"a large number of manufacturers, each with a number of models to choose from, are selling in what is essentially a small market,"

Effective Computer Planning

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Issue Addressed by this Paper for this Journal

This journal addresses engineering issues. This paper covers an issue in general management engineering. The issue addressed is:

> Are engineering, business and industrial firms just entering the computer age in any substantial way necessarily doomed to follow in the footsteps of those other firms who jumped in, in earlier periods, and suffered?

We believe the answer might, in many instances, be yes—that is, unless top management forces the issue and explicitly works out a rationale for computer use within their respective companies.

Intended Audience

The intended audience for this paper are top executives (the "topper", the better) in firms who are now grappling with the computer question. Also addressed are technical professionals in computer engineering interested in general management engineering issues.

Executive Summary

The major points presented in this paper are:

1. Increasingly, computers are becoming a very important *company resource,* not only for the large, but also for the mid-size and smaller firm.
2. The company's resource does not have to be elaborate and computer facilities need not be fancy and have the latest in "bells and whistles".

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3. Understanding life cycles in evolution of companies as well as the evolution in computers and computer use can substantially improve the chances of attaining effective computer planning (ECP).
4. Once at hand, computer resources need to be husbanded as befits the substantial investments they frequently entail.
5. Using computers is a living thing so we fully expect that things will change including, of course, what we have written here.

Computers and Company Resources

The computer age for business and industrial firms does not have any history of any significant length. For the most part, even in the United States, this goes back to 1953 when the IBM 709 computer was introduced or even perhaps to 1959 when the IBM 1401 system was announced as available for U.S. customers.

Yet since then—over a relatively short period of time, computers have come from the most peripheral of influences in company operations to take a front and center role in many firms. Typically, those firms now in an "advanced setting" have taken stages in evolution for computer applications briefly described on the following page.

As companies have made increasing commitments to computers, they have found that computer budgets have escalated rapidly from modest to sometimes frightening levels. They find increasingly the need constantly to update their computer facilities even to the point of making very subtantial commitments to computer facilities.

In the earlier days of the computer age, rules of thumb were developed to provide ballpark answers to the question of adequacy of computer budgets and yet staying within the range clearly this side of extravagance in computer expenditures. Today, with the proliferation not only of computer hardware but also software beyond the imagination of computer visionaries, these rules of thumb have had to be discarded for other approaches.

These approaches now in use vary from industry to industry as well as from company to company. But what has caught the fancy of many computer planners is the organizational learning curve propounded by Nolan, approximating an S-shaped logistic model as shown in Fig. 1.

Table I. EVOLUTION IN COMPUTER APPLICATIONS[1]

Stage I: *Cost Reduction-Accounting*
Payroll

[1]A Modified Withington-Strassmann Evolution Model based on Strassmann, P., "Stages of Growth", *Datamation*, October 1976.

Receivables
Payables
Business Procedures

Stage II: *Proliferation in All Functions*
Cash Updates and Management
Ledger Postings
Budgets and the Planning Cycle
Inventory Control
Personnel and Manpower Planning
Orders and Shipping Hot Lists
Sales Analysis and Procedures
Production Planning and Schedules

Stage III: *Emphasis on Control*
Project Control
Production Control
Material Requirements Planning
Cost Analysis
Chargeouts
Statistical Analysis

Stage IV: *Database Applications*
Simulations
Computer-Based Planning Models
On-Line Inquiry at Executive Work Stations
On-Line Order Entry

Beware the "Bells and Whistles" Bias

It is difficult to argue against the fact that there is a "bells and whistles" bias in many computer people. "More is Better" and "Most is Best" is oftentimes their attitude as far as computer facilities are concerned. Unfortunately for all computer people, there are economic considerations for which top management is responsible. Business firms must not only be profitable but also have sound financial conditions as reflected in their financial statements.

Yet in some instances, top management have just a nodding acquaintance with computers. So they inevitably delegate (read as abdicate) their responsibilities in the computer area to computer people. It is no wonder then that, in some firms, computers, like Topsy, "just growed". With the "bells and whistles" bias, when in doubt computer people acquired more not less computers.

