"decision-makers say they would rather be 60% correct on Monday when the normal proposal must be presented, than 100% correct a month later – when the business opportunity is gone. . ."

The Information Center*

by

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The delivery of computer power on demand to end users has been a problem for most organizations. In recent years, we have seen the evolution from data processing to information processing, that is, from unit record processing to the synthesis and analysis of business information. More and more, data in computer form drives the basic business activities. However, this data tends to be harnessed to operational tasks and often is not even available for the demand-processing requirements of those in the same department.

The key to increasing the availability of data processing to end users is program development. But the problem for many organizations is how to take advantage of the dramatically improving cost/performance of the computer with an increasingly constrained data processing (DP) resource. Mushrooming user demand is generating a lengthening backlog of applications waiting to be put on the computer. However, as personnel costs rise steadily, the shortage of qualified programmers becomes more acute. To aggravate the situation, a growing proportion of the application development resource is needed to maintain existing application systems, further constricting the resource available to develop new applications.

The DP industry, however, has begun to learn that writing procedural code is not always necessary. With the growing library of "user friendly" tools and packages, or end-user products, the end user, with the appropriate support from data processing, can frequently formulate the solution to a business problem directly. As a result, many organizations are turning to end-user computing

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to relieve the growing pressure on DP and to direct the pent-up demand and energy of the user community into constructive channels.

Significant productivity gains can be realized by off-loading demand-processing requirements to end user. But to do so, DP needs to be restructured. The Information Center offers both an organizational concept and an alternate service strategy to traditional application development. It supports distributed access to data and data processing by non-DP trained end users. It has proven to be both viable and cost-effective for the end user and data processing alike. It can help effectively distribute the power of the computer to meet diverse business needs.

Let's explore the forces that have produced the Information Center Concept, examine what it is, and see how it works.

Today's business environment can be characterized as one of rising costs. This cost curve would represent any of a large number of cost elements, such as raw materials, tools and machines, salary and benefits, interest rates, marketing expense, and transportation costs.

During the same period, dramatic gains have been made in the cost/performance of the computers in terms of raw computing power. From 1953 to 1978, cost/performance has improved by a factor of 180 – without even considering the effects of inflation. According to the Sloan School of Management at the Massachussetts Institute of Technology, computer logic costs are dropping by 25% per year, memory costs by 40%, and communication costs by 11%.

The improving cost/performance trend has fostered broader use of the computer throughout an organization. We have seen the movement from batch to online systems and the more recent emergence of end-user systems.

This trend is reenforced by the widespread use of computer terminals throughout an organization. In 1972, there was 1 terminal for every 286 employees in American business and industry. By 1979, the ratio was 1 to 44, with the prediction that by the mid-80's it will be about 1 to 8.

Thus, the non-data processing-trained professionals and administrative personnel, who support managerial fact finding and decision making, represent a major end-user opportunity.

Early data processing consisted primarily of batch accounting and procedure-oriented applications to keep track of business activities. They tended to be remote from the business processes they tracked.

The next phase of the DP evolution integrated data processing with the business processes. It was predicated upon the consolidation of data into centralized data bases so that all affected records could be updated during the short span of time that a transaction was in the system.

A degree of interfunctional coordination was required to facilitate the flow

of data between related applications and minimize the redundancy of data elements.

The online systems increases productivity significantly, which justified the terminal as a primary workstation, often on a wide decentralized basis.

Along the way, many scientific computing applications evolved using mathematical tools, such as FORTRAN, linear programming, and simulation techniques. These tools represented a natural extension of the calculator and slide rule used by these discipline-based professionals.

The resulting application systems have indeed improved the efficiency of many organizational processes, increased the productivity of the workers, and sliced reduced overall costs.

In 1980, the Sloan School of Management conducted a study of user needs. The resultant report developed these findings from interviews with user managers:

* The user manager identified the installed application systems supporting his or her functional area of responsibility.

* These managers then listed their three most important activities and critical decisions that could be supported by the computer.

* Comparison of this list with the installed application revealed that fully 34% of these most important management tasks were unsupported by any computer system.

