

MOVING TOWARD INFORMATION MANAGEMENT
IN AN INTEGRATED ENVIRONMENT

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Government and business leaders both in our Nation and in other nations have been stressing the need for a raised awareness to overcome the pressing economic problems of today such as the steady upward inflationary spiral and the uncontrolled drop in productivity. In our own country, the campaigns of last year's election have helped to raise our awareness of the need to revitalize America and to increase our productivity. The present outcry for economic renewal and for sound fiscal policies are perhaps the greatest since the Great Depression. As we all know, there are no easy solutions to the problems which face us, but a growing consensus points to existing and future technologies to hold the key. However, technology alone is not the answer. Today much job design in the United States is better suited to robots than to mature adults because of the increased use of technology and automation which has made work more simplified, standardized and routine. In the past, advances in technology with their resultant economics, and greater managerial control have increased productivity, which in turn has contributed to a general increase in affluence, education, and the level of aspirations of Americans.

As a result of these benefits many people rightly want jobs that allow them to make greater use of their education and skills, and that provide intrinsic work satisfaction while affording the opportunity to enjoy the luxuries of our society. In effect the nation may have arrived at a point in

conflict with itself and the result of this conflict is that productivity is plummeting to an all time low.

At the same time, America's leaders, as well as their counterparts in other industrialized nations throughout the world, are advocating a renewed commitment to the free market system. Their expectation is that the return of business incentives will spur greater investments back in people and products thereby helping to increase productivity and job satisfaction, and to reverse the current inflationary spiral. This commitment mirrors an international trend towards deregulation and the elimination of obstacles to entrepreneurial freedom and corporate growth.

We are all aware of the effect of inflation in our own personal lives and are reminded of this every time we watch the evening news or return from a trip to the supermarket. These effects are also felt in all aspects of today's business operations. Increasing material and inventory costs, steadily rising labor costs, and high costs of financing are but a few of the factors combining to add external pressures to our nation's businesses. These pressures affect all industries, but naturally the effect varies with each. Additionally, these pressures impact all aspects of business whether they be income-producing or revenue-consuming. Traditionally, management has invested disproportionately in certain of these aspects. During the past ten years, management has increas-

ingly turned to data processing to provide monitors and controls over the production-oriented functions (such as Inventory Control, Order Processing, etc.). Investments in hardware and software have been heavily justified by projected increases in sales and by anticipated savings in production. This philosophy has created an imbalance between capital investments in income producing functions versus typical "overhead" functions. In the latter, investments have been of secondary importance because of an imperception of the need to stimulate and support "white collar" activities. No doubt you've seen those figures comparing the low state of office productivity with a better record chalked up by industry and agriculture. They get repeated often in management circles and have been verified (with small discrepancies) by a various number of sources. Basically these figures are as follows:

	Capital Investment Per Worker	Productivity Increase During the Past Years ¹
White Collar Worker	\$ 2,000.00	4%
Industrial Worker	\$25,000.00	90%
Farm Worker	\$35,000.00	185%

While these figures are sometimes disputed in terms of their detailed composition, their value should be viewed on a broader scale. The challenge for today's executives is to make

¹ "Editorial", Walter A. Kleinschrod, Administrative Management, October 1980, pg. 23

the same level of commitment to the administrative and professional functions as it has to the operation functions. This commitment must be made in order to improve the effectiveness of workers in the office as we have improved the effectiveness of workers in industry or on the farm. In order to help fulfill this commitment we, the "experts" of the information industry, must demonstrate the importance of information in today's business world. To do this, we must first acquaint ourselves with the presence of information in various forms throughout our organizations and understand the role that it plays in the organization. This means that we must strive to understand those technologies and applications which traditionally have not been an integral part of Data Processing (such as Text Processing, Telecommunications, Reprographics, Micrographics, etc.)

The Information Resource

Our primary challenge must be to educate both management and staff in the value of the Information Resource. To do this effectively it is critical that we establish a common base of understanding and a common set of expectations. This challenge is compounded by the fact that the Information Resource is a concept rather than a tangible product. Webster defines a resource as:

- o An available means or property
- o Natural advantages or wealths
- o A capacity for finding or adapting means of achieving
- o The power of achievement
- o A skill or ingenuity in meeting any situation

These definitions really don't help us describe the Information Resource any more than a few words can properly describe the six senses. But since the Information Resource is a concept and not an object, it can best be described in terms of the unique environment in which it applies. The Information Resource is different to a manufacturer than it is to a service organization. Therefore, in order to educate management and staff in the value of the Information Resource, we must first define the scope and breadth of the Information Resource within the individual organization. Once the discrete components of the Information Resource has been identified, it's our challenge to envision the role of this cohesive base of information in the organization's current and future operations. To do this we must describe that role in terms of its impact on the firm with regards to the business environment, to the operating procedures, and to the bottom line. To be effective, the Information Resource must be perceived by the people in the organization to be an extension of themselves and should help foster their association with the organization itself. This will result in an improved awareness of their value to the

organization and their impact on everyone's success. The key-stone to the vitality of the Information Resource is its ability to match the organization's strategy and structure and to provide a medium for the organization's success in meeting its corporate missions.