A favorite question of the senior author to computer people who inevitably brag about their work is: "Have you ever recommended less, not more in computers when you were striving to go from here to better (or to best) in computer applications?" And only rarely has a respondent replied in the

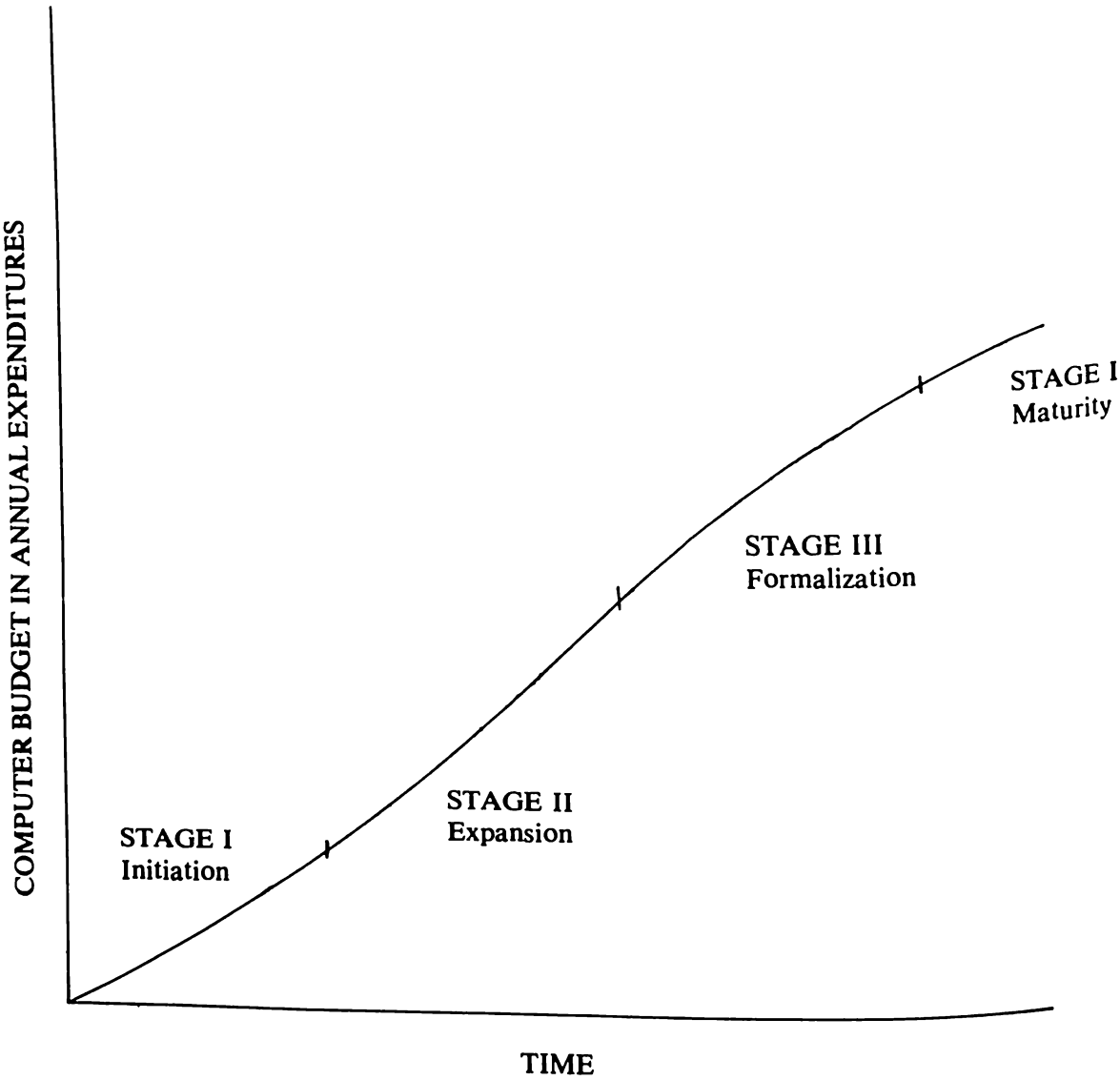

Figure 1. Nolan Computer Logistic Model[2]

[2]Adapted from Nolan, R., "Thoughts About the Fifth Stage", *Harvard Business School Working Paper*, October 1975; Gibson, C., and Nolan, R., "Managing the Four Stages of EDP Growth", *Harvard Business Review*, January-February, 1974.

affirmative or even conceived of a situation wherein they would urge a move for less, not more, in computers.