* Furthermore, only 20% of all the listed tasks were found to be appropriately supported by computer systems.

In examining the management levels within an organization, we begin to see how responsibilities and perspectives change as one goes up the hierarchy. At the operational level, management supervises predefined activities and processes. At the control level, management tracks and measures these activities to make sure that the operating units are performing properly against the objectives of the organization. It is at the strategic level that these objectives are set and resources are allocated.

As a result, staff work is needed to support managerial fact-finding and decision-making. Raw data must be collected, organized, and summarized in reports to provide the basis for forecasts and plans and to identify and describe the alternatives available.

As a consequence, we have seen an explosion in the professional ranks in the years between 1958 and 1977 – a 97% increase. The average salary for a professional has increased 26% in the past four years. By and large, it is these

professionals who are doing the fact-finding and staff work for management.

The indirect work force has grown two-and-one-half times faster than the direct work force. Yet technology has been employed largely to improve the productivity of the direct labor force. The International Data Corporation reports that while industrial workers have increased their productivity almost 90% in the past decade, office workers have shown only a 4% gain, while office costs have doubled.

However, a further problem exists. Within the office, the administrative, professional, and management personnel are supported to a much lesser extent than clerical personnel. It is in the management, professional, and administrative realm where productivity gains will have a significant payback. And it is precisely this area that is less structured than the operational and clerical areas.

In examining the activities and requirements of the administrative, professional, and management groups, we can define three types of support systems:

* Decision support systems that directly support management decision-making.
* Personal computing systems that provide individual job support tools and functions.
* Organizational support systems that handle those necessary activities common to most organizational units that, because they are dispersed throughout the organization, often are not identified for automation or because of their dispersal, cannot meet the cost justification threshold for application development.

Let us examine each of these three system types in turn.

Upper level management needs a decision support vehicle that can take in the account external data, such as competitive active market analysis, and government regulations, while still providing a business view of internal corporate data. A decision support system must provide a bridge between the DP system and management decision-making process which processes data into alternate information for and defines a structure or model for the analysis of that data and a systematic evaluation of alternatives.

Although these systems are used for managers, they are not necessarily used directly by them. The concept does not necessarily imply a terminal on every manager's desk. The systems support managerial judgment but do not replace it. They can be used to identify and describe alternatives as an aid to decision making, or perhaps only to validate a decision once made.

Such systems "will be able to focus either on a recurrent problem of concern or a particularly critical one-time problem". For example, a decision

support system can be used against operating cost data for periodic profitability analysis. Or it might be used to analyze the impact of dropping a company's own charge account system and turning customer billing over to credit card companies.

Finally, these systems are designed, not so much to save management time, but to improve the quality of the decision-making process – to improve management effectiveness. Alvin Toffler, in his book "The Third Wave", cites a recent survey showing that between 150 and 300 information transactions consume 80% of the manager's time daily.

Let's look at some examples to help differentiate decision support systems at the three management levels.

At the operational control level, an operational system would keep track of sales transactions; the corresponding decision support system might analyze available promotion alternatives to increase sales of lagging products.

At the management control level, an operational system tracks actual sales performance to plan; the corresponding decision support system helps develop next year's sales plan.

At the strategic planning level, an operational system might track product sales by type; the decision support system would help assess options for market expansion in the penalty-free realm of simulation as opposed to the real world.

Given the dynamics and high rate of change in today's business environment, decision support systems must be flexible and responsive. As external factors and variables change, resources must be rebalanced and new tradeoffs made. But there is a time value to management information's decision point. Decision makers say they would rather be 60% correct on Monday when the normal proposal must be presented, than 100% correct a month later – when the business opportunity is gone.

A decision support system then, provides a flexible query capability, analytical tools, and the ability to evaluate "what if" questions.

Through a terminal, the computer can provide a wide, flexible range of job support functions and services, such as:

* Information manager – Studies show that on the average 15% of a professional's time is spent retrieving information.

* Problem solver – Once the appropriate information is at hand, a series of common functions can be used to calculate percentages or ratios, perform statistical analyses, and the like.