Distributed Information Processing

If we look at the Information Resource as being a broad based commodity which serves all aspects of an organization, we have to think in technical terms of its orientation to a distributed/integrated information processing environment. To many technicians distributed data processing simply means a dispersement of computer hardware and data to multiple sites around an organization. The shortcoming of this definition is that it overlooks a wide range of non-data processing activities and issues that help make information systems work. Similarly, it does not satisfy the need of an Information Resource to align itself with an organization's strategy and structure. A broader definition of DDP acknowledges that information processing is an organizational resource composed of many areas of activity which are performed and controlled by various and diverse individuals. In reality, DDP can only truly exist in an integrated information environment. By that we mean that Distributed Data Processing is the composition of interdependent functions which draw and build upon a common base of information. These functions can vary from traditional

data processing applications to newer word processing functions, and looking to the not to distant future, to extensive use of electronic mail and computer-based communications. With this broader definition and application, the term Distributed Information Processing becomes more representative.

Basically, in order to appreciate the value and potential of Distributed Information Processing in an integrated environment we must first accept the fact that today's technologies transcend the traditional structures of business ten years ago. With today's technologies, these different functions are converging and are often indistinguishable. Distributed Data Processing operations based on localized minicomputers are bringing their capabilities closer to the administrative user, and are becoming a more responsive and attractive alternative for traditional Word Processing applications such as text management. At the same time, increased list and records management capabilities of word processing involve activities which were once the sole domain of data processing. The challenge in making distributed systems work is to design and implement systems which tie together the diverse function of an organization and break down the communications barriers which naturally exist in any organization, thereby providing a more natural use of information.

The objective of this presentation is to identify the value of integrated information, to surface the major concepts of integrated information, and to highlight those issues which are critical to successfully implementing an integrated information environment.

Why Distributed/Integrated Information Processing?

In order to understand the value of integrated information in today's business environment it is helpful to take a quick look back at how technology has changed the way we process information. To do this let's look at both the development of traditional data processing and at the development of automation in the modern office. In the mid nineteenth century the "modern office" was graced with the invention of the adding machine and the manual typewriter. Each of these products promised a high potential for increased staff productivity. During the earlier part of the twentieth century (from 1900 to 1940) the main focus of scientists and inventors was in developing and perfecting mechanical devices to improve on the adding machine and the manual typewriter. Generally, little increase in productivity was realized. Even though it was 1946 when the first electronic computer was put into operation, it wasn't until 1964, when IBM introduced the System/360, a new concept in commercial computers, and also introduced word processing in the form of Magnetic Tape Selectric Typewriters that real increases were seen. After this time, in the late 1960's and early 1970's, the ability to achieve and maintain a

high level of productivity was largely dependent on the prudent use of technology. During that period, the impact and effectiveness of technology in the business environment was generally clearly defined. Computers were used to perform data manipulation and processing to improve accounting and management effectiveness. These computers were maintained in a controlled environment pretty well divorced from the mainstream of daily office life. From a historical perspective, the computer was thought of as a tool (granted more sophisticated than its earlier counterparts) but a tool none-the-less. Meanwhile out in the office there were other tools - typewriters (some manual, some electric, some with memory), copiers, adding machines, file cabinets, etc. which sought to increase staff productivity through speeding the process of performing their functions. Hence, a newer, better typewriter simply replaced an older, slower typewriter. A bigger filing cabinet replaced or supplemented a smaller one. If you were to ask someone to describe the typical office chances were that you'd get a list of some of the equipment in it. This list would probably include the items mentioned earlier, and most of them would also have been used to describe the "modern" office of 20, 50, or even 100 years ago. In reality, businesses, with exception of course, really hadn't changed much in quite a while. Electric typewriters replaced manual ones, calculators replaced adding machines, telephone switchboards were automated, and everything looked more streamlined but most tasks in the modern

office are performed much the way they have been for decades. The focus on using technology never really touched on changing the way that tasks were done and how information was used.

