined to be necessary to the viability of the enterprise.

5. Availability of the Required Technology.

This is very basic to the decision being made and impacts all the other decisions. Not only must management be concerned with what is available now at the location of the enterprise, but it must be concerned with what can be developed for that enterprise and the lead-time for delivery. These are limiting factors in computerizing any organization. Custom development almost always requires a longer lead time for delivery and implementation. In addition, custom software can present serious conversion problems if a decision is made later to change hardware. Other important factors for consideration, which are the subjects of discussion in a subsequent area of these GUIDELINES, are the rate of technology change and how an enterprise can take advantage of technology refreshment.

6. Availability of the Necessary Information Technology Skills

Being able to employ, develop, and retain the kind of personnel that enable a quality operation is key and has significance in whether an organization has a centralized or decentralized information processing service. If these skills are in short supply it is to management's advantage to lean toward centralization.

7. Availability of Necessary Training

In today's computer market the necessary training for both hardware and software is usually available from the vendor. However, management must be assured that the training is adequate, delivered within a reasonable time of equipment delivery, and that the cost is reasonable. Under no circumstances should equipment be procured without the associated training. This would be inviting disaster.

8. Style of Management

This criteria is based upon the type of MANAGEMENT CONTROL to be exercised within the enterprise. Some of the results of applying the other criteria will provide necessary input here. For example, if it is a small enterprise with a desire for tight top level management control, and there is a short supply of quality information processing skills available, then these factors point toward establishing a centralized information processing unit. However, management would still need to examine and weigh how quickly the enterprise needs to respond to market fluctuations and competition. If the enterprise must be in a position to respond quickly to those forces, this would point toward providing distributed processing to, at a minimum, key managers within the enterprise.

Conversely, if the enterprise itself is more decentralized both organizationally and geographically, there is an ample supply of information processing skills available, and there are established needs for immediate response and to be able to have direct functional control of specialized applications, these factors point toward implementing distributed processing.

SUMMARY

In examining each of the building blocks for establishing an information processing capability it becomes increasingly clear that the importance of good planning and thorough analysis of the enterprise's goals cannot be overstated. As each step in the process builds on the previous one, the quality of the preceding decisions directly impact the next. This holds true in determining the organizational placement of the information processing unit. In this chapter we have tried to impart knowledge of the parameters at each end of the placement scale. This combined with a through understanding of the specific enterprise's goals, requirements, and limitations should enable determination of a "good fit" along that scale. There is no "instant cake mix" solution to organizational placement. The ingredients to a sound placement decision are unique to the enterprise and the quality of the decision making effort. What we have provided is guidance on factors to consider, and why they are important.

CHAPTER 5

INTERNAL ORGANIZATION OF AN INFORMATION PROCESSING SERVICE

INTRODUCTION

Today, the information systems that exist in most small to medium sized enterprises are built on yesterday's management technology. That technology is based on hardware and software configurations that were designed for a centralized operational environment. This combination of management, computers, and software, most frequently referred to as Data Systems Operations Management, has historically served the enterprise quite well. Consequently, there is an excellent body of knowledge already developed and available in almost any business library that will spell out how to get that kind of information processing unit started.[1]

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1. The term Information Processing Unit implies a single centralized unit. In deference to the fact that many enterprises will elect to implement distributed processing, which implies plurality; the remaining GUIDELINES discussions will use the term Information Processing Service to denote those information processing systems that are based on distributed processing.

CONFIGURATION A

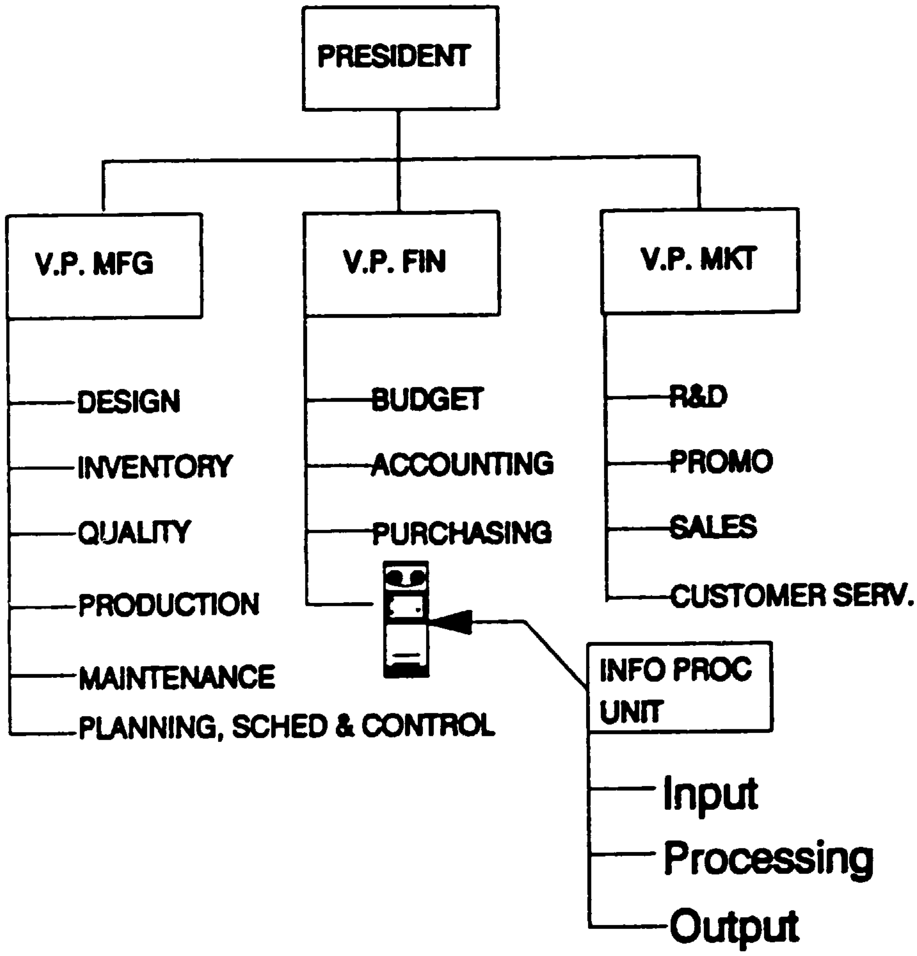

FIGURE 1

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In today's fast moving international markets, trying to establish a viable information processing system based on what worked well yesterday is like trying to drive an automobile by looking through the rear view mirror. Yes, you can do it! But, a lot of people will pass you!

CONFIGURATIONS A and B

In order to put this into perspective, Figure 1, CONFIGURATION A, presents an oversimplified but nonetheless useful schematic of how the Information Processing Unit usually fits into the enterprise's structure. Generally, it is found, as depicted, reporting somewhere in the organizational chain of the Vice President of Finance. In this configuration it is clearly an operational arm of that Vice President and primarily serves his functional needs. Those needs are usually associated with Budget, Accounting, and Purchasing functions.[2] Data is gathered and information is processed in three broad task categories: Input, Processing and Output.

INPUT

The input to the process, whether it is from one of the other Vice Presidents' functional areas or from within the finance function, is usually in the form of paper (i.e. attendance reports that form the basis for producing a payroll). The data on incoming paper must first be put into a format that allows it to be electronically processed. This is done by having the data key punched into either cards or magnetic media that can be "read" by the host computer and processed according to the specific applications program being used.

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2. There certainly may be other functions. But these are the minimum that one usually finds; and for the purposes of this discussion using them as examples keeps things simple.

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PROCESSING

This activity is the means whereby data is "batched" and then electronically entered into the host computer's central processing unit. The central processing unit then manipulates it in accord with the applications programs and then formats it for the desired output.

OUTPUT

Once the information has been processed it is then printed in a format designated by the processor's application program and the characteristics of the printer.

SKILLS

The skill mix required for this configuration is composed of those who are competent in operating the various machines (i.e. keypunch, tape drive, disk drives, the central processing unit, and the printers) in addition to managing the physical flow of data and information.

The flow of data from the various functional areas to the Information Processing Unit and the return flow of both the data and information is a time consuming process. The Information Processing Unit Manager must carefully schedule and prioritize production. Unfortunately, this, more often than not, leaves other functional customers outside the Vice President of Finance's domain dissatisfied.

What is needed today is a more responsive method of operation. The management of the enterprise needs to draw the best out of past experience and build an Information Processing Service that is responsive to the new interdisciplinary and functionally interdependent needs of 21st Century world class enterprises.

CONFIGURATION B

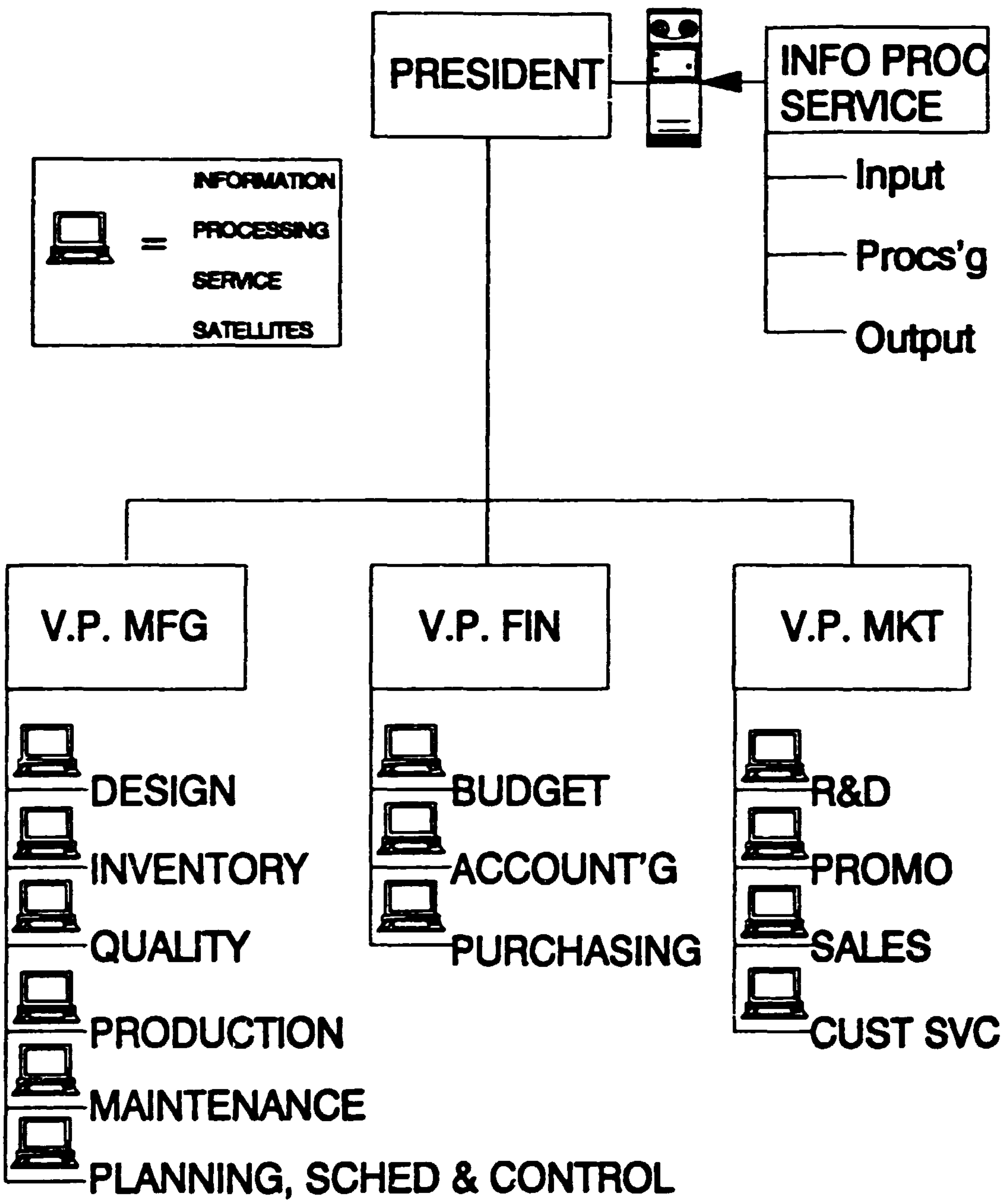

FIGURE 2

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To develop the new perspective the enterprise management must blend the best of past Data Center Operational Management experience with new and somewhat different emerging requirements of the Information Processing Service Management needed for the last decade of this century and the beginning of the next.