Understanding Life Cycles as Evolution

The senior author has worked on something called corporate life cycle. Table II, which spell out in a skeletal fashion the relationships among business strategy, product-services mix, organizational structure, and management control approaches.

Life cycles depict evolution. The Withington-Strassmann model provides a glimpse at the possible evolution in computer applications. The Nolan Computer Logistic Model gives a semblance of evolution in computer expenditures, while Tuason's framework gives a setting against which specific systems, even if not computer based, can be scoped to fit into existing company situations.

All these life cycle representations have some intuitive appeal. But they, by themselves, do *not* make for effective planning in computers. We need to work out something beyond these guides—a suggested approach. And this suggested approach follows.

Attaining Effective Computer Planning

The absolute attainment of the most effective computer planning is but an ideal. Yet we need a good grasp of this core concept so that we can strive toward that ideal.

In our computer work, some going back to the ancient long-ago time of 1963, we have discovered that attaining effective computer planning is by no means easy. It is a constant, year-to-year struggle.

TABLE II. ORGANIZATIONAL STRUCTURES AND STAGES IN CORPORATE LIFE CYCLES (CLC)[3]

CLC STAGE	ORGANIZATIONAL STRUCTURE
Stage I Company	Simple departmental structure by functions
Stage II Company	Functional or product divisions with incubator staff (line) groups at head office levels
Stage III Company	Multi-company groups or sectors with two or three layers of staff groups at corporate, group or sector levels.

[3]Adapted from: Tuason, R., "Corporate Life Cycle", *Academy of Management Proceedings*, 1975.

In this paper, we distill our years of experience into what we know to be a way that works toward attaining effective computer planning. In spelling out this procedure, we first present the concept of balancing requirements with allocable resources. The ideal balance point in Effective Computer Planning (ECP), or the ECP Point is shown in Figure 2.

A Company's Computer Mix

Elements involving hardware, software and peopleware form collectively a computer mix. Benefits to the company for this computer mix are in effect the yield. Specific company situations—which can change from time to time—would, of course, provide the details which influence the specific yield.

The ECP Point

What we mean by Effective Computer Planning or ECP is the look-ahead, anticipatory actions by management in ways which result in satisfactorily meeting a balance in their internal computer needs with their company's computer budgets. In Figure 2 is shown a representation of the challenge to top management in anticipating their internal computer needs depicted as UNMET COMPUTER REQUIREMENTS FOR THE COMPANY's USER DEPARTMENTS OR GROUPS. These anticipated needs must be balanced with the financial allocations to the company's computer resource. Computer budgets are the ways through which top management can effectively control the seemingly inevitable piling up of computer facilities which form part of their respective company's computer resource. Since in many companies there already exists an annual planning and budgeting cycle, we propose that allocations for computers be treated no differently. We show these levels of expenditures as the COMPANY'S COMPUTER BUDGETS. The difference, at any point in time, between the levels in computer budgets and the remaining levels in UNMET computer requirements is the COMPUTER DIFFERENCE. This computer difference sets the stage for the company's yield from the computer mix. The high point in this curve is the ECP POINT.

Striving for the ECP Point

Striving for the ECP point can be difficult in any company simply because, (1) there still might be a "technology gap" in top management, and, (2) because of the "bells and whistles" bias among computer people who, many times take the implicit position of MORE IS BETTER as far as computing is concerned and any "right-thinking" executive who somehow did not absorb this more-is-better message is stamped as a Neanderthal type. The authors based on their collective experiences have seen at least three characteristic ECP Curves shown in Figure 3.

