Strategy for the '70's: stay flexible with datacomm investments

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In the past, many managers have failed to survive periods of drastic changes in their field. For data communications managers, the problem is acute since information processing is one of today's fastest changing environments. Here's a management survival plan for the 1970's, based on maintaining flexibility in data processing and communications investments.

I think that it is a reasonably safe statement to say that little in human experience is comparable to the rate of technological change we have been experiencing in our information systems activities. When we examine the history of developments in tools serving mankind, we find that centuries and, in rare instances, decades must pass before an institution or tool improves by an "order of magnitude"—or a factor of ten. For instance, in weapons development, it took approximately 300 years to go from a muzzle loading rifle to a cartridge loaded by means of bolt action—approximately a ten-fold increase in fire power. Another revolutionary technology—aircrafts—consumed 30 years to evolve from a DC3 to the modern four-engine jet airplane and thereby improve its load-carrying capacity per dollar by a factor of ten.

History tells us that any time we are confronted with technology changes of an order of magnitude, we are confronted with significant collateral structural changes which have broad management implications. Just think of the political consequences due to changes in weaponry or commercial and cultural realignments arising from low-cost universal travel.

Well, all of the changes of the past pale by comparison with the order of magnitude improvements we have been realizing steadily since the early 1950's every five to six years in the computer field. Consider further the current rate of inventions coming out of our laboratories. There is little doubt in my mind that the rate of change will continue unabated for the balance of our careers in information processing, which is a personal way of looking at reality.

As an industry—or profession, if you please—we have witnessed the elimination of generation after generation of whole layers of managers who simply did not survive the onslaught of change when their environment drastically altered under their feet. What follows is one manager's strategy for longer-term survival under conditions of stress and change in the information processing field. Essentially, it is a question of maintaining flexibility in data processing and communications investments.

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Protecting past investments during growth

As the initial lesson on "flexibility" and protecting "investments," let us first define our terms.

The most visible part of our investment is *application code*—about four million lines on a worldwide basis. This code resides in computers made by every conceivable computer manufacturer in addition to our own Sigma systems. Over 85% of the code is written in Cobol. As a matter of fact,

at Xerox we code in a specially restricted version of Cobol which is subject to software audit checks. This code, valued at in excess of 50-million dollars—at development cost—is in fact residing in hardware of considerably less capital cost. This insight leads us to the first startling conclusion about flexibility in "hardware": Look at your software costs before considering hardware trade-offs.

Let me dramatize this point perhaps another way. Our investment represents between 1000 and 2000 man-years of programming labor; and since at least 50% of the programming force is always tied up on maintenance anyway, the idea of abandoning any large amounts of accumulated code becomes simply unthinkable. Therefore, one of the principal strategies for any data processing executive is to manage his hardware so as to incur minimum losses in his software investments.

The next most prominent part of the investment is our files—about nine-billion characters of disk on-line storage in the U.S. alone, and in excess of 75,000 reels of magnetic tape. Even though the value of this data to our corporation exceeds the value of our application investments, the files themselves are a relatively high turnover commodity and represent a much less significant hurdle in terms of the cost to change, even though radical changes in file organization techniques can be exceedingly expensive. The primary strategy is therefore to keep upgrading continuously your file media on an incremental cost-performance basis.

Third in importance are your commitments to the systems software surrounding your hardware investments by job codes, control languages, communications protocols, special routines, library conventions, and the like. Your attachment to these conventions are the most subtle elements of your tie-in with a particular hardware since it is rare that systems software investments are made in any overt way. Mostly, your organization gradually drifts into the cozy envelope of methods which, in each particular tack, is supposed to aid you in improving productivity. Recently, I tried to make an assessment of the magnitude of this software and, to my great surprise, discovered that for large computer systems this type of software can easily account for three to ten times the total amount of application code written by a user, and *at cost* be 40 to 80 times more expensive than the hardware sales price.

Lastly, your investment is made up of the management and technical know-how of your organization to make cost/effectiveness/flexibility trade-offs. At one extreme, you can place total reliance on your hardware supplier to make all of the decisions for you and hence you can avoid making any resource commitments to this area. At the other end of the spectrum, you can mobilize your talent to continually seek for the best possible approach that would yield results for which you could be fully accountable.

Managing $100-million worth of info tools

In what follows, I will be describing the Xerox strategy to managing over $100-million of assets in internal information processing tools.