Since it is very clear that no enterprise will survive long in the international marketplace without having a well articulated set of strategic, tactical, and operational requirements, we will assume that these have been carefully developed (as outlined in earlier chapters) and are well understood throughout the enterprise.

Given that assumption, we can then turn our attention to better understanding just how much the new information managers role needs to change. To do that, we will briefly examine and contrast some of the current operations responsibilities of existing data center operations management. We'll do this first by contrasting how an Information Processing Service, (Figure 1, CONFIGURATION A), differs from an Information Processing Unit, (Figure 2, CONFIGURATION B), in terms of input, processing, and output. The most immediate difference between the Information Processing Unit and the Information Processing Service is the organizational placement within the enterprise. This placement should be reflective of its broader service base and its insulation from undue influence of any single functional area. The Information Processing Unit is clearly an operational arm of the finance function. It is operational in nature. In contrast, the Information Processing Service is set up primarily as a staff function to service top level management needs, and, as a secondary process services the information needs of the intervening levels. This placement reflects the fact that information is now viewed as a strategic weapon in the world's competitive arena and it must be readily available to those who have strategic responsibility for the success of the enterprise.

As depicted in Figure 2, CONFIGURATION B, the functional areas have their own satellite information processing services that are based on mini and micro computer configurations.

In this configuration of an Information Processing Service all the functional data bases are accessible by the other functions on an 'as needed' basis. Each function inputs, processes, and outputs their own data as well as drawing on the data and information from other functional areas when it is needed. This is usually done through communication links (e.g. local area networks).

It is not difficult to see that the input is a combination of original keying by the Information Processing Service Satellite at the originating function and electronic down loads from other functions whose data may be necessary for an analysis/report. The processing is done at the lowest level possible and is, therefore, much more timely than the "batch" processing done before by the Information Processing Unit. The output is also done at the lowest level so that the information is provided to the right person in the least amount of time.

In Configuration B, the processing of information is now much more of a service than it was structured as the centralized operational arm of a major function. In this new role it possesses input, processing, and output capabilities that are more powerful than those in the individual functions. At the same time, the central location, like the individual Information Processing Service Satellites, can download data and information from any Information Processing Service Satellite as needed.

In addition to the Information Processing Service's role of establishing and maintaining information processing capability, it has another very important role. It must also function as an in-house consultant to all the customer functions that need assistance in conceptualizing, developing, and implementing new requirements.

Given this macro view of the differences between an Information Processing Unit and an Information Processing Service, we will now take a look at the differences in greater detail.

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STRUCTURE OF THE INFORMATION PROCESSING SERVICE

The structure of the Information Processing Service is build around three separate but interrelated levels of computing power which are deployed throughout the enterprise in a tier arrangement. The top tier consists of the host processor[3] which maintains and provides access to all the enterprise information databases. The second tier consists of the enterprise's collection of Satellite Information Processing Service Units. They serve as the information processing systems for the various functions (e.g. manufacturing, shipping, quality control, budget). The functional area databases and analytical capability for day to day operations reside at this tier. These Information Processing Service Satellites also provide office automation activities such as electronic mail and calendaring which are interconnected throughout the enterprise and provide access to the Information Processing Service Satellites in other functional areas. The third tier consists of networked or stand-alone computer based workstations which meet the information, design, and analysis needs of the department's employees.

To ensure the long term viability of this three tier strategy requires that the enterprise provide for the portability of applications by (1) standardizing their purchases on hardware that provides an open architecture and (2) by adherence to vendor independent standards for the purchase of operations systems, languages, communications and applications programs. Moreover, stand alone and multi-user configurations should consist of a combination of interconnected hardware and software.

Now that we have provided broad information about the need to develop an Information Processing Service capability without having it tied to a unique vendor's product or process standards

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3. Depending on the size of the enterprise and technology selected, this could be a mainframe computer, a mini or super mini computer or a combination of these.

embedded in the technology underlying their hardware or software offerings, it is appropriate to look at the major functions of the Information Processing Service and its mirror Satellite Information Processing Service Units.

OPERATIONS

In general the major operational requirements for what we are now calling an Information Processing Service differ from its predecessor, the Information Processing Unit, in a number of important ways. The Information Processing Unit Manager must be concerned with the complexities of scheduling the flow of data and information from the various functional users through the data entry, computer operations, controls, distribution and, often, delivery tasks. The new Information Processing Service Manager must not only continue these activities, but must also be concerned about a number of other activities that are now carried out in the functional Information Processing Service Satellites. For example, data entry which used to be done through a centralized group of data entry clerks is now done in each functional area. It is now the responsibility of each function manager to collect and input functional data in a fashion that can be conveniently uploaded, without re-keying, to the host computer as well as being made available to other function managers on an 'as needed' basis. This requires either the careful development of standard and ad hoc reporting formats, or the application of the kind of distributed relational databases that will support the analysis, query, and specialized reporting necessary to satisfy all levels of management.

The intensified demands for information throughout the enterprise requires that the Information Processing Service Manager take on a strong consultive role with the function managers and their information specialists. This role needs to embrace not only the selection of hardware and software to ensure compatibility throughout the enterprise, but also the development of specialized applications that best satisfy each function's operational requirements as well as the broader enterprise requirements. Additionally, the Information Processing Service Manager must assist others in the selection and delivery of training to keep those involved in information processing up-to-date in the current applications as well as any newly emerging applications from various vendors.

Managing an Information Processing Service will be very different because information needs will be articulated at all management levels with the result that all but the most sensitive information will flow directly or indirectly through the Information Processing Service Managers. In this new role they will find themselves at the hub of a much broader information flow than they have in the past. With that broader information flow comes increased responsibility.

In response to changing tactical and strategic needs of upper management, the managing of the information flow will take precedence. Yet, the operational needs of the individual functions will, at the same time, continue to require daily attention in order to ensure credibility of the output.

As if the foregoing isn't enough, the Information Processing Service Manager must ensure the integrity of the information center where the host computer(s) are housed, monitoring the necessary inventory of equipment and manpower in order to execute the established and anticipated workloads. Just the right balance of redundancy must be carefully provided to offset the problems of equipment failure and of key staff shortages. In addition, alternative power sources must be made available for those times that the usual source of electricity is not available.

Based on the discussion thus far, it should be evident that the new responsibilities of the enterprise's Information Processing Service and its management requires a rethinking of its: organization, administration & management, operation, personnel education & training and maintenance functions.

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In order to provide some logical flow to the very complicated determination of the most desirable organization structure for an Information Processing Service, we will first discuss the concept and then provide definitions for an Information Processing Service and give a brief discussion about the major tasks it must perform.

MANAGEMENT AND ADMINISTRATION

These activities are considerably different from those of the traditional Information Processing Unit. To be successful, the management and administration of the Information Processing Service needs to be integrated into the day-to-day operations of the entire enterprise. Information Processing Service Managers are not just responsible for the top level processing of information and data. They are also responsible for the effective integration of all the individual workstations with the Information Processing Service Satellites, integration of Satellites to other Satellites, and integration of those with the enterprise's information center where the host computer resides. Consequently, the Information Processing Service Manager must maintain a very close working relationship with the functional managers because the Information Processing Service Satellites are managed by the independent function managers.

In addition, the Information Processing Service Manager must effectively carry out the role of an internal information consultant to client Information Processing Service Satellites and others who need (but who often do not recognize that they need) assistance in improving their own internal information management. This includes not only assistance in the development of solutions to their clients immediate information needs but also in the forecasting and acquisition of their future hardware, software, language and application needs.

Because of the far reaching impact of the Information Processing Service throughout the enterprise, administratively it should report directly to a top level enterprise official - not to a functional manager. it must be positioned to respond first to the strategic informational needs of the enterprise and then to the operational needs.

PERSONNEL

The selection of personnel for the Information Processing Service will require some adjustment from the past practice. Because of the fact that they will service other functional areas as well as the needs of top level management, the key personnel must first have an understanding of how the enterprise operates and competes, and secondly, be information experts. The need for this cannot be over emphasized. Even IBM learned the hard way that computer experts could not serve effectively their manufacturing needs without also becoming experts in manufacturing. Additionally, it became painfully evident that, on balance, those with outstanding computer skills did not readily assimilate the needs of manufacturing. Consequently, in order to meet the manufacturing needs, those with manufacturing skills were provided with the additional computer skills. Then, and only then, was the desired progress made in applying computer technology to the process of manufacturing. In a similar vein, the enterprise must very carefully select its satellites' personnel in a manner that will ensure that they first understand the functions they serve, and second, are qualified information professionals and technicians. To do otherwise will create a cadre of information managers and specialists who are adept at their own trade, but who cannot effectively apply that trade to the overall needs of the enterprise.

Now that we have covered the differences between the type of information system employed and some important concepts that need to be understood and applied, we must turn our attention to the mechanics of making that entity a reality. Selecting, planning, and designing a modern Information Processing Service is a complex and difficult task. It requires a significant outlay of resources and a substantial investment of time to properly establish this function so that it will have a direct and positive impact on the future of the enterprise. In this section we will examine the basic criteria that establish the parameters of the Information Processing Service, examine some organization charts depicting the three major functions of the Information Processing Service -- Operations, Development, and Technical Support, as well as discussing in more detail the additional functions of Administration and Management, Maintenance, Personnel, Education, and Training.

CRITERIA FOR ESTABLISHING STRUCTURE

The internal organization of an Information Processing Service is based on two major criteria. The first is what management expects the Information Processing Service to do. This forms the basis for determining the kinds of equipment that are required to satisfy the information & computation needs. The second is dictated by the equipment selected to do the job. This decision determines the skills required, the physical layout and the environmental requirements (Heating, Ventilation, and Air Conditioning). Within the context of these two criteria all of the internal organization decisions are made.

In situations where the computational needs require a mainframe computer as the host, the decisions concerning the skills, layout, and environmental requirements are mandated by the vendor that provides the equipment.[4] These requirements are so specific to each original equipment manufacturer's equipment offerings that we will not address them further. Instead we will concentrate on the modern organization configurations that are built around the much more flexible and less costly mini and

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4. For example, if the main frame requires chilled water to maintain the correct operation temperature this will necessitate special plumbing, air conditioning, and both primary and backup electric service. Additionally, this configuration will require special skills for both operation and maintenance.

micro configurations for both the main Information Processing Service and the Information Processing Service Satellites located within each major function. (See Figure 2).

There is a wide variety of configurations that are useful in developing the organization of the Information Processing Service that range from one end of the scale to the other. In making decisions about the configuration that should be used, it is useful to examine both extremes to determine how modern, conservative or middle-of-the-road management wants to situate itself. As the Information Processing Service moves toward the more modern configurations, it approaches a "lights out" operating environment where all the computers in the main information center are tied to magnetic or magnetic optical storage devices and information is randomly accessed, by communication links, from the Information Processing Service satellites located within each functional area.

The other extreme is the more traditional configurations (See Figure 1) where the main information center is tied to a tape media for information/data storage and information/reports, (almost exclusively in paper copy format), flow to the customer functions based on a batch processing operating environment.[5] This environment is far more labor intensive and requires programmers to write each specialized inquiry and manually mount and dismount the magnetic tapes that contain the required information. It also requires an extensive tape library and archive, all environmentally controlled and still tied to a paper reporting format.

It becomes clear from this discussion and what we have seen in the previous section that it is probably more attractive to establish a modern, as opposed to a traditional, information

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5. One might realistically ask why not configure this alternative with the same kind of random access disk storage media as the other? The answer is that technically you could. But it doesn't make much sense. The random access capability is more expensive and does not start to pay for itself until you reduced the manpower required at the main Information Processing Service location and provide true random access, (electronic media not paper), for the end users, e.g., the function managers.

processing system. This means, of course, acquiring the modern technology and moving towards a lights out environment with its attendant lower resource and skill requirements.