* Report Writer – Once the data has been analyzed, results must be presented, either formally or informally.

A typical job support scenario might be:

* Information retrieval: How many instances are there?
* Data analysis: Expressed as a percentage of the total?
* Simple computation: As compared to the same period last year?
* Useful models: What if we increased inventory by 10% or reduced the service level to 90%?

The computers also provide support for communications that occur across an entire organization. These might be called departmental support activities. Every organization has requests for personnel information, lease-versus-buy calculations, floor-space planning, departmental expense analysis, and a range of "publishing" activities for bulletins, newsletters, reports, budget contracts, and proposals.

The primary application of the computer has been in the basic operational areas of an organization, with each application organized as a separate and independent system.

Data Processing has traditionally attacked the high-volume, repetitive tasks, because they can be justified most easily on a cost-displacement basis. The evolution has been toward transaction-driven systems, where an external event may trigger a series of programs.

Overall, these systems provide detailed monitoring to manage and track the day-to-day operations of the organization. To the extent that exceptions to the normal conditions can be defined, they evolve toward exception control or management-by-exception kinds of systems.

These systems, oriented toward the operational level of an organization, tend to concentrate on updating records and generating the primary deliverables. End-user support tends to receive secondary emphasis. To the extent that end-user needs can be predefined, the appropriate reports will be produced as a by-product of the process. However, end-user concerns, as we have been discussing them, tend to be much less structured, more iterative, and often involve self-defining data.

These are the Inhibitors to using data processing:

* Justification Problems
* Low Priority
* Communications Barrier
* Long Development Cycle
* Scheduling Problems

Why do end-users often face the inhibitors?

Data processing is project-oriented because of the complexity of operational systems and the time required for their development. As a consequence, DP usually is not organized to handle ad hoc, iterative requests.

According to recent surveys, maintenance activities consume about 68% of the data processing resource. This figure is confirmed by the IBM survey indicating that installation managers are assigning only 28% of their application programming resource to new applications development. Each new application delivered carries with it an ongoing requirement for maintenance.

The backlog of applications waiting to be developed by DP continues to grow. The typical backlog still represents between three and five years of work, running in some cases to as many as eight years.

Thus, improved computer price/performance fuels end-user demands for more applications.

But the very fact of the application backlog (the queuing up for resource) affects DP's responsiveness (the ability to deliver the new applications) resulting in user frustration. In addition, the dynamics of the environment force more and more changes to existing programs, impairing DP's ability to develop new applications.

The demand for computer applications continues to grow. Improved cost-effectiveness extends the possibility of automation into ever more areas of the organization. At the same time, the user community is developing a better understanding of what is possible with the computer and a realization of the importance of the data assembled and consolidated over the years by data processing.

Data processing, however, faces very real constraints. The Bureau of Labor Statistics projects an increase in DP personnel of only 2% to 4% over the next several years. Meanwhile, the availability of qualified programmers continues to shrink, with the shortfall expected to reach 26% by 1985. And the effective resource available for new application development is further diminished by growing maintenance requirements. The result, then, is a widening gap between the user demands and the capability of data processing to meet them. This gap is translated into the application backlog, which continues to grow.

Demand-processing comprises query, analysis, reporting, forecasting, and "what if" kinds of planning activities, often using private as well as organizational data. But how can these demand processing not be effectively supported, given DP's mission to build and maintain operational systems? Does DP have the skills and technology, not to mention resources, to implement query and analysis items to the extent required?

The potential solution on the demand-pressing dilemma is the availability of the knowledge and technology which now exist to effectively support end-

user computing and to let users "do their own thing". User products have been developed with the functional capabilities desired by end-users.

What do we mean by an "end-user"? In our definition, we mean any non-DP-trained individual who, with the right tools and support, could take advantage of the power of the computer.

The dilemma for the non-DP-trained end-user has traditionally been how to tap the power of the computer without tripping over such technical complexities as job control language. "These people – geophysicists, chemists, physicists – are interested in solving problems, not in learning the intricacies of operating systems."