From a data processing perspective, the centralized DP environment of the 60's reflected the image of corporate thinking towards information processing. Information was a discrete commodity; that which belonged to accounting was processed by accountants and clerks, that which belonged to management was processed by administrative support personnel and very rarely did one function interface with the other. This led to an increased sense of propriety and helped insulate the different departments within an organization.

Distributed/Integrated Information Processing is a concept which has only recently come of age. Technological, economic, and educational developments now allow us to design information systems that may achieve the objectives of matching the organizational structure, supporting the business strategy, and reflecting the character of the organization itself. The effect of distributing information in an organization is one of breaking down some barriers, of establishing communication channels that never existed, and of raising the awareness of users in different departments within an organization of what other departments are doing with information. With this awareness comes a realization of what information may be available for mutual use and what benefits might be realized. It's the recognition of the potential use of information and the

acknowledgement of the resultant benefits through sharing and communication that allows the concept of the Information Resource to become a reality. Without integration, the Information Resource is merely a collection of discrete bits of information.

What's Involved in
Establishing the Integrated Information Resource?

When embarking upon integrating information and developing the information resource, we have to first sit back and look at the way the organization conducts itself to be sure that the scope of the resource is comprehensive and change-oriented. Technologies such as process control, computergraphics, laser printing, intelligent copying and integrated telephones and switching units, don't always apply to every organization. However, the actual or potential need for any of these or other technologies could be a deciding factor in the structure of the Information Resource in terms of the nature of the information base and the type of equipment used to process and store the information. Just as in designing a data base it is prudent to anticipate and allow for future enhancements and/or modifications, in planning the Information Resource it is imperative to consider and evaluate future issues. This is why we must develop and review long range strategies and be aware of trends in business and technology. Five years ago, people planning an information system could be content with assessing the needs and direction of their own organization. Today, however, we

must be mindful of external concerns such as inter-company communications and information exchange. The impact of advances in the areas of communications and human system interfaces mandate a closer, more deliberate look to the future. For example, while the concept of using electronic mail may not be feasible for a given organization today, it is our responsibility as the planners and designers of this information resource to determine the probability of the need to tie that capability in at some future point. Additionally, when defining the nature and extent of integration amongst functions, it is important to probe into the current methods of operation, into the current use of information, and examine the effectiveness of the current approach versus potential alternatives. For example, trends in office organization have promoted the use of functional centers and word processing centers as opposed to individual secretaries. These centers receive work, process the work and return it to the originator in the same fashion that a data center would process work from various users and sources. Many organizations which operate under this approach are presently evaluating the merit of centralized dictation which replaces the dictating equipment on a professional's desk with the use of the telephone into a dedicated processor/storage device. This device digitizes the dictation and treats it like any other stored information on magnetic media. This information can then be manipulated by the processing center or can be shared with other processing centers in the same way

that stored information can be manipulated by any data processor in a more traditional environment. While this is an individual example, the intent is to show the potential breadth of application and technology which the Information Resource must address. These actual and potential needs should be surfaced during the design process (which will be briefly discussed later in this presentation).

Issues of Integration

Once the decision to integrate has been made the next step is to address the major issues that are associated with integrated information. Briefly, those major issues are:

1. Management and Control of the Information Resource
2. The Mode of Functional Integration Required
3. The Functionality and Accessibility of the Information
4. The Skill and Experience of the Various Users

Management and Control

As data processing matured, the organization which housed data processing also matured. In the early stages, the purpose of data processing was to provide an automated means of performing established functions, such as processing payroll, reporting and maintaining accounts receivable information, etc. The rationale for data processing was basically to lower cost and time, and to achieve a higher degree of reliability and accuracy. To provide these services, the data processing facility was operation-oriented and became a function within

finance. The EDP manager reported directly to the executive of finance and was normally on an organizational par with the controller or assistant controller. In the later stages of data processing development, the purpose expanded to include automating the processing of business functions and to provide comprehensive management information. The domain of data processing expanded from just accounting functions to incorporate business functions and management reporting and control. The rationale for data processing was to improve efficiency, to sustain reliability, and to increase profitability. In essence, it also provided a decision-support mechanism. To support these new objectives, the data processing facility broke away from the direct control of the executive of finance and became an anomaly of sorts in that it was too unique to be treated like any other division in the organization. The director or manager of information systems was still not perceived to be business-oriented enough to merit executive status or participate in the corporate planning process. During this time, this maturing group began to concern themselves with information planning as well as systems development and systems operation and with the spread of computer support throughout the organization, operations now began to concern themselves with issues like communications and user interface. In the 80's, the purpose of information processing is to establish and maintain a base of information which reflects all key aspects of the organization and which provides a catalyst for continued