OPERATIONS AND DEVELOPMENT

As we have seen, the primary purpose of the Information Processing Service is to provide information that is critical to successfully designing, producing, and delivering the enterprise's goods and services. In order to accomplish this with any degree of effectiveness, a workable balance must be struck between the first two major functions -- Operations and Development. On one side of the scale is the advocacy for end user computing and on the other side concern about the use and protection of computer resources.

It is important to clearly establish what each of these functions is designed to accomplish. The development function is responsible for creating the programs and procedures which govern the way in which data is gathered and converted into useful information.[6] The operations function is responsible for delivering data processing products, such as reports etc., to the end users.

A lot of give and take is involved in providing the environment within which each of these functions can perform their assigned tasks. It is very important that they develop a workable system that combines hardware, software, and personnel. Within that workable system there needs to be shared development of information systems where the development function focuses on internal technology and the operations function focuses on input and output.

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6. INFORMATION CENTERS, Volume I, Management, Chantico Publishing Co., Inc. Carrollton Texas.

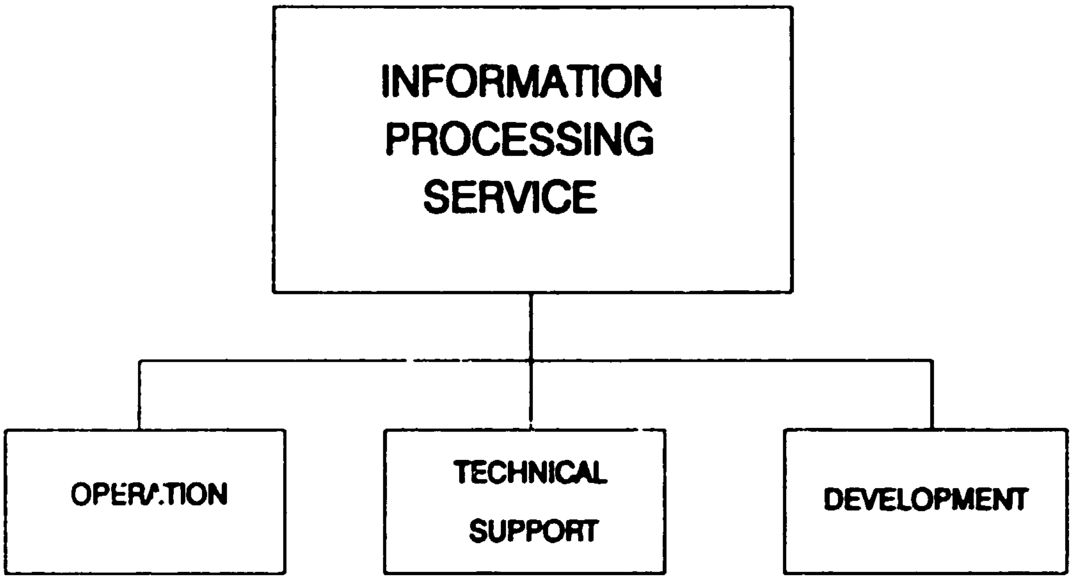
INFORMATION PROCESSING SERVICE
OPERATION
TECHNICAL SUPPORT
DEVELOPMENT

FIGURE 3

CHAPTER 5

TECHNICAL SUPPORT

The third major function is Technical Support. Here, the objective is to ensure availability of hardware and software. While the operations and development functions are directly identified with the products of the Information Processing Service, the technical support function is frequently considered overhead and viewed as an expense by management. Nevertheless, there are indirect benefits that accrue as a result of performing this function. End users are the primary recipients of those benefits, but the quality of technical support also impacts the operations function and the development function. The impact is significant enough for technical support to be looked upon as a necessary function that contributes to the present and future viability of the Information Processing service.

Figure 3 shows a simple organization chart based upon the three major functions. This is the first step in visualizing and building the enterprise's Information Processing Service.

Each of these three major functions has subfunctions. The size of the enterprise will determine how large the Information Processing Service will be in terms of Personnel, but the functions and subfunctions will be performed in any case, no matter how trivial. As an enterprise grows, there is the tendency to expand the Information Processing Service subfunctions to meet the expanding information demands and one may realistically see a subfunction that was originally a rather small portion of someone's job generate a requirement for a full time position.

GROWTH/EXPANSION

Growth projections should be included in the Information Processing Plan mentioned in previous chapters. These growth projections must come into play in setting up the internal Information Processing Service organization. For example, despite the fact that an enterprise may be small at the present time and can afford only a limited investment in

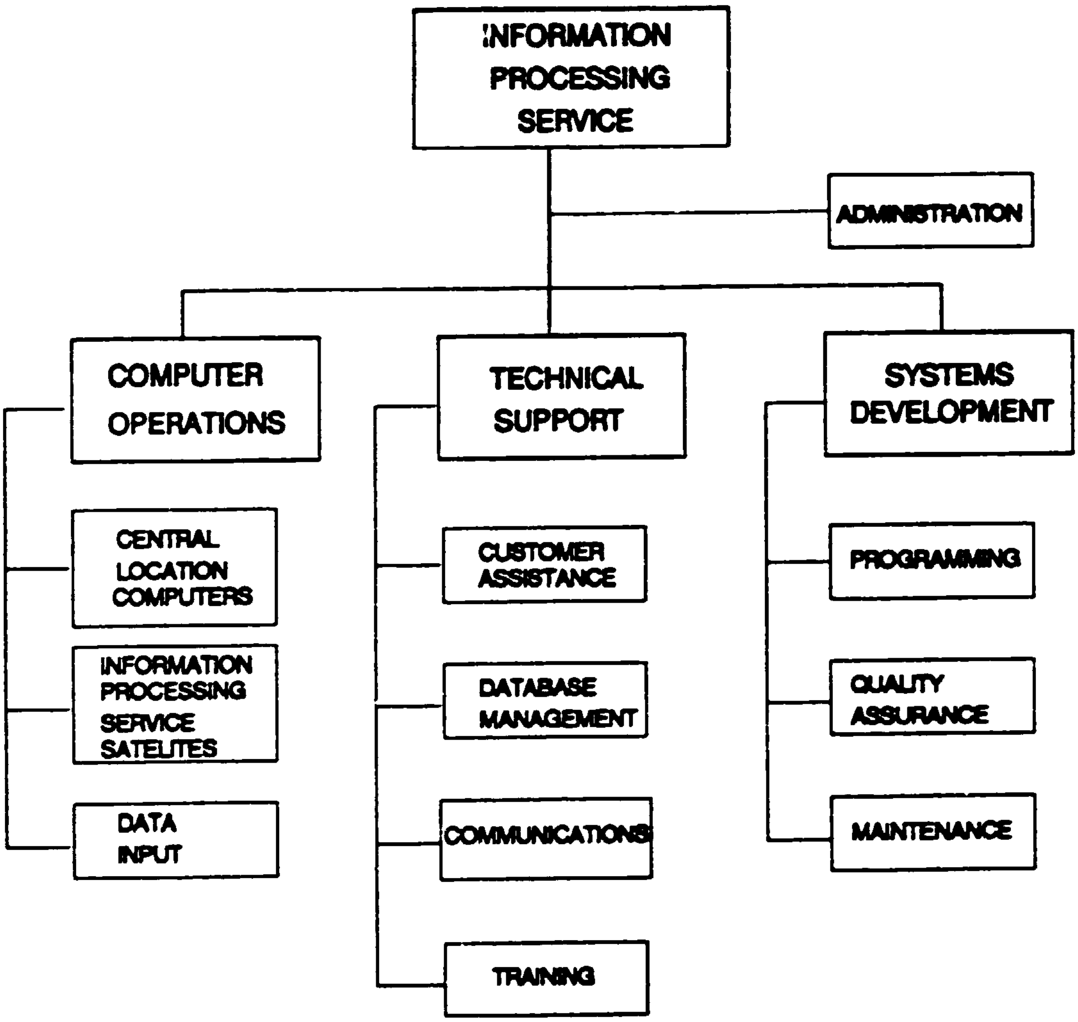
INFORMATION PROCESSING SERVICE
ADMINISTRATION
COMPUTER OPERATIONS
TECHNICAL SUPPORT
SYSTEMS DEVELOPMENT
CENTRAL LOCATION COMPUTERS
INFORMATION PROCESSING SERVICE SATELITES
DATA INPUT
CUSTOMER ASSISTANCE
DATABASE MANAGEMENT
COMMUNICATIONS
TRAINING
PROGRAMMING
QUALITY ASSURANCE
MAINTENANCE

FIGURE 4

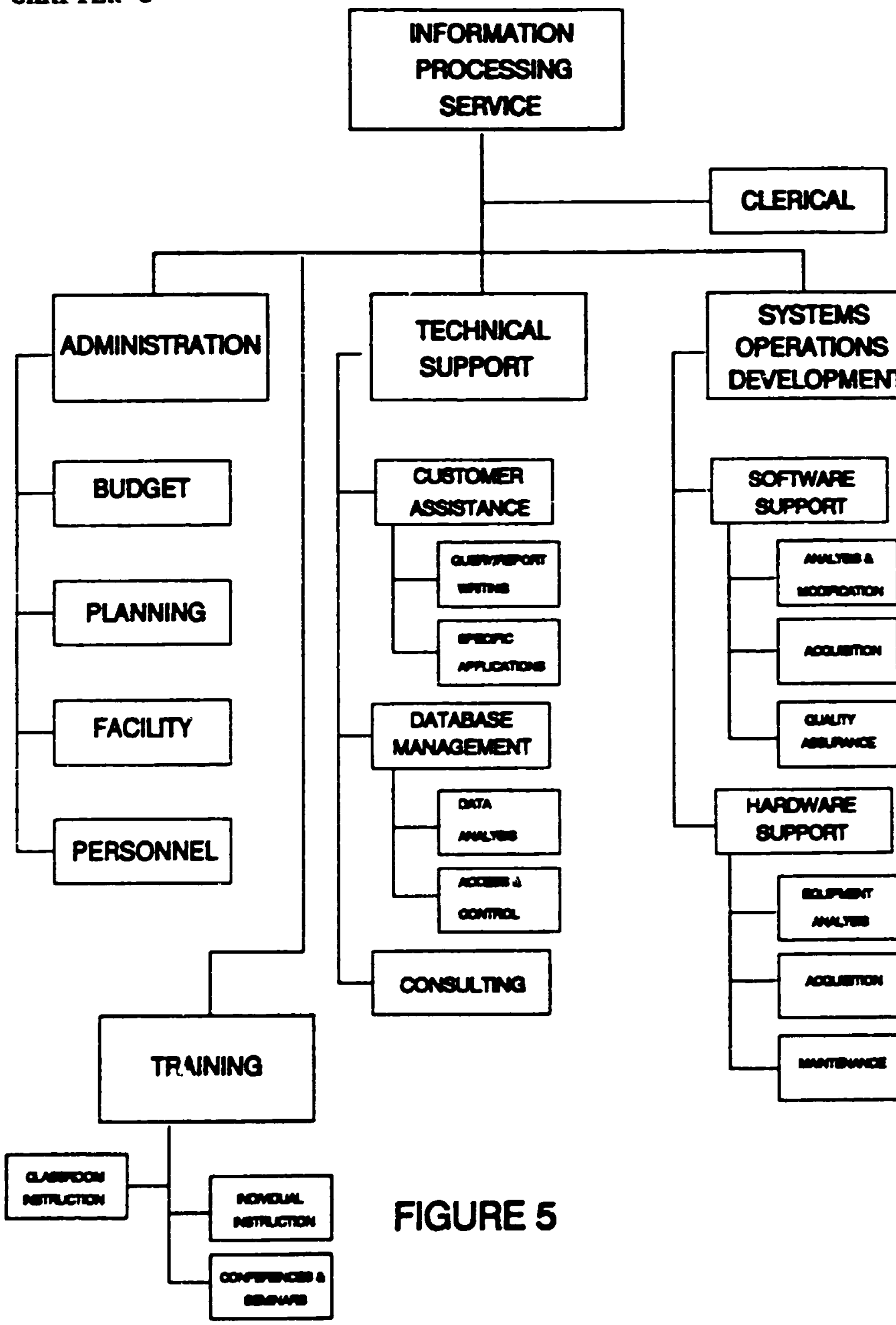
INFORMATION PROCESSING SERVICE
CLERICAL
ADMINISTRATION
TECHNICAL SUPPORT
SYSTEMS OPERATIONS DEVELOPMENT
BUDGET
PLANNING
FACILITY
PERSONNEL
CUSTOMER ASSISTANCE
DATABASE MANAGEMENT
DATA
CONTROL
CONSULTING
SOFTWARE SUPPORT
QUALITY
HARDWARE SUPPORT
TRAINING

FIGURE 5

the Information Processing Service, prudent management will plan as much as possible for growth in space, personnel, electrical power, and technological advancement. Regardless of the budget size or the amount of space available, it is extremely unlikely to successfully create, renovate, relocate or expand an Information Processing Service without meticulous planning.