From our experience with interactive products, the following requirements emerge:

* "User friendly" software products that permit problem expression in a language natural to the problem area, without requiring data processing knowledge
* Support and assistance in their use so that the end-user is not left floundering in the strange and too often arcane world of the computer
* Access to the needed data, whether private, public, or organizational, in a manner and format meaningful to someone not versed in programming.

The end-user, demand-processing activities we have surveyed tend to cluster in the following application areas:

* Query processing
* Report writing
* Analysis/problem solving
* Business planning
* Text processing
* Training

The best answers are dependent upon the availability of information within given time constraints . . . data is only raw material. When it can be swiftly accessed in a form relevant to the user's requirements, it becomes information that can be used in making decisions.

Data presentation is a widespread need, ranging from simple lists to highly structured report formats. End-users need a simple and responsive vehicle for assembling and organizing the data and quickly producing the desired report.

The requisite for problem solving is well expressed by the futurist Isaac Asimov in his article "On Computers" in DP Solutions: "You can be creative, or you can spend all your time adding and subtracting; you can't do both."

Raw data is nothing unless it is organized in a meaningful analysis.

Managing the complexities and interrelationships of multiple components or variables often requires a modeling structure.

The control and maintenance of text is a common organizational requirement. Only about 20% of the information contained in the typical office is involved in data processing; the rest is largely unformatted. The "office automation" problem is obviously a broader issue than can be addressed with the available end-user products.

Training must be available when and where needed to be timely and cost-effective.

Although the tools are available to address many demand-processing requirements, the non-data processing professional can have a number of seemingly simple concerns when attempting to use those tools. If these simple concerns are not addressed effectively, they can become a very real inhibitor to the success of end-user computing. That is why the second and perhaps the most important ingredient for successful end-user computing is support and assistance.

Access to data is the third requirement for successful end-user computing. Let's look first at end-user data needs. There are three principal types of data that end-users require.

The first is private user data – data that is entered, maintained, and "owned" by the end-user.

The second type of data required by end-users is public purchased data. This is generally proprietary data that can be purchased by businesses, for example, market research data, address lists, or census sample.

The third type of data to which end-users may require access is the protected organization data contained in the corporate data base.

Although the major concerns relate to protected organization data, it should be recognized that one of the predominant end-user needs is for private user data.

The third ingredient for successful end-user computing is data access support. This support includes:

* Understanding the user's application and helping him locate the necessary data.
* Assisting the user in obtaining authorization to access the required data.
* Initiating the procedure to extract the appropriate data.
* Providing for backup, recovery, and archiving of end-user data.

The Information Center is therefore both an organizational concept and an alternative strategy within data processing for servicing user application requirements. Unlike the traditional functions of building, delivering, and running operational systems, the Information Center helps end-users build applications themselves and use the computer directly in demand-processing mode.

The mission of the Information Center is to provide users with services not offered by traditional application development. This service consists of tools, techniques, and support that will allow users to access their data on their terms to satisfy demand-processing needs.

The primary objectives of the Information Center are to build user self-sufficiency in their use of demand-processing services, to increase user-productivity, and to improve the decision-making process by making relevant data more readily available.

To achieve these objectives, the Information Center must establish an effective "partnership" with the end-user community. As its part in this partnership, the Information Center provides:

* Easy-to-use software tools and consulting
* Education and consulting in the use of those tools
* Help in obtaining access to data
* Administrative support

The end-user also brings some key resources to this partnership. The user provides the knowledge and understanding of the job to be done and the justification for accomplishing the task.

But most important, from an application development point of view, the user provides the development resource and assumes the responsibility for application maintenance.

In return for this investment, however, the end-user will receive a number of intangible benefits. Among them are:

* Increased motivation and better use of professional talent
* Timely availability of information
* The ability to analyze business problems more thoroughly
* Increased productivity of office staff, both professional and clerical

Because the Information Center represents an alternative strategy to application development, it should be separate from, but on the same level as, application development in data processing organization. A strong partnership should consist, however, between the Information Center and application programming to help ensure appropriate use of both alternatives. Establishment of a separate organizational unit also projects the image of commitment to end-user computing to both users and others in data processing.