The Computer Priesthood

There is a computer priesthood replete with buzz words like EBCDIC (pronounced "eeb-see-dick"), DDP (meaning Distributed Data Processing),

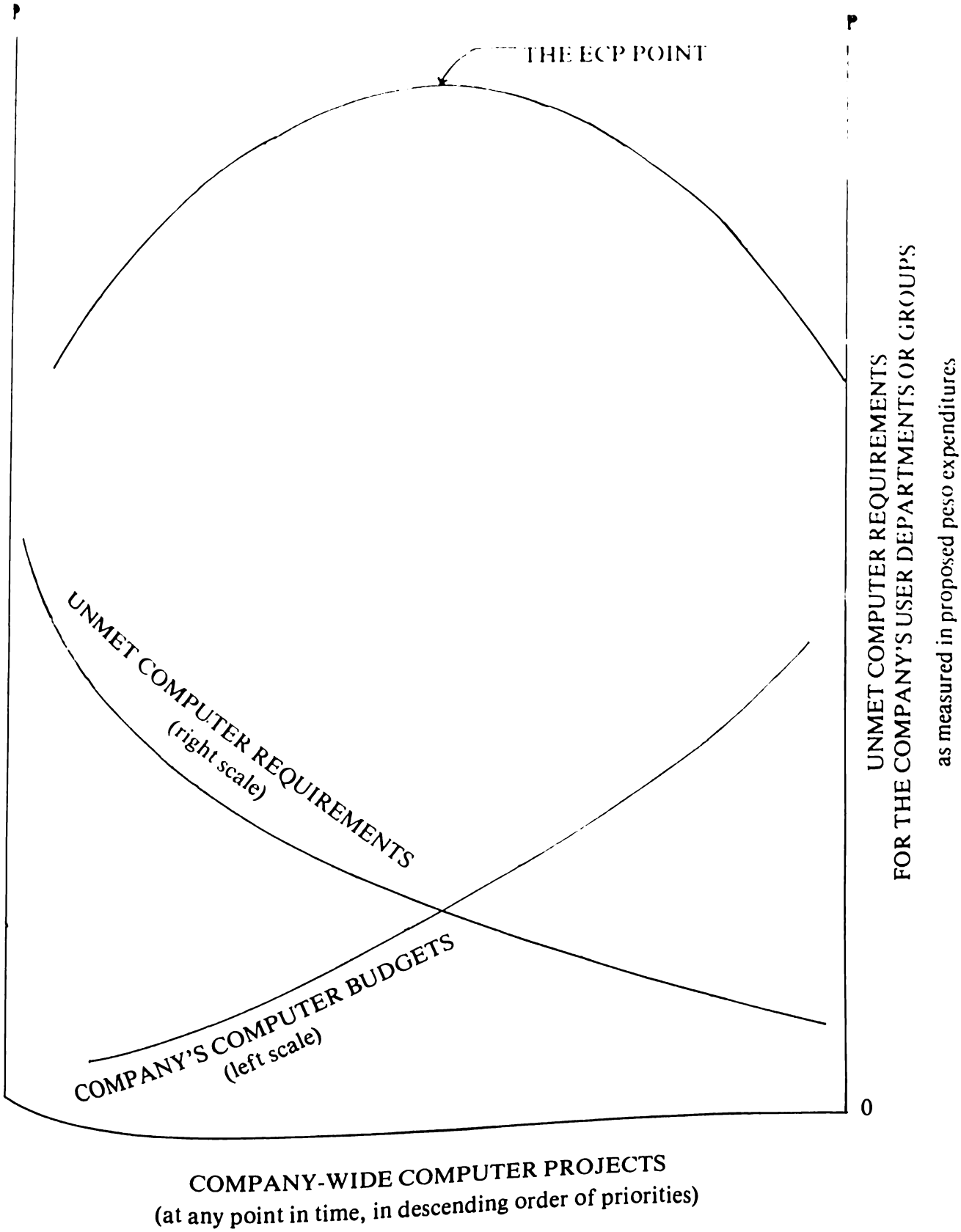

Figure 2. Yield for the Computer Mix

hex (for hexadecimal), DBMS (meaning Data Base Management System), and countless others. When computer types get together, their rate of speech using these "words" can swamp the non-initiated to the point of befuddlement. And, not only is there a computer priesthood, there has developed a "technology gap" between those who have managed to keep up and those who, once initiated, then coasted and therefore got left behind by those who did keep up.

Is it any wonder then that many of those in top management who never had the time or the opportunity to be initiated into the computer priesthood feel left out and befuddled by computers? Is it any wonder they take a stance of "Don't Point That Computer at Me" and try not to show it?