Assuming growth from the small to medium size Information Processing Service, we can also assume an increased demand for information processing products and services which will translate to function expansion and thus a more extensive organization chart. Figure 4 reflects the change. Figure 5 depicts a further expansion of the various functions in the Information Processing Service. As the reader will note, these examples provide a measuring stick by which you can gauge which organization chart is most representative of the functions performed within your enterprise.

Now that we have developed some understanding for the structure of the Information Processing Service via the organization chart, it is important to decide who is to be charged with the responsibility of setting it up.

Very early on management must decide whether to hire a professional consultant or to assign an internal manager to accomplish setting up the Information Processing Service.

HIRING A PROFESSIONAL CONSULTANT

If hiring a professional consultant is management's decision, it is wise to contact the consultant before any other commitments have been made. Working together from the beginning and establishing candid communications is essential to the success of this effort. In addition to hiring the consultant, top level management should appoint an internal project manager and all information regarding the project should flow through this project manager. The literature is replete with examples of over-enthusiastic executives holding direct conversations with consultants, bypassing project managers only to have to redo tasks at great expense because decisions were made "in a vacuum".

Depending on the size of the consultant's organization, a consultant's project manager should also be identified and in that case the two project managers would work closely throughout the project. It is very important that both of these individuals have decision making authority.

Another critical element of the project is to get the vendor whose equipment the enterprise plans on purchasing involved as soon as possible. Vendor's specifications for their products are very precise and they can frequently preclude clients from making bad decisions. For example, it may appear at first review that it is more economical to tap into power circuits that have other equipment running off them in order to set up the enterprise's computers. Vendors will not only point up the risk of flawed information that can result from such action, but they can collaborate with the enterprise's project manager to determine an alternative economically feasible way of proceeding. One consultant calls it "warranty suicide" to take liberties with air conditioning, temperature, humidity, or electrical specifications. When there is a problem with a computer, the manufacturers will first examine the environment, and all the support equipment before considering that it could be a problem with their own equipment.

GOING IT ALONE

When management decides to set up the Information Processing Service without the assistance of a professional consultant, finding the right people to manage the project is the first challenge. Managing the setting up of the Information Processing Service is essentially a straight forward, project management function. Selecting the project manager is the first step in the in-house project. In the U. S. A. this person is typically an engineer or someone with a substantial amount of information processing expertise, (six to ten years experience) including management and supervision.

The next step is to organize a group of people that have the necessary knowledge of electricity, acoustics, lighting, air conditioning, security, design layout, fire control, telecommunications and local building, fire and zoning codes, if applicable. Even with all this, there can be risks associated with doing it all in-house. For example, one consultant tells a story about being called in to analyze an air conditioning problem in one of a number of small computer centers set up by a larger organization. All construction had been accomplished without the assistance of a consultant. He determined that the walls of the computer room had not been built slab to slab to isolate for environmental control, security, and fire protection. Instead the walls were only built high enough to meet the dropped ceiling. As a result, the proper temperature could not be maintained and the company was incurring very high utility costs in their attempts to do so.

PHASING IN THE INTERNAL ORGANIZATION

For major undertakings that lend themselves to sequential achievement of tasks (with some overlapping activities), a phased project approach is quite effective. Sequential phasing builds a relationship between one phase and the next and at the same time allows sufficient control over each phase and the project in total. Another useful tool is flowcharting. By reducing the project plan to a visual, it becomes easier for project team members to track progress and easier for management to visualize where the team is in relation to project completion.

PHASE I - GETTING STARTED

In this phase a project team is established, their charter is prepared and approved by management, macro and micro schedules are prepared, tasks are assigned to team members, site selection factors are examined, analyzed, and adjusted for requirements, and a report is prepared for management.

CHAPTER 5

COMPOSITION OF THE PROJECT TEAM

Whatever the size of the project team, there are specific functional area skills that are needed to set up the Information Processing Service. First is the person who will be the Information Processing Service Manager. This person is responsible for ensuring that all the tasks are assigned, that the established schedule is met, that unanticipated problems are handled, that sufficient control is exercised, and that upper level management is kept informed.

In addition to the project manager, sufficient additional resources must be assigned to cover the following functional area skills:

Engineering - responsible for electrical power, temperature control, building construction, fire protection, and security.

Architecture - responsible for designing the Information Processing Service facilities using the most modern materials at the most reasonable cost.

Maintenance - responsible for ensuring that all electrical equipment, mechanical equipment, environmental standards, and any structural facilities can be maintained within the designed facility with the minimum amount of cost and effort.

Auditing - responsible for ensuring internal procedures and standards are established and used, and ensuring the integrity of data security as well as physical security.

Armed with these functional skills, the project team needs to augment these resources by open communication and interaction with the vendor whose products will be installed. Usually, the vendor will assign a technical specialist to work closely with the

MACRO SCHEDULE

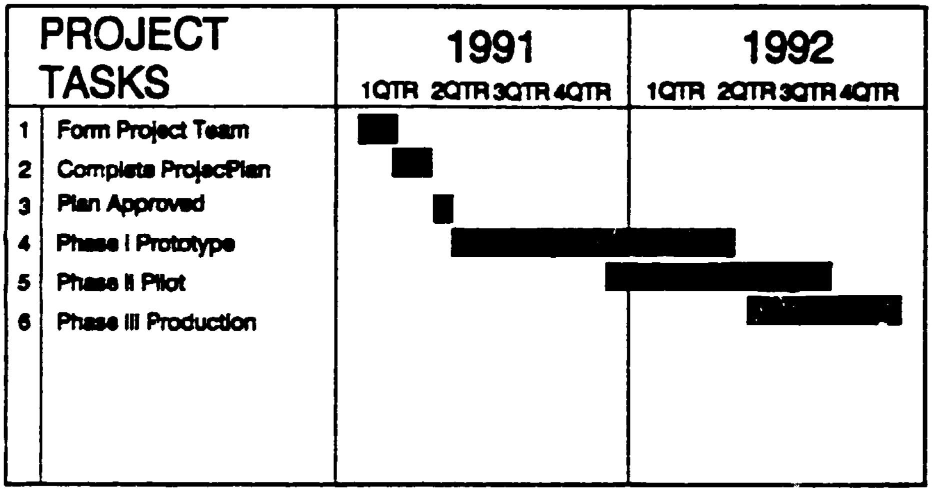

FIGURE 6

MICRO - SCHEDULE

TASK	RESPONSIBLE PERSON	COMPLETION SCHED	COMPLETION ACT	REMARKS
MEETING ON FEASIBILITY OF COMPUTERIZING ABC ENTERPRISE	[illegible]	[illegible]	[illegible]	
PREPARE REPORT ON MEETING WITH RECOMMENDATIONS TO TOP MANAGEMENT	MR WEST	[illegible]	[illegible]	ILLNESS
OBTAIN APPROVAL TO PROCEED AT BRIEFING TO MANAGEMENT	[illegible] & WEST	[illegible]	[illegible]	DELAY IN MEETING
IDENTIFY MEMBERS OF PROJECT TEAM AND OBTAIN COMMITMENT FOR RESOURCES	[illegible]	[illegible]	[illegible]	
SOLICIT INPUT AND DEFINE REQUIREMENTS	PROJECT TEAM	[illegible]	[illegible]	FUNCTIONAL RESPONSE DELAYED

FIGURE 7

enterprise's project team. Now the project team is ready to lay out the tasks in each phase and assign an estimated completion time for each task. A small amount of time invested in drafting some standard forms for team members to use will facilitate progress. A macro schedule for the total project and micro schedules for each phase such as those shown in Figures 6 and 7 make the tasks of reporting and controlling easier. Using this approach the Project Manager can monitor the assignments of each member of the team in accordance with the overall project plan. Unforeseen requirements can be quickly identified, added to the micro and macro schedules, and addressed as soon as possible. The best laid plans of mice and men don't include everything. But monitoring tasks on a detail basis throughout the project builds in flexibility and there are fewer surprises.

REVIEWING PLANS FOR GROWTH FACTORS

Here, again, the importance of careful planning for growth cannot be overestimated. Once the immediate needs of the enterprise are known, (see section on developing requirements) the project manager and the project team need to review the Information Processing Plan to ensure that not only the current needs of the enterprise, but the enterprise's forcasted growth, expected market fluctuations, and any other business indicators have been factored into the decisions being made. A cardinal rule for anticipating growth is to always locate computer facilities where expansion is easily accommodated.

ELECTRICITY

One pitfall to avoid at all costs is setting up the computer facilities in a location/s where there is insufficient electrical power. It is very expensive to correct this kind of error. Bringing in additional current involves purchasing and installing new lines, transformers, and switch gears. As if the expense isn't enough, the extensive delay in construction certainly is. This may well be an area where the enterprise management should have some consulting advice even if they have decided to go it alone. Even after sufficient power has been achieved, some determination must be made as to how "clean" the power is. It is important to know the tolerance the computers have for the local electrical current in order to avoid any difficulties that can arise from inappropriate matching of the two.

COOLING SYSTEM

Adhering to the manufacturer's requirements for temperature regulation is another top priority. Whether you are dealing with a mainframe, mini, or a micro computer, all have environmental limitations. Failure to respect those limitations will result in the equipment overheating. Consequently, continual "down time" will occur along with the resultant loss of productivity. Because the power and cooling systems are so critical and loss of either has a very serious impact, it is prudent to provide for some backup of these systems.

SITE SELECTION

There are a number of factors to be considered when making a site selection. To begin with the architects of the Information Processing Service should work closely with the engineers to examine building blueprints that show all structural elements that will impact any installation. In making the site selection, the project team must be concerned with security, physical location, and how to restrict access when desired. There should also be some application of the auditing skills required to ensure security of the physical facilities as well as the data. Microcomputer systems make minimal demands on sites because they are easily assimilated into the normal working environment.

CHAPTER 5

PHASE II - DESIGN

Once the site has been selected, sufficient power and backup has been achieved, fire protection has been factored in, physical security concerns have been satisfied, and any building or building modification has taken place, Phase I comes to closure with a report to management. If this effort is completed successfully, it is followed by top level management approval to proceed with the second phase - design.

Without regard for whether centralized processing or distributed processing is implemented, the physical plant facilities are where the greatest costs are incurred. Design errors are not easily recouped and for the most part are extremely costly to correct. Clearly, this spells out the importance of making sure that these facilities are designed for low risk, dependable, effective operation.

During this phase the project team designs the required computer facilities, taking into consideration the functions that must be performed and all factors that are pertinent to the smooth operation of the Information Processing Service. They must optimize the design plan to ensure room for expansion, passageways that facilitate easy access and efficient personnel movement, placement of hardware and support equipment that ensures effective use and proper access, effective placement of fire protection and detection equipment, alarms, signs, and sprinkler systems, hazard free placement of cables, nonflammable furniture, effective lighting, emergency lighting, and intrusion controls to name just a few.

In addition to all of the above, there are people to think about. Attention to human needs has a good rate of return because employees who are satisfied with their work environment inevitably produce more and better work. Management is frequently unaware of the comfort level of the workers but it is well to remember that in the final analysis it is the people who make the system work.