growth and effectiveness. And in keeping with the Information Resource we have been talking about, we see that it indeed touches on all aspects of the organization. The rationale for doing this is that it then provides a means to sustain growth and effectiveness in all phases of the business operation and it minimizes the effect of external constraints. In order to support these objectives and to truly be a part of the organization's plan, information processing has finally come of age and has established itself as a corporate entity in its own right. As such, it merits its own executive with a role in corporate planning, and has a structure which spans information services, communications, advanced office systems, and customer services. The key to the success of this structure is that the management of the Information Resource must pass to someone who can effectively relate well in all levels of the organization (horizontally) as well as in all functional areas of the organization (vertically).

One of the greatest challenges in managing the Resource may arise from balancing the needs and approaches of the traditional MIS function with those of the traditional WP function. This is due to the idiosyncrasies of each and is compounded by the pre-established misgivings between them. Characteristically, the major problems of word processing have not been in the area of technology or systems design. The majority of the problems have been and continue to be people problems. Word processing totally changes the social structure of an organiza-

tion. If it is not total or if management's commitment is not total, there is usually chaos which results in a waste of time, energy and money. Therefore, the manager of the Information Resource must be more people-aware than the manager of a data processing facility ever had to be.

Modes of Integration

Depending on the type and volume of information being processed throughout the organization, the modes of integration will vary in each instance. Word processing hardware is more function-oriented than data processing hardware. Therefore, the acceptability of one model to an end user is much more critical in the WP environment than in the DP environment. This fact often negates the use of mainframe hardware to perform WP functions thereby eliminating some otherwise obvious options. Basically, there are three modes of integrating data processing and word processing. They are:

- o Multifunction System - which is capable of storing and processing information in either a traditional data processing or word processing sense. Typically, this would be a mainframe computer with capability of interfacing with data processing or word processing CPTs as well as with a wide range of peripherals (from Laser printers to intelligent copiers) as well as with other processors in either a direct or a remote sense.
- o Shared Resource - which is a cluster of single or multifunction systems which have primary functions that would share some common resources such as storage, printers, and other peripherals. This is akin to a distributed environment with a series of minis communicating in varying degrees of compatibility.
- o Standalone - single function computers with no automatic interfaces and along which information is integrated on a batch access and retrieval basis only.

Functionality and Accessibility

The third major issue revolves around the required functionality of the system and of the information. This touches on the design of the database as well as the selection of the particular hardware used to perform various functions, and is closely related to the above issue.

Unlike data processing, word processing applications are typically preprogramed and are function key oriented. This presents a major obstacle in retraining support personnel from one type of equipment to another. Therefore, in terms of hardware functionality, the type and volume of function that is being performed is of critical concern. The data base should be designed to allow access through a series of paths either directly or through logical record relationships.

Skill and Experience

The final major issue revolves around the skill and experience of the users themselves. As distributed data processing became commonplace in the DP environment, data processing professionals have learned to be more aware of nontechnical people such as clerks, managers and executives. The priorities, expectations, and needs which face this diverse group of users is greatly different from those which face data processing professionals and technicians. For example, most data processing managers don't have to devote their energies and skills to three and four cycles of revisions of two and three page memos and would have a hard time in adjusting to the environment. The

psychology of dealing with the varied demands and responsibilities is critical to the success of an integrated information environment.

Naturally, there are no easy solutions to these and there are other issues and pitfalls that are associated with integrating functions and information in today's business environment. These are as varied as the organizations themselves. The key element is that in launching into an integration effort, with functions as well as information being addressed, it is of critical importance to realize that the requirements definition and user review process and the proper organizational plan is vital to the success the entire effort.

An Approach to Creating an Integrated Environment

Traditionally in the office environment, and to a lesser extent in a data processing environment, users have been "sold" someone else's perception of a solution to an immediate need; rather than "buy" a solution which satisfies their immediate needs and is compatible with the overall information plan of the organization. In order to develop and implement such a plan it is important to take a multi-phased approach which is designed to establish and maintain the common expectations and objectives of the various users throughout the planning, development and implementation process. One such approach is composed of four major phases. These are:

- o Planning Phase
- o Design Phase
- o Development Phase
- o Implementation Phase

Planning Phase

The purpose of this phase is to define the information objectives, to formalize operational concepts, to establish common expectations, and to determine the feasibility of integrating functions and information. The two major steps within this phase are: an Initial Investigation and the Feasibility Study. The Initial Investigation looks to evaluate general needs throughout the organization and to establish the value of proceeding with the Feasibility Study. The Feasibility Study should develop the conceptual characteristics of an information solution through different alternatives, and to define the projected costs benefits for each function within the organization for each alternative which has been defined.