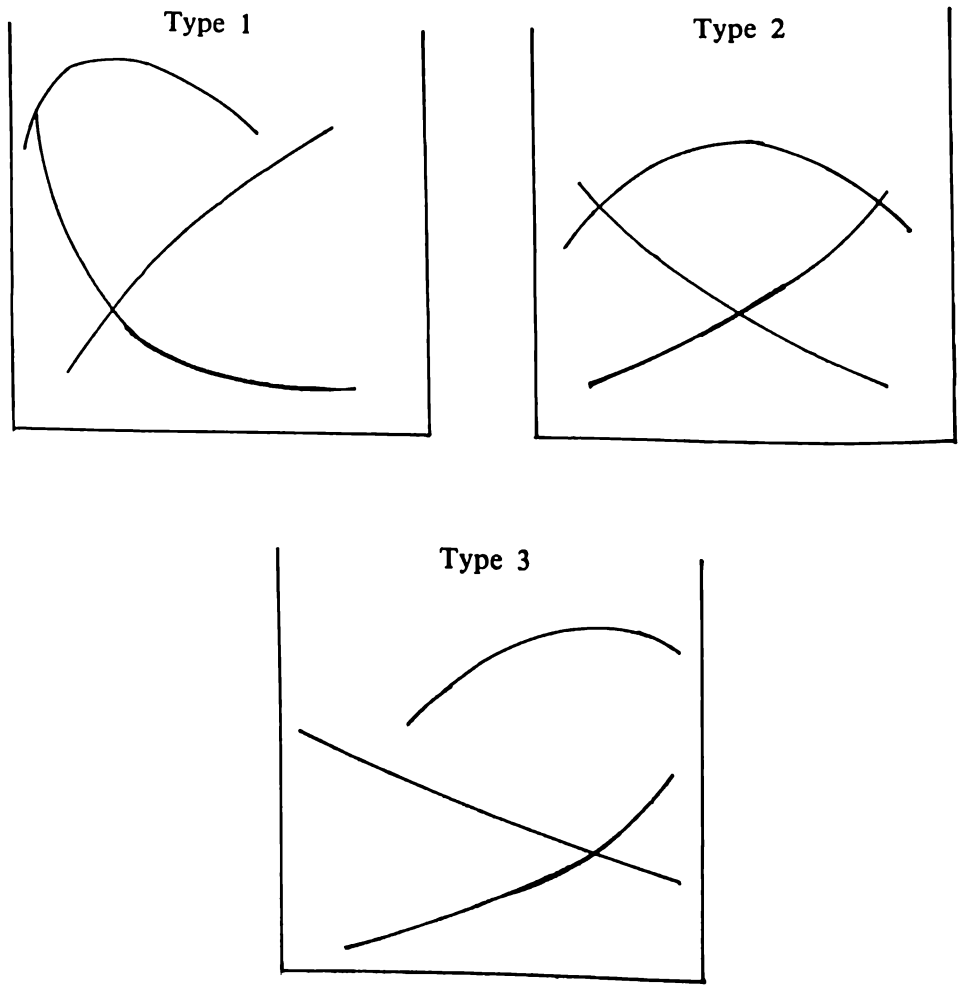

Figure 3. Characteristic ECP Curves

The authors would rather place the onus for this technology gap" on the doorsteps of the computer priesthood. We'd like to think that top management do *not* have to be graduate electrical and electronic engineers to use and to support the use of computers. We likewise believe that computer users need not be computer whiz bang types.

The Philippine Environment

Let us examine the environment of computer use in the Philippines. Business and industrial firms of any significant size in the Philippines have to a large extend reached a stage of development somewhere between what Tuason has described as the Stage II company and the Stage III company. For those who have opted for any important degree of computer usage, the vast majority would probably be classed as between Stage I and Stage II of the Withington-Strassmann evolution model. A number have reached Stage III while a few would probably be at, or just entering Stage IV.

With respect to hardware, because of the promotion by the manufacturers, many customers have essentially state of the art equipment. A peculiarity in the local set-up is present, however. A large number of manufacturers, each with a number of models to choose from, are selling in what is essentially a small market. Because of this, with a few exceptions, partial manufacturer support can be justified for software and occasionally, also for hardware.