DESIGN PHASE CHECKLIST

DESIGN CONSIDERATIONS	ACTION TO DATE	TASKS REMAINING
SUFFICIENT SPACE FOR MAINFRAME COMPUTER	POSITIONED ON SITE	ELECTRICAL HOOK-UP
ADAQUATE ISLE SPACE FOR STAFF OF 20	LAID OUT	FLOOR COVERING
SPACE FOR PERIPHERALS	PARTIALLY LAID OUT	
REQUIRED ELECTRICAL OUTLETS	INSTALLATION IN PROCESS	
AIR CONDITIONING	INSTALLED	FINAL CHECK-OUT

FIGURE 8

A useful tool in moving through the design phase is to draft a checklist that lists all design considerations along the Y axis and what portion has been done and what action needs to be taken along the X axis. This type of matrix enables the project manager to exercise effective control as the design phase progresses. For example, see Figure 8.

PHASE III - IMPLEMENTATION

When the complex tasks of phases I and II are completed satisfactorily, we are ready to initiate the third phase, implementation. It almost goes without saying that the quality of the job the project team has done in the first two phases will be reflected in implementation. Here, again, the project team approach is most effective because implementation is a complex process and pulling everything together successfully calls for a lot of input from various sources, constant monitoring and control, and accountability on the part of the project team members.

Because the implementation phase is the last portion of the project and the one everyone has been waiting for, it is a high visibility undertaking. Everything takes on added significance as prior planning is put to the test of successful implementation. In this phase the following takes place: any required building or building modification, ordering and acceptance of the equipment and software, acceptance testing of items delivered, stocking of supplies and sufficient spare parts, monitoring costs, preparing maintenance and operational manuals, and a final check on all operational and maintenance aspects of the new function. The project manager must ensure at the outset that all team members are fully aware of their responsibilities and perform well throughout each stage of implementation. Only in this way can the project manager achieve the goal of completing implementation on schedule and within reasonable cost limits.

Several of the major tasks in this phase deserve special attention, in particular, ordering, delivery, and acceptance testing. Traditionally the frustration level runs high in these areas but establishing good procedures, enforcing them, and paying attention to detail can really pay off. As one reliable source remarked, "Remember planning and equipping a computer operation is not a job for the faint hearted. It demands experience, organization, common sense, patience, a knack for getting along with others, flexibility, an instinct for cost control, and a commitment to perfection. After all, if a computer facility can't be perfect, it's got to be almost perfect, or it's not going to work." (Outfitting the Computer room, Eric Marcus, DATAMATION, July, 1986)

ORDERING

It is critical that supplies needed for implementation are ordered sufficiently in advance of project start to ensure that they are readily available when needed. A small, seemingly unimportant, item can delay large installations and negatively impact the project schedule. The ordering process must be standardized and each item no matter how small must be ordered on the proper purchase order form. This ensures traceable records of items ordered, when they are scheduled for delivery and the associated cost. Prudent management will require vendors to confirm the orders, the materials and delivery dates.

DELIVERY AND ACCEPTANCE

Establish delivery and acceptance procedures well in advance of receipt. It is wise to clarify to vendors that a document that says an item has been received DOES NOT constitute acceptance. It is impractical to open each piece of equipment as soon as it is delivered. Therefore some procedures must be worked out with the vendor where the enterprise is afforded the opportunity to open the delivered items and examine them to make sure they are not damaged. Then a signed document constituting acceptance must be returned to the vendor. This must be accomplished quickly because vendors have a substantial investment in the items and do not want to risk damage while in the enterprise's possession. This procedure works well when dealing with items that do not require testing. In those instances acceptance testing must be done and the item is not officially accepted until it successfully passes the acceptance test.

ACCEPTANCE TESTING

Too frequently information processing equipment is delivered and installed without acceptance testing. Almost as frequently problems that would have otherwise surfaced in acceptance testing arise during the first weeks of operation. At that point it becomes even more difficult to determine the source of the problem because of the complex connections of facilities, equipment, communication links etc. and each vendor is always sure it is not his product that has caused the difficulty. Detailing the necessity for acceptance testing in vendor contracts and specifying the length of the acceptance test provides a comfortable measure of protection against system breakdown after installation.

ADMINISTRATION AND MANAGEMENT

There are a number of basic administrative/management tasks the Information Processing Service Manger must accomplish before he is open for business. These provide the basic parameters for operation both within the Information Processing Service and within the enterprise. The amount of time and resources required to accomplish these tasks is directly related to the size and complexity of the Information Processing Service and the enterprise it serves.

MISSION STATEMENT

The first task of the Information Processing Manager is to develop an Information Processing Service Mission Statement which clearly delineates the mission from which broad objectives can be established. When this has been accomplished, top level management agreement and approval of the statement must be obtained.

THE OPERATING PLAN

Next, an operating plan for the Information Processing Service must be put together. Planning is a complex management process and must be accomplished in a manner that ensures achievement of the objectives of both the Information Processing Service and the enterprise. The operating plan is a detailed document that lays out what the Information Processing Service will accomplished during the year and ties those goals to the necessary resources. It identifies the functional customers, the amount of work that will be done for each and the allocation of resources to achieve the acceptable quality level of each task.

FINANCIAL AND PERSONNEL PLAN

The primary objective of the Information Processing Service is to maximize service to its customers and, at the same time, minimize the costs associated with providing that service while maintaining quality standards. As with all organizations the Information Processing Service must have a budget to cover operating costs and pay the staff. Most often this document shows projected cost by month. It includes direct costs such as salaries, indirect costs such as benefits, overhead costs such as heating, cooling, and lighting. It is important to establish the level of service and quality that will be required as a starting point for defining the costs. Personnel costs for staffing for that level of service and quality and utilities, supplies, etc. must be added to construct a realistic plan. Another important point to remember is to involve those people that will have to implement the plan in the initial development of it. Having helped to develop it, they will be committed to making it work.

CHAPTER 5

FUNDING APPROVAL

After the Financial and Personnel plan has been developed, top level management approval must be obtained. When top level management has been involved throughout the development of the plan and has demonstrated support of stated goals, objectives, milestones, and controls, this becomes a pro forma exercise.

MARKETING AND PUBLIC RELATIONS

Plans to market and sell the Information Processing Service to gain acceptance and approval from the customer functions must also be constructed. A good quality product delivered on time is an excellent reference but not the only way to get business. There must be an outreach effort that has been carefully researched and planned. Then a selling process must take place. Make contacts with system users and establish credibility. Good interpersonal skills are an important asset here. Researching and targeting jobs that can improve customer function performance, emphasizing how the use of computers can improve productivity and reduce costs, establishing policies for handling and measuring performance, arbitrating disputes and being equitable and cooperative in all relationships will develop strong customer support.

JOB DESCRIPTIONS

Job descriptions to cover all the functional tasks of the Information Processing Service must be written in preparation for filling those positions. A job description delineates tasks and responsibilities, skill requirements, and the degree of supervision required. In building the staff of the Information Processing Service, a balance must be struck between the resource requirements dictated by the desired level of service and quality and the salary the enterprise can pay, the qualifications of the applicants, and the benefits and career progression that can be offered. Timing is important too because sufficient lead time for hiring is necessary to ensure the staff reports when needed. Frequently the advertising, interviewing, and approvals take longer than anticipated.

MAINTENANCE

Maintenance of the information processing systems and the physical locations where equipment is located is critical to the success of the Information Processing Service. However mundane maintenance tasks may seem, diligence in this area will pay off. There is no substitute for good maintenance. This just doesn't happen. It requires thoughtful planning, careful control, and the ability to put the necessary preventative and corrective resources where they are needed on a timely basis in order to avoid disrupting the system. This is doubly important because maintenance costs have experienced significant escalation over the past ten years.

Maintenance is the ultimate responsibility of the Information Processing Service Manager who must assign duties and responsibilities to the staff and check periodically to ensure that they are done satisfactorily. A regular equipment maintenance schedule should be developed that delineates when tasks are to be accomplished. All maintenance and preventative maintenance tasks must be identified for all systems, components, and equipment. Management must be concerned with such things as how well preventative maintenance records are kept, how frequently printer ribbons are changed, are there sufficient spare parts and are they stored correctly, are all the required tools available, is all equipment receiving regular service, and are work areas clean and laid out in a manner that enhances workflow and facilitates maintenance. And, finally, maintenance procedures must be developed and documented in a manual for ready reference and for training.

CHAPTER 5

PERSONNEL AND TRAINING

PERSONNEL

Several major points were made in the previous section regarding the type of personnel needed and the skills required to make the Information Processing Service a success. While it should be the goal of the personnel function to hire individuals with both information processing skills and knowledge of, for example, manufacturing, this is not always possible. However, the practical approach is to train to augment whichever skill is lacking. End users become more proficient with time and often are excellent candidates for promotion to information processing positions because of their knowledge in both functional and information areas.

TRAINING

Whatever the size of the enterprise, a training plan that spans at least one year should be developed and followed. It must be developed so that the training eases the uninitiated into the technology gently and offers higher level training for those that are already computer literate at the same time. As the uninitiated progress they can move on to the more advanced training. Many large organizations establish a minimum level of training to be functional and then ensure that all employees receive that training as a baseline and then lead the users, step by step to the desired level of competence.

The success of the introduction of this new technology depends heavily upon the knowledge and training of the users. The more training opportunities the Information Processing Service makes available to the users, the greater the chances of successfully implementing information processing. However, it is important to remain flexible in spite of prior planning because training is a user-driven function and even though in most organizations the demand will increase at an increasing rate, it is not always within the control of the Information Processing Service Manager. It must be budgeted and the interruption to normally assigned tasks must be taken into consideration. It quickly becomes evident that planning and implementing training is no simple task. In preparing the training plan specific training objectives should be identified and approved by top level management. These are generally centered around the identification of the training that is needed, establishing curriculum based on those needs, and targeting the number of people that will be trained in specific areas within specific timeframes. Training objectives should be tied to business issues. In that way, understanding of the role the Information Processing Service plays in addressing those business issues through the use of new technology is facilitated.

It is important to remember that the 'students' are adults and must be taught as such. Users come from different backgrounds, with different educational levels, different experience, and different understanding of computers and how they operate. In general, they will want to learn how to use computers to solve problems that exist in their own functional areas and will want to achieve this quickly. They do not always understand the amount of technical knowledge they must acquire to be proficient. The training should begin by providing a general education on computing/information processing. Then the students should be taught among other things how to get started, how to handle data from files, how to analyze and define program requirements, and when to call for help. A small percentage of users will want to learn programming languages, and more intricate technology.

CHAPTER 5

SUMMARY

This chapter compares and contrasts the Information Processing Unit and the Information Processing Service, addressing the essential differences encountered when an enterprise elects to establish centralized processing versus distributed processing. It delineates the structure of the Information Processing Service from a conceptual basis, considering the configuration that must be established to meet strategic goals in an enlarging geographical marketplace. It defines the three tiers of computing power around which the Information Processing Service structure is built and finally, the reader is provided step by step guidance in the mechanics of making this entity a reality.

CHAPTER 6

SETTING UP THE INFORMATION PROCESSING SERVICE

INTRODUCTION

This chapter will address how to set up the information service from the following perspectives:

(1) Profit Center or Cost Center
(2) Make or Buy decisions
(3) Methodology
(4) Operating Procedures and Standards.

In keeping with this, it is important to remember that a prudent entrepreneur invests the necessary up-front time to investigate the pluses and minuses of these kinds of business decisions. Ultimately, this can spell the difference between success and failure. Careful consideration of the pros and cons will enable sound and timely decisions.

PROFIT CENTER

Setting up the Information Processing Service as a profit center is based upon the concept of the center earning a profit from other functional sections of the same enterprise and, in some instances, earning a profit by supplying information processing services to organizations external to the home enterprise. While at first review this appears to be very appealing, especially when considering utilization of computer capacity, it should be approached with caution. Again, some careful analysis of the enterprise's objectives and the pros and cons of operating the Information Processing Service as a profit center is needed. Let's examine some of the pros and cons that immediately come to mind.

a) PROS

1) The information requested by other functions internal to the enterprise will be used because under the profit center approach the requesting functions will be paying for that information.