Many approaches have been taken to justify end-user computing. Not infrequently, the decision is based on an intuitive feeling of executive management that end-user computing satisfies business needs, thus, is a viable strategy for application development.

Another justification strategy is to identify user or DP cost savings. Most frequently, these are direct cost savings associated with bringing outside time sharing in-house.

The approach used was an after-the-fact user survey. In these surveys, users were asked to quantify the benefits of end-user computing in terms of headcount reduction or avoidance and other tangible cost savings, such as reduction in idle inventory. In both cases, the return on investment for end-user developed applications was higher than for DP-developed applications.

A more rigorous justification approach is also available to assist customers in identifying in advance the potential productivity impact of end-user computing and to quantify the benefits as well as offsetting the costs.

The problem, from the DP point of view, was:

* A limited amount of application development resource, of which 70% was devoted to maintenance
* Unresponsive to user needs and loss of control

The problem for end-users was:

* Dissatisfaction with the long queue for service and the lengthy development cycle
* Lack of flexibility

The solution was to establish the Information Center. Four people were assigned to support two end-user products to provide query, report-writing, and problem-solving capabilities.

The results, after five years, were:

* Information Center staff grew to nine and supported over 500 users.
* Five percent of the DP application development resources supported 25% of computer application utilization.
* DP resource devoted to maintenance dropped from 70% to 40%.
* Fifty percent of project requests were satisfied by end-user computing.

The results for the end-user were:

* It was cheaper for the users to develop and maintain applications themselves than for DP to do it.
* Productivity of high-priced professionals was improved.
* Capabilities were extended, especially in planning areas.
* End-user computing was more responsive to end-user needs by providing

faster turnaround, more flexibility, and more control.

* When surveyed after the fact, users identified $2 in benefits for every $1 in cost (includes DP charge for end-user computing and user cost to develop the applications).

The results for the DP director were:

* Development and maintenance requirements were both reduced.

* Relieved of the requirement to develop and maintain user reports. DP resources were better utilized by concentrating on defining and building the data environment.

* DP appeared responsive and had high visibility in user areas.

* The return on investment was good (100%) as compared to the ROI for DP-developed applications (in this case 37%, with an average payback period of 30 months).

* The ratio of DP support resource to machine utilization was in keeping with strategic objectives.

* DP had better control – In the words of the DP director, "Users are going to automate one way or another. It is only a matter of whether they do it with you or without you."

As a productivity solution, the Information Center has helped the company in a number of ways:

* Business volumes for this company are expected to grow 100% in the next five years. The company objective is to hold the growth of the indirect head count to only 20%.

* The gap is the company's "productivity wedge," of which approximately two-thirds is the Information Center target.

* Therefore, in the words of the vice president of business systems, "The Information Center is our single most important productivity tool."

With respect to productivity, the options available to an organization are essentially to:

* Eliminate work
* Simplify work
* Automate work

Most organizations have largely exhausted the first two options. And in many cases most procedural work has already been automated. It is the role of the Information Center to allow organizations to automate many nonprocedural job tasks and organizational activities and thus improve productivity in these areas.

The potential productivity impact of the Information Center is two-fold. First, providing resources to the indirect work force allows more work to be done in less time; the resultant increase in productivity can help control escalating expenses by eliminating the need to add to the head count. Second, the expanded decision support capabilities that make it possible to evaluate more alternatives and explore new business opportunities can result in better informed management decisions that yield greater revenue to the organization.

The end-user benefits from the Information Center in a number of ways. Among them are more systematic and effective decision support information available when needed to solve a business problem or accomplish the task at hand, freedom from many manual activities, and the opportunity to focus more directly on business problems.

For the data processing department, the Information Center strategy allows DP to be responsive to end-user demand-processing needs by supporting end-user computing. At the same time, the DP resources is better able to develop operational systems and to structure the data environment for the user. The resulting benefit is accelerated development for both structured and unstructured applications.

The Information Center offers improved productivity to both end-user professionals and DP professionals. Through user involvement in application development, more applications will be implemented sooner, and the return on the organization's investment in data processing will be realized sooner.