Software, especially in manufacturer-supplied operating system, is also essentially state-of-the-art. With regard to applications packages, the situation is not as simple. Manufacturer-supplied software, while usually of very good to excellent quality, canot easily be "tailored" to suit a firm's specific needs usually because of the manufacturer's understandable reluctance to provide full documentation with respect to listings, detailed algorithms and/or flowcharts. Most firms often have to fit their system into the package to realize maximum use of these packages. Proprietary packages are also in use. Many of these are purchased from abroad and some horror stories have been whispered around computer circles with respect to the trauma associated with difficulty in tracking down elusive bugs and in solving program crashes because there is no local representative of the software firm which developed the package to turn to in a hurry. No one individual might be at fault; it is at times a comedy of errors. Again, proprietary packages may not have the detailed documentation needed to allow "tailoring" of the package to suit the needs of the user firm. Many firms locally, have in-house computer software staff to develop the packages needed. But given the explosion in the demand for computer people, the personnel have not had the time to pick up adequate management training or experience nor the depth of computer science background to develop the coordinated applications packages characteristic of the "advanced setting" of Stage IV of the evolution model previously discussed.

This brings up the problem of competent personnel. Prior to the late 1970's, no university or college was offering a bachelor's degree in computer science. Practically all the training was through short courses in hands-on computer fundamentals, programming in a formal programming language, and a smattering of system analysis and design courses. Because of the short supply of highly-trained personnel, it is not unusual to find as a commonplace event, job hopping from one firm to the other with each hop resulting in a substantial jump in compensation. Often, the last hop just might be to a job overseas.

To compound the personnel problem, there is at times a reluctance to assign full-time, with the computer installation, an executive with sufficient management background and clout to oversee the development of the coordinated applications packages needed by the firm. This also is understandable given the shortage in well-trained, highly-qualified managers and executives.

Computer Budgeting and the Planning Cycle

There should be no question that computer expenditures be included in the budgetary process and the planning cycle in companies. From time to time, the spectrum of possible computer applications must not only be set up but also be kept current. Likewise computer possibilities must continually be explored. Computer proliferation means an inordinately complex mix of hardware and software combinations which, as part of computer facilities, can provide computer user-focused services. The challenge at the beginning is to develop an economic technology and services fit among all the important elements to the computer puzzle.

Computer Resources and Obsolescence

Computer resources once acquired must be husbanded as befits the substantial investments they frequently entail. Computer facilities are accumulated by companies over time. Computer talents and skills resident in the company's professional staff and work force are also at hand in varying quality levels over time. All these—and more—make up the computer resources for companies.

In husbanding computer resources, we believe it is important to pay attention to computer obsolescence in a way reminiscent of the "new-lamp-for-old" tale of long ago. A new lamp is not necessarily better than an old, especially if the user setting and context is analyzed. For example, even today, first generation (vacuum-tube) computer equipment are in operation for the US Air Force defense network. After several computer generations and many updating studies, Air Force experts have concluded that the original computer equipment though now quite ancient are still adequate.

Obsolescence can be very different if viewed from the computer manufacturer versus the client company standpoint. Vendor releases may surely

render any computer system obsolete. Yet users may continue to find their existing computers to be adequate and quite satisfactory. After all, when car manufacturers announce and make available their newest car models, not all customers are driven to junk their existing cars and mortgage their future to afford acquisition of the newest equipment. Conversely, if users find their requirements to be best met by the latest models, then, we believe companies should not hesitate in acquiring these new(er) equipment.

Computer Use is a Living Thing

Using a computer effectively is a living thing. Company requirements change. Computer technology changes even more rapidly. Business and industrial firms are *not* necessarily doomed to failure in following in the footsteps of those other firms who jumped in earlier periods and suffered. The concepts and techniques presented in this paper can be used in ways which serve to bypass or avoid the mistakes of others. In our experience, one of the best ways this can be brought about is by means of a company-wide Computer Council which is set up not on an ad-hoc basis. This Council can be charged with shepherding the company's computer resource and thus should be made up entirely of executives and managers with a direct stake in computers within the company. This Council need not have an inordinate burden in meetings; it would be the unusual case where they need to meet each and every month. Frequently they might discover that meeting 2 to 3 times a year covers all substantive issues adequately.

Summary

We have addressed the issue of effective computer planning. We have raised points we believe to be useful for top management. We know from our professional and work experience that what we have covered here works in actual practice.