2) The distribution of cost to the customer functions is directly related to the amount of services each customer function requests.

3) Providing notification of such costs to the customer function allows periodic review which should lead to better management of their information processing funds.

4) Providing information processing services to organizations external to the home enterprise can make better use of computer capacity and reduce the cost of ownership.

5) The profit center approach automatically implements controlled growth of the Information Processing Service because it will only grow as fast as it can successfully meet its workload and sell its services.

b) CONS

1) Planning for the growth and development of the Information Processing Service becomes very difficult because it is tied to the short term operational needs and budget limitations of the in-house functional units it services.

2) There is the tendency when servicing external organizations to give them priority processing because the work is billable and brings funds into the enterprise. This can result in serious internal problems.

3) The internal customer functions that "spend" more demand higher priority processing that may not be warranted in light of the overall enterprise objectives and needs.

4) Because under this approach the Information Processing Service is primarily dependent on its internal customers for funding, it is extremely difficult to maintain the quality of managers, programmers, operators, etc., and currency of technology that are required to ensure a viable on-going organization.

5) Because the information processing costs to the internal customer functions compete with other budgetary elements, those customer function managers may elect to "save" that cost by retaining manual methods which will not be in the long term best interest of the enterprise.

6) The accounting for the services provided to internal and external customers can impose a substantial workload that carries with it an additional cost.

CHAPTER 6

COST CENTER

Setting up the Information Processing Service as a cost center is based upon the concept of spreading the cost of that unit as overhead to the other functional sections of the same enterprise, similar to the way personnel, accounting, and administration are handled. With funding on a more solid basis, management of the Information Processing Service is more easily facilitated.

a) PROS

1) As a cost center the funding for the Information Processing Service will normally be part of the budget the enterprise establishes for overhead. Thus, funding for operations, personnel and equipment is consistent.

2) With consistent funding the Information Processing Service's growth can be planned and implemented.

3) If the cost of information processing is spread as overhead to each customer function the Manager of the Information Processing Service is free to establish processing priorities based on the enterprises long and short term goals and the best utilization of personnel and equipment.

4) Because the cost of information processing is spread as overhead to all customer functions there is no incentive for customer function managers to retain manual methods as a means of "saving costs" when automated methods are more efficient and effective.

5) Cost center funding ensures a consistent financial base, thus removing a lot of the incentive to give external customers priority treatment.

6) There is less accounting associated with this approach.

b) <u>CONS</u>

1) The cost of the Information Processing Service is not distributed to the customer functions on the basis of the amount of services requested. This removes the incentive to give preferential treatment based on volume.

2) The Information Processing Service must compete with all of the other functions in the enterprise (overhead and operating) for scarce resources.

3) The cost center approach doesn't force the Information Processing Service to earn it's own way by "selling" its services.

4) Without good management this approach can leave the enterprise in the position of high investment in expensive technology and under utilization of computer capacity.

MAKE OR BUY DECISIONS

In terms of these guidelines, the make or buy decision for setting-up an Information Processing Service boils down to whether management sets the unit up or it hires information processing specialists to do it for them.

One of the main ingredients to making this decision is the degree of computer literacy that exists within the enterprise. This added to market competition, the availability of funds, and the rate at which technology is changing provide the basis on which to build the decision. Unless the degree of computer literacy is very high it is inadvisable to "go it alone". On the other hand, turning over the computerization of an enterprise entirely to an external group can have some serious consequences. The most prudent approach seems to be a comfortable amalgamation of the two. There is no substitute for expert advice, provided (1) it is current and (2) those receiving it fully understand. Involving the enterprise's employees and managers ensures that you will have a working system when the experts leave.

The funds that are available is another controlling factor. As in all business decisions there is financial risk. Careful analysis must be done to ensure adequate return on investment as well as no serious interruption to the enterprise's cash flow.

The rate of technology change is a driving factor in getting the most for the investment.

METHODOLOGY

DEVELOPING AN IMPLEMENTATION STRATEGY

Once the management of the enterprise has made the decision to establish an Information Processing Service, they need to establish a Committee, whose primary purpose is to devise the strategy to be followed in setting-up the information processing function and ensuring its continued viability over time. Then that strategy must be translated into a workable plan of action.

THE INFORMATION PROCESSING PLAN

After the strategic approach has been determined, the next step in the methodology of establishing the Information Processing Service is the development of a comprehensive Information Processing Plan. This plan is an integral part of the strategy and must clearly delineate both short and long term goals. To accomplish this, the Committee must proceed based upon responses to questions that address where they are starting from, where they want to go, and how they are going to get there. An essential part of the development of the information processing plan involves determining how quickly management wants the enterprise to be computerized and what controls will be applied to ensure meeting those objectives. Building this plan and developing an understanding of the pace at which to proceed and the controls to be applied is, once again, a process unique to each organization. How this plan is implemented directly relates to (1) the rate at which computer technology will be absorbed initially and (2) the rate at which the enterprise will embrace new technology.

A CASE STUDY

A recent study performed by DATAPRO Research Corporation, Delran, N. J. 08075 U.S.A., was based upon research with ten different organizations. It revealed that two forces - acceleration and control - were the factors that dominated "all actions regarding user computing support strategy".

As a result of that study, DATAPRO developed and categorized strategies for managing growth that are applicable to setting-up Information Processing Service units and deserve consideration in developing the strategy the enterprise will employ to accomplish this task. Figure 9 shows a matrix for the two forces mentioned above - acceleration and control - and assigns arbitrary levels of "low" and "high". A separate strategy is shown in each of the four quadrants which is designed to categorize the management approach to implementation of information processing/user computing. The definitions of the four approaches are shown on the page following Figure 9, Four Management Approaches to Implementation of Information Processing.

STRATEGIES FOR GROWTH/IMPLEMENTATION

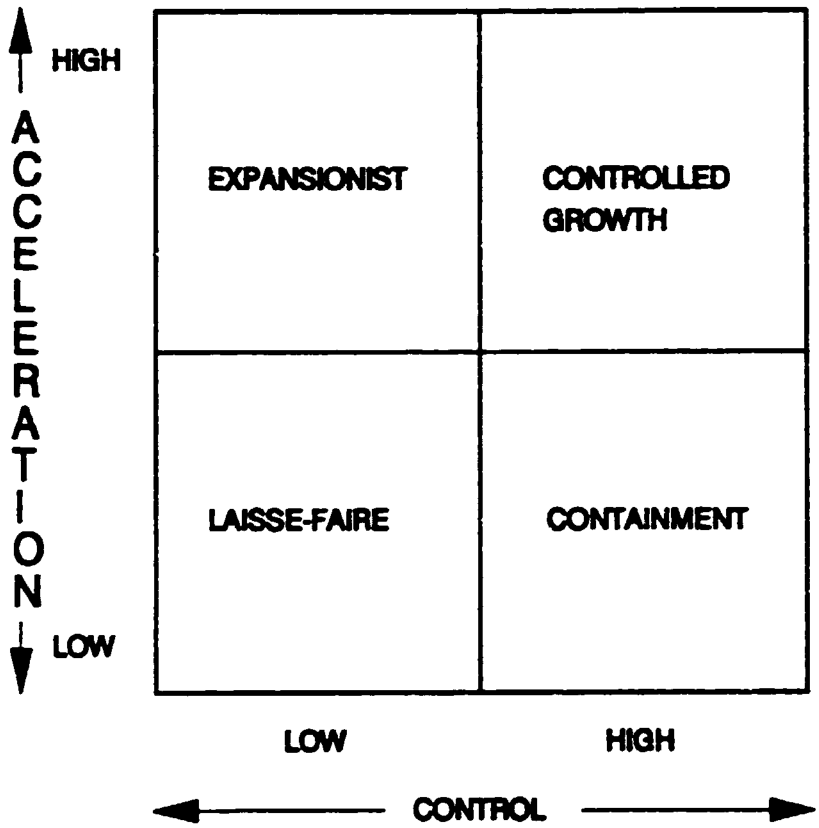

FIGURE 9

CHAPTER 6

STRATEGY DEFINITIONS

LAISSEZ-FAIRE

This is the approach that the study found most typical and depicts a situation where interest is relatively low and there is no particular urgency or strong motivation to increase the growth of information processing. The information processing activity is minimal and management remains uncommitted.

CONTAINMENT

In this approach management is committed to a slow, careful implementation. A deliberately slow rate of acceleration is employed and very tightly controlled so as not to exceed the limited growth pattern established by management.

CONTROLLED GROWTH

This approach results when management has decided to implement at a faster pace, but still wants to apply careful control to the situation. An environment of encouragement prevails where sufficient resources are provided to make sure the desired growth occurs at the pace management has determined it needs.

EXPANSIONIST

Here the management is very generous with resources to support their decision to implement information processing but is not concerned with any comprehensive approach. Essentially, management is saying "let the user decide what works best for them".

The DATAPRO study concluded that (1) nearly all organizations start through the quadrants of Figure 9 with the laissez-faire approach, and (2) organizations either move clockwise or counterclockwise through the approaches shown in that figure depending on the time of the introduction of "acceleration mechanisms versus control mechanisms".[1] The enterprise's movement through the various approaches will be clockwise if the primary concern is the pace at which implementation occurs and concern with control is secondary. If, however, control is the primary concern, the enterprise's movement through the approaches will be counterclockwise because the desired controls will be introduced at the outset. It is important to note that the study did not conclude that all organizations move through all four approaches, but suggests that as the organization matures in its computer implementation it settles down relatively close to the center of the quadrants.

IMPLEMENTATION STRATEGIES

A number of implementation strategies exist today, but the one that seems to have accrued a great deal of credibility is the "Three P's" approach. It is the basis for most of the following strategies. It includes the three phases involved in moving from the conceptual stage into full scale implementation.

THREE P's = PROTOTYPE, PILOT, and PRODUCTION

The first phase is setting-up the prototype. After meeting with success there, the pilot project, or phase two, is initiated. Finally, armed with all the lessons learned from the first two phases, management

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1. From Understanding the Information Center Role, DATAPRO RESEARCH CORPORATION, Delran, N.J. 08075, November 1986.

should feel comfortable with beginning the third and final phase - information processing production for the whole enterprise.

The benefit of using this approach is that "this strategy maintains an inverse ratio of risk to expenditure: high risk at the outset is balanced by low investment; only when risk declines toward zero and system use rises toward production status is investment in tools permitted to rise in proportion to benefits."[2]

THE HORIZONTAL STRTEGY

This strategy seems to be the most popular of the current strategies. It proceeds along simple, logical lines implementing one functional tool (e.g. word processing, spreadsheet, electronic mail, etc.,) at a time until that tool has been put into production across the enterprise. "A slight overlapping occurs with tools put into production in various stages of development to ensure a steady flow of implementation."[3]

THE VERTICAL STRATEGY

This strategy selects one department of the enterprise and implements the full range of tocls at once. The downside of this approach is the probable negative impact on the users. Users may feel inundated, become frustrated, and give up trying to learn the new system. If the operation is not very complex and there is a reasonable degree of computer literacy, this may wcrk well.

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2. Barcomb, David, Office Automation, A Survey of Tools and Techniques, Digital Press, 1981, pg 23.

3. Barcomb, David, Office Automation, A Survey of Tools and Techniques, Digital Press, 1981, pg 23.

THE MATRIX STRATEGY

This strategy proceeds similarly to the horizontal strategy and expands vertically in those departments where more in-depth use of the functional tools (e.g. word processing, electronic mail, calendaring, spread sheets, etc.) is needed and can be readily absorbed. The vertical expansion of functional tools for the remaining departments is phased-in over time based on demonstrated need.

THE SHOTGUN STRATEGY

This strategy is well named because it implements the functional tools on a random basis. It is usually what occurs when management has not invested the necessary time to develop the implementation plan discussed previously and the results are indicative of the lack of a comprehensive approach to implementation.