Design Phase

The focus of this phase is to develop the detailed foundation for the potential solution. This solution will be a blend of manual and computerized system procedures which satisfies the individual users requirements and support the goals and character of the organization as a whole. The major steps within this phase are: Business Analysis, Operations and Information Analysis, Technical Environment Analysis, a Conceptual Design, a Systems Review and Evaluation, and the Creation of the Development Plan.

The Business Analysis is intended to identify the corporate goals and objectives and define how those goals and objectives

cascade through the various departments and functions within the organization. The result of this analysis is to define the structure within which the information needs of the organization should be viewed. The Operations and Information Analysis is made up of two major components; the first being an organization survey which is intended to define the individual job functions and responsibilities, needs, and work patterns throughout the organization and to identify how these functions are qualified and how they support the corporate goals. The second component is a technical survey conducted to define the objectives, functions and inter-relationships of information in a technical sense (i.e., in terms of systems and operations). The Technical Environment Analysis is intended to determine the requirements and constraints of the organization, which will affect the environment within which the solution must function. The next step in this process is the Conceptual Design within which the objectives and requirements determined above will be addressed in the confines of the technical environment defined previously. This design will show how each function will be performed and will generally define the interaction level of other functions under the new approach. The System Review and Evaluation, which looks to identify and review the hardware and software alternatives, will support the conceptual design and will assess each alternative in terms of its satisfaction of the objectives, constraints and expectations.

The final step in this phase is to Create the Development Plan for the implementation of the proposed solution defining target dates and deliverables through the completion of the development process.

Development Phase

Based on the design developed in the prior phase, the focus here is to develop the actual system and prepare for implementation. This is done through the following steps: A Manual Procedures Design, An Application Specifications Development, User Orientation and Training, Implementation Planning, and System Testing.

The first step, Manual Procedures Design, looks to develop the detailed manual systems design and to review these with the users. This design will provide the blueprint for orientation and training, and for the system testing which follows. The second step, Development of Application Specifications, Coding and Testing of the applications themselves looks to develop the programs, through module testing, and supporting documentation. The third step, User Orientation and Training, is intended to serve two purposes. The first is to help the user understand the integrated information concept, how it relates to their particular responsibilities and how their efforts blend with those of others; and secondly to train them in the use of the new system. The fourth step, Implementation Planning, seeks to identify the test criteria and test cases which

will be used to validate the accuracy of the system. Secondly, to develop the schedule for the implementation of the system from system testing through the start of production processing. The final aspect of this step is to develop the plan for the conversion from current operations to the new system. The last step in this phase is Systems Testing which provides an integrated test of manual and computerized systems in a controlled environment.

Implementation Phase

Upon successfully concluding the system testing, the development process enters into this phase, which is intended to establish an operable environment for the "production" use of the new system. The major steps within this phase are the Phased Conversion and Implementation and the Refinement of Operating Systems.

The first step, Phased Conversion and Implementation, brings each function into a production mode according to the implementation schedule and expands the integrated information base by its own functionality.

The second step, the Refinement of Operating Systems, is intended to identify areas of need for modification and fine tuning and to allow management to prioritize and schedule these needs for implementation without impacting the progress of the main development effort.

There is an advertising slogan that states, "...the future belongs to the efficient ...". While the intended thrust of that slogan is directed toward conservation of energy its merit holds true for businesses as well. The challenges that face us both in our business and personal lives will require our full understanding and reaction. Information will play an increasingly important role in how we meet those challenges, and we cannot afford to waste time and money gathering or sifting through data in order to get it.

America's businesses are being charged with a mandate that requires a commitment to improved business effectiveness and profitability. Now more than ever, their success in doing this will depend on their ability in motivating and satisfying their employees and extending their skills and experience with the use of technology. We have demonstrated the ability to do this well in industry and agriculture and must continue to do so. The new challenge is to match those achievements in the office. The technology to do this is here today and is being followed with impressive advancements for the near future. The understanding of how to use these technologies and how to exploit our most abundant resource - Information - is the opportunity that we share.