THE CHORUS-LINE APPROACH

This strategy implements specific functional tools in designated areas of the enterprise based upon need. However, it differs from the shotgun strategy in that each implementation is part of a carefully devised plan that has been developed to achieve the goals of compatibility and integration. This approach is designed to implement first what is needed where the best return will be realized. However, it can sometimes cause friction when other areas in the enterprise are not selected for the initial implementation.

CHAPTER 6

PHASES OF THE THREE P's

PHASE I - THE PROTOTYPE

After the Committee selects the strategy it will apply and develops an Information Processing Plan, the next step is to determine what group within the enterprise will host the prototype project. If possible the prototype should be set up in whatever information processing function exists or with the group that will become the Information Processing Service professionals. Through examination and analysis of the functional tools, it can be determined what works best for the specific enterprise and a good "fit" can be achieved. This process increases the knowledge of those participating, imparting knowledge that makes them even more effective in the next phase of implementation. During this phase of implementation, testing of a variety of products will take place in order to develop the prototype. Essentially, this is the process of selecting what will work best for the enterprise and the "fitting" continues until a satisfactory configuration is determined. Then, that configuration is tested during the follow-on pilot project phase. It is often advisable to lease hardware for this first phase in order to limit financial investment and operational risk.

Once the location for the prototype has been selected, management needs to announce the selection and provide an informative briefing to all levels of the enterprise's employees. This "public relations" effort is time well invested to generate interest and alleviate concerns. Frequently, the advent of the introduction of automatic data processing heralds fear of job losses. It is important for management to allay those fears in order to generate the enthusiastic support that is needed to achieve a smooth transition to the new technology. An environment of "openness" during the planning and development phase will foster interest in the new technology and generate a cooperative attitude.

When the prototype is set up, employees should be encouraged to try using the hardware and software. This is especially true for those employees who have no prior computer experience because it is important for management to gauge their reactions and use this information to modify plans where necessary. During this prototype phase is an excellent time for the enterprise managers to exercise their curiosity about the computers. Here careful, interest, instruction, and understanding will win their acceptance and support for the Information Processing Plan. The total approach here is to make it as comfortable as possible for people to accept the coming changes and willingly get behind the implementation effort.

PHASE II - THE PILOT PROJECT

After the prototype is set up the Committee must seek out the best location to test the information processing configuration that comes out of the prototype phase. The major purpose of running a pilot project is to determine on a small scale basis what are the strengths and weaknesses of the system that is being tested. This is a very sensible way to approach proposed changes. It provides important feedback to management which can be used to modify the system to achieve a better "fit". At the same time, it accommodates the very human negative reaction to change by introducing changes at a pace that allows the changes to be more easily absorbed. Along these same lines, it is important to encourage interest and participation in the pilot project because in this manner management will have more employee support when full scale implementation takes place.

CHAPTER 6

SELECTION OF THE LOCATION FOR THE PILOT PROJECT

While the prototype is underway, the Committee needs to be "marketing" the Information Processing Plan and encouraging managers of the functional areas of the enterprise to volunteer to be the site for the pilot project.

WINNING SUPPORT

Listed below are several approaches for convincing functional managers to participate.

NEEDS/BENEFITS

Researching the needs of these areas and how information processing will benefit these operations will provide the means of convincing potential site managers of the merits of your request.

AVOIDING DISRUPTION

Offer to set up the pilot project in such a way that it does not alter the current methods of operating. This avoids disrupting normal activity and makes managers more receptive.

FUNDING SUPPORT

Assuring managers that any funding needed for the pilot project will be provided is always an enticement.

CHAPTER 6

PRIORITY TREATMENT

Arranging to provide hardware and software on a priority basis to the volunteer site is additional motivation.

In making the selection of the location for the pilot project, it is best to select an area where there is a reasonable degree of enthusiasm for information processing and the benefits it offers. At any rate, the group selected must be adept enough to identify problems and make suggestions on how to solve any difficulties.

Once the location for the pilot project has been selected, management should announce the selection and provide another informative briefing to the enterprise employees. This approach continues to stimulate support and participation by keeping employees informed and involved.

As the time to initiate the pilot project draws near the Information Processing Service professionals and the committee that developed the Information Processing Plan need to work very closely with the volunteer site group. This assures that they are readily available to provide advice and support and handle any difficulties that may arise.

During the pilot project management needs to be very receptive to the problems cited by the testing group. Taking prompt action on those issues gains credibility for the pilot project as well as the long term information processing objectives of the enterprise.

An added benefit of the pilot project is that as it proceeds those employees involved receive a special education that will be very useful as the enterprise moves on to the next phase in implementing its information processing system. The enterprise can benefit substantially by drawing upon this resource to help instruct others in the implementation and use of the new information processing system

MEASURING THE RESULTS OF THE PILOT PROJECT

In order to achieve the best measurement of the results of the pilot project it is necessary to allow sufficient time for the volunteer group to become proficient in the use of the functional tools provided. It should be noted that it takes a different amount of time to master some tools than it does for others. For example, it normally will take considerably longer to master spread sheets and word processing than it will to master electronic mail or calendaring. The information processing professionals working on the pilot project are usually able to judge when proficiency has been achieved. Then, and only then, should measurement of the effort be initiated. Measurement at any earlier stage will provide very skewed results.

Based upon the assessment of the success of the pilot project, the information processing professionals should prepare and submit a report with recommendations to the Committee and top level management. Careful planning and execution of both the prototype and the pilot project phases should result in a management decision to proceed to the production phase.

CHAPTER 6

PHASE III - THE PRODUCTION SYSTEM

The most prudent management decision is to use a progressive approach to production implementation. Proceeding in this manner will limit risk and allow time to assess and correct as implementation proceeds. A host of policy decisions must be made at this time regarding hardware (whether to buy, rent or lease the equipment) and software (whether to buy "off the shelf", commercially available, whether to license, whether to have software custom written). Provided the planning invested in the two prior phases was sufficient, and the implementation of these phases is successful, the third phase should proceed relatively free of difficulties.

A very valuable resource in achieving successful implementation of the production phase, and one that management needs to cultivate and capitalize on, is the positive opinion of the pilot project site manager. Enthusiastic support from that functional manager can sell all the other functional managers. His opinion probably carries more weight than the marketing efforts of the information processing professionals because here is a peer manager who has tried it and he likes it. With each successive group that tries it, more are encouraged to "get in line" for implementation. All managers know that information is power and lack of it negatively impacts the job to be done and any personal aspirations of moving up the ladder in the enterprise. These are strong motivational reasons for getting involved.

As the enterprise moves into full implementation of their information processing system, attention must focus on the procedures and standards that will be applied to ensure effective operation of the Information Processing Service.

CHAPTER 6

PROCEDURAL STANDARDS AND FERFORMANCE STANDARDS

Standards are established to help management gauge how well the Information Processing Service is being operated in terms of measurable tasks, jobs, and functions. These measurables can be conveniently categorized in terms or Procedural Standards and Performance Standards. The former establish the way a job is to be done. The latter establish how well the job was done in accord with the Procedural Standards. Consequently, the setting of Standards must be done with care so that they credibly reflect how well the Information Processing Service's management is meeting their established service criteria of:

> QUALITY, meaning error free production. The criteria for quality is easily measured in terms of the number of times a job has to be re-run before it is acceptable to the requester divided by the total number of jobs run.[4]

> QUANTITY, meaning that the Information Processing Service must demonstrate that it is producing the kind and quantity of data/information expected. This is easily measured in terms of numbers of error free jobs produced over a given time period divided by the total number of jobs produced.[5]

> TIMELINESS, meaning that the information must be in the hands of the requester by the time it is needed. That time is not necessarily when the Information Processing Service finds it convenient to do the job; but is established through negotiation with the requester and in light of how his priorities rank with

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4. Depending on the situation, there are other measures one could use such as the number of machine hours used to produce error free products or the number of man hours used. The important thing to remember is that whatever measure is used, that measure must credibly reflect the output and resources being used. Otherwise the measure will be meaningless.

5. One can get more sophisticated here by weighting the products by their priorities.

others who also are competing for the Information Processing Service's time. This measure is quite simply expressed as the count of the number of times the actual completion date/time coincides with the requested completion date/time divided by the total number of jobs done.

PROCEDURAL STANDARDS

In order to maintain effective control over the expenditures of the Information Processing Service's scarce resources the Information Processing Service management must develop procedures for running most jobs. Emphasis should be placed on those jobs that are either repetitive and (or) consume a lot of resources each time they are run. This determination must obviously be tempered by the necessity of running frequent non-repetitive jobs which may in aggregate consume a considerable amount of resources.

Each procedure must accurately identify the sequence of tasks necessary to complete a job while maintaining the necessary Quality, Quantity and Timeliness criteria mentioned earlier. Care must be taken to ensure that those who must follow them understand and agree to them. If they don't they will continuously circumvent the established Procedures and render both the established Procedural Standards and the Performance Standards meaningless.

One of the easiest ways to establish the Procedural Standards is to use a flow diagram to graphically display the sequence of tasks associated with a job. This sequence of tasks is the procedure[6] you will use to accomplish the tasks associated with the job each time it is run. The procedure does not become a Procedural Standard until it has been determined that the sequence of selected tasks reflects the most effective and efficient way of doing it. To ensure this, run the job in accord with the selected sequence a

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6. Sometimes you will see the term "process" used to describe similar activities. In this discussion we consider the terms to be interchangeable and will use the term procedure throughout.

few times. Each time an iteration of the tasks is accomplished adjust the documentation of the sequence of tasks until you have verified that you now have the most effective and efficient procedure. Now that procedure becomes the Procedural Standard for that job. Each time the job is run, it will be run in accord with that established Procedural Standard.

However, any time the sequence of tasks associated with a Procedural Standard is changed or the equipment or skills used are changed, the Procedural Standard must be reverified to ensure that it still represents the most effective and efficient way of doing the job.

Once a Procedural Standard has been verified and has been agreed to by those who will use it, then and only then are you ready to establish the Performance Standards.

PERFORMANCE STANDARDS

In essence, Performance Standards gauge how much of the enterprise's resources are being expended in executing the jobs in accord with the established Procedural Standards.

By definition Performance Standards are a quantitative measure of the amount of resources consumed to perform a given task, series of tasks, or a complete job. They are most often expressed in terms of a measurable output (i.e. the number of reports produced) divided by the input or resources expended to produce it (i.e. the number of man-hours, machine hours, elapsed time, or money required to produce the reports). Lets work through a simple calculation to demonstrate how a Procedural Standard for producing a 100 page weekly payroll may result in a Performance Standard:

- Output = One 100 page Weekly Payroll

- Input = 115 machine hours

- PERFORMANCE STANDARD = One Weekly Payroll Report of 100 pages per 115 machine hours. Or expressed differently .87 pages per machine hour is the performance standard.

In establishing Performance Standards there is always the temptation to try to develop just one Performance Standard to measure all of the operations of an Information Processing Service. That approach defeats the purpose of Standards!

At a minimum, Performance Standards must be established, as we have just done, for each job in terms of the three criteria Quality, Quantity and Timeliness. These three criteria must then be viewed and analyzed together -- not in isolation from one another! Only in this way will you have a comprehensive view of the Information Processing Service's performance.

Additionally, Performance Standards must be viewed as tools that tell the Information Processing Service management how well it is doing with the available resources. These tools must be used as the basis for asking questions about WHY resource consumption is above or below acceptable norms. They must not be used as negative incentives; but rather to elicit management and operator assistance in ensuring that the Information Processing Service is operating in an efficient and effective manner.

ACCEPTABLE NORMS[7]

The effective establishment of ACCEPTABLE NORMS is the key to making the Procedural Standards and Performance Standards truly useful management tools. The methodology used to establish these norms must not be judgmental! Quite to the contrary! The methodology must be quantitatively based on valid statistical techniques, the results of which will

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7.
The development of Acceptable Norms uses traditional Statistical Quality Control Techniques. The techniques themselves can be found in any good statistical quality control handbook. The example used is just that - an example. Actual situations may require the development of a series of Acceptable Norms for heterogeneous kinds of jobs.

reasonably reflect the capacity and capability of the Information Processing Service to achieve its expected level of performance.

While the actual methodology for developing the norms is simple, it does require time to ensure the collection of statistically accurate data. The collection of such data can only be done over a number of months, usually six, but it can be as long as eighteen. Unfortunately management is often impatient with the length of time necessary to ensure the credibility of the data collected. Because of this, management will sometimes substitute their judgment for what they think or speculate the norms should be. Time after time when this judgmental approach is used it has resulted in the alienation of the Information Processing Service operators, poor morale and, in extremes, slow downs and even sabotage. It is far better to take the time to do it right the first time! The process can be broken down into the following steps - and the example presented here is for Quantity.[8]

1. Obviously, the first thing to do is to gain acceptance for the Procedural Standards and the Performance Standards by involving those who will actually be following them and whose performance is being measured by them.

2. Next, a system must be established to collect the necessary data by type of job. In this example we'll use the number of payroll jobs.

3. When there are at least 20 data sets for a job, calculate the average and one standard deviation. Then plot the average and one standard deviation above and one standard deviation below the average on a chart. (See Figure 10) The average and standard deviation form the basis for the Acceptable Norm. The average is the Performance Standard and the range above and below the

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8. While the example is for Quantity, the same approach can be used for the development of Performance Standards for Quality And Timeliness.

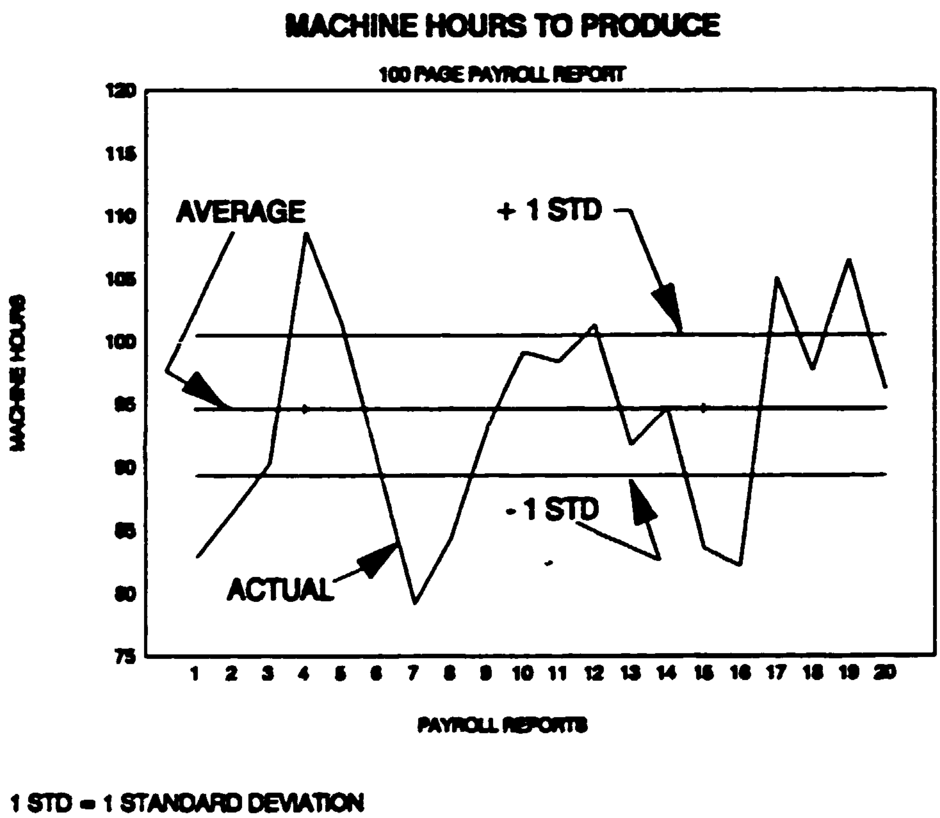
MACHINE HOURS TO PRODUCE
100 PAGE PAYROLL REPORT
AVERAGE
+ 1 STD
- 1 STD
ACTUAL
MACHINE HOURS
PAYROLL REPORTS
1 STD = 1 STANDARD DEVIATION

FIGURE 10

average measured by the standard deviation is the Acceptable Norm. Here, management is looking for performance that is consistently at the average (Performance Standard) or below. But management will accept performance within the range of values between the upper and lower standard deviation.

Any time the performance falls outside the Acceptable Norm - that is, the range between the two standard deviations - management should investigate the situation to determine the cause. Where the situation with operators/technicians is found favorable, management should attempt to standardize it and where it is unfavorable management should quickly take corrective action. Moreover, any time there are three consecutive plots above the Performance Standard management should determine the cause and take appropriate corrective action.

4. Continue to collect the data and plot the actual figures against the average and standard deviations calculated for the first 20 data sets.

This data collection will continue for as long as the Information Processing Service must produce the payroll job. At the end of each 12 month period the average and deviations must be recalculated to reflect improvements that have been made in the skills of the operators. Any time the Procedural Standard is changed or the equipment is modified new Performance Standards must be established as well as the associated Acceptable Norms.

The example just given for the development of Acceptable Norms for the payroll job can be applied to the development of Acceptable Norms for any job. However, it becomes inordinately complicated when the Information Processing Service has a schedule of different jobs with different Acceptable Norms.

CHAPTER 6

This is where we use the Performance Standard as a means to aggregate the machine hours and apply a new technique called the Earned Hour concept.

EARNED HOURS

Using our earlier example of the weekly payroll we had a Performance Standard of .87 pages per machine hour[9]. If the payroll used 100 pages then it would have earned 87 Earned Hours (.87 pages/machine hour x 100 pages = 87 Earned Hours.) Now if we have a number of jobs with different Performance Standards that are put in terms of a number of things done per machine hour we can add them together to get the number of total Earned Hours (machine hours). Then if we divide the Earned Hours By the actual number of machine hours for the same period we have the ratio that tells us how well all the resources have been used to complete the associated jobs for a given period.

JOB	PERFORMANCE STANDARD	PRODUCTION	EARNED HOURS
Payroll	.87 pages/mach hr	2,000 pages	2,299
Finance	.56 pages/mach hr	1,500 pages	2,679
Travel	.36 pages/mach hr	2,500 pages	6,944
Legal	.12 pages/mach hr	500 pages	4,167
TOTAL			16,089

TABLE 1

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9. We use machine hours for simplicity. The actual application could be made with man-hours, sales revenue, programmer hours or any other measure that makes sense for the enterprise.

If, in TABLE 1, the total actual machine hours expended for the period were 20,000 and the Earned Hours were 16,089, then the overall performance for the organization was 80.4% [(16,089/20,000)x100 = 80.4%].

The previous discussion on Procedural and Performance Standards is easily applied to the enterprise that has a relatively centralized Information Processing Service. But what of those that have selected a distributed operation where there are mini Information Processing Services throughout the enterprise that are based on a family of interconnected mini and micro (Personal Computer) computers that are serving various functional areas and reporting to those same functional heads. Well, to the degree their jobs are measurable and have a reasonable degree of repetitiveness, the same concepts can be applied, but on a smaller scale.

The important thing to remember is that regardless of whether the Information Processing Service is centralized or decentralized through a distributed system, the application must provide the necessary Quality, Quantity and Timeliness of data and information. To ensure consistency in these services the development of both Procedural and Performance Standards is a necessity that cannot be ignored. Without the information generated by the application of these Standards the service nature of the Information Processing Service will quickly become suspect and its long term survivability within the enterprise will be placed in jeopardy.

SUMMARY

In this chapter we have examined the pros and cons of setting up the Information Processing Service on the basis of a profit center or a cost center. We have provided guidance in making the "make or buy" decisions, identifying some common pitfalls. Examination of the methodology to be used led us into the various strategies applied and how they impact. The three P's - Pilot, Prototype, and Production provides a road map for achieving implementation. And finally, we have discussed procedures and standards, so necessary to the long term survivability of the enterprise.

GLOSSARY

BACKGROUND COMPUTING
This refers to the ability to have a computer run more than one application program at a time by having the one you are working on running in the foreground and another on working at the same time tin the background.

BAND WIDTH
This can be thought of as the width of the communication channel - analogous to the width of a road that carries automobiles. The wider the road the greater the number of transportation vehicles that can be on the road at the same time. In a like fashion the wider the band width the greater the amount of data that can be carried at the same time.

BRAINSTORMING
The technique for developing alternative courses of action or solutions to a problem. Using this technique, the people who have the greatest potential for creating a viable alternative or solution are gathered in one place. Here they offer their comments without evaluation by their colleagues. Then at a later date the alternatives and solutions are arrayed for more disciplined evaluation. This technique allows for the free flowing exchange of ideas and then an evaluation.

BUFFERING
This is the process of temporarily storing data in a software program or in RAM to allow transmission devices to accommodate sifferences in data transmission rates. In these situations data is temporally stored in the buffer while the environment is prepared for it. When work is complete the data is moved out of the buffer into active RAM or on to the magnetic or optical working environments.

BUSINESS PLAN
This is simply a very detailed plan that lays out both the enterprise's strategic and tactical plans for a projected period of time. Because of its sensitivity to the enterprise it is held very close and is hardly ever disclosed in its entirety to any one outside the officers of the enterprise and key investors or bankers.

COMPUTING PLATFORMS
This is another term that simply means the Central Processing Unit and its associated input and output devices. A computer is often referred to as a computing platform.

GLOSSARY

COPROCESSOR

This is a hardware device (usually a chip) that expands the capability of the existing processor by accelerating the computation capability of the primary processor. It is most often found in the micro-computer environment below the 80386 series.

CORRELATION AND REGRESSION ANALYSIS

A mathematical and statistical technique that is used to evaluate relationships between independent and dependent variables. It is often applied to forecasting. If additional information is needed on this subject one needs to seek a good statistical text book.

DOWNSIZING

In the context of this document this refers to actions that lead to improved performance by reducing the physical size of a computer, organization or staff.

HALF LIFE

An expression borrowed from the physical sciences that refers to how long it takes to reduce the efficacy of a substance to one half of its original potency. In the computer and associated technologies is refers to the useful life cycle of a computing technology, hardware or software. At the point where the half life is reached one should expect to see new technologies introduces.

HOST COMPUTER

This is the main computer in the enterprise to which a number of minis and micros may be attached.

HUMAN EQUATION

This term is used to refers to the understanding or lack thereof of individual needs, wants, objectives and ego drives. One who understands the HUMAN EQUATION is one who works well with the people he deals with.

INNOVATION CYCLE

This is a complicated time line that addresses how long it takes from the time a new technology is conceived to the time it is first successfully commercialized.

GLOSSARY

LIFE CYCLE MARKETING
This addresses the process of developing marketing plans for a product and (or) service that cover the entire expected life cycle. (i.e. introduction, growth, maturation, decline and replacement)

LINEAR PROGRAMMING
A mathematical technique that is used to identify the optimal allocation of resources to products and (or) services which are susceptible to linear relationships and constraints. THis is often applied to the production environment to optimize the allocation of materials and manpower to the enterprises product/service lines.

PHOTONICS
The application of photons to the computer environment. This is an emerging application that will need to be monitored by the information community.

PRODUCT LIFE CYCLE
Like the innovation cycle this too is a time line. It refers to the amount of time a product or service can be profitable sold. The cycle is often broken down into definable phases of an inverse logistics curve where each change in slope defines a phase in the life cycle.

PSYCOGRAPHIC
This is a marketing term that is used to describe how a marketing professional can locate buyers who have similar habits (i.e. reading, recreation, etc.) and also purchase the enterprises products.

RAM
The usual abbreviation for Random Access Memory. This is the electronic memory that is set aside to temporally hold data that is being manipulated by a computer's operating system and (or) the application program in use.

RATE OF RETURN ANALYSIS
This is a technique that is used to compare the attractiveness of alternative investment strategies. It is complicated an requires someone who is well versed in the application.

VIRUSES
This is a general term that is used to describe hostile software programs that are introduced into a system. The purposes of these viruses is to do harm to either or both the

application programs and the associated data. They are very hard to detect until after they have done their damage. And even then they are often quite illusive.

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