Strategy #1: Decentralize Equipment Analysis and Initiative. Even though repeated attempts have been made over the years to superimpose standardized solutions to hardware configuration and planning, I find that much strength and innovation comes from an environment where many components of a large corporation are encouraged to seek their own unique solutions. For instance, the trade-off decision between batch processing, remote job entry, and time sharing has evolved in a much more flexible manner by not relying on a central staff to mastermind technology development. It is important to realize that large centralized data processing installations are basically conservative and become frequently over-identified with a particular manufacturer, who in turn reinforces monolithic planning.

At Xerox, we are not afraid that local units may overdo this initiative; occasional failures are a low price to pay for high motivation to innovate.

Strategy #2: Use Multiple Vendors. Our firm has benefited enormously from a highly competitive approach to securing the most cost-effective solution to our data processing problems. This policy has sharpened the ability of our organizations to deal with change and diversity and has forced our software development to consider flexibility as a design variable which will be surely tested sooner or later. Let me cite a few examples:

- We use main frame equipment supplied by five major vendors and an endless variety of peripheral gear.
- Except for purchased main frames—which account for less than one-half of all computers in the U.S.A.—all other medium- and large-scale main frames are leased through leasing companies. Altogether, we do business with four different leasing companies.
- We have little hesitation to add multiple vendors to the same main frame. As an example, one of our large computers has seven different vendors, one each for CPU, add-on core, large-scale core storage, disks, tapes and printers, communications front end, and terminal displays.
- We issue RFP's (requests for proposals) to multiple suppliers, including sources with a different set of technologies.

A few months ago, we awarded a national contract to a time-sharing service organization after receiving bids from vendors offering solutions calling for: medium size on-site computers with cabled terminals; multiple accounting machines; totally interactive time sharing; and partially interactive time sharing.

I could cite many other examples of pursuing diversity which at times may seem lack of coordination. Nevertheless, the important point to remember is that an organization will pursue alternatives and flexible solutions only if management will in fact allow it.

Strategy #3: Have a Strong Standards Program. Standard documentation, standard routines, standard Cobol, standard data center library procedures, and many other elements are absolutely essential for containing escalating conversion costs since flexibility is gained, in the short run, usually at the expense of incurring some conversion expenses. On a worldwide basis, we have six full-time professionals dedicated to a vigorous standards activity.

Strategy #4: Gain Experience in Conversions. To have flexibility, your organization must not be afraid of conversions and must know how to manage it successfully. If you do not have a cadre of people who are well seasoned in this area and who do not know how to estimate costs, your claims of having hardware investment flexibility will not be believable.

Strategy #5: Use Outside Resources. Flexibility does not apply only to hardware technology. With escalating workloads, you need to have a carefully conceived *capacity flexibility*. Two years ago, we made a conscious policy decision not to provide any more 100% computing capacity internally and go outside for 5-8% of our processing requirements. I am pleased to say that this new policy has worked out exceedingly well and provides not only an opportunity of buying "peaking" computing power at most attractive prices, but has also added a highly desirable competitiveness into our organization.

It may be also worthwhile to note that our research, engineering and financial analysis people have always used remote access computing resources as a means of gaining access to specialized software facilities. Since our internal data processing organization charges internal users for services rendered using *equivalent competitive market prices*, you can see that we are continually forcing a re-balancing of the methods of using computing resources.

From a managerial policy standpoint, this approach of arriving at a good make-versus-buy equilibrium will most likely account for the strongest influence pushing diverse users towards seeking increased flexibility in the deployment of computers in Xerox.

Strategy #6: Acquire Systems Integration Capabilities. We are realizing annual savings well in excess of $5-million by means of: leasing company discounts; plug-compatible peripherals; specialized processors; unique modems and diverse terminals. Even so, these savings do not come free. As a collateral safeguard, our organization had to develop and refine skills by which we can project systems performance under a variety of conditions with a fair degree of confidence. For example:

- Using hardware monitoring equipment, our analysis personnel have found new flexibility in using older disk technology and as a result, managed to extend the life of these devices by at least one year.
- By devising a special core management routine, we have been able to forego conversion costs of a teleprocessing network to a much larger main frame.

Strategy #7: Do 10-Year Planning. All of the strategies described above were essentially of a tactical nature—the use of attractive alternatives to move our information systems activities towards a broader spectrum of services while maintaining, at the same time, a driving force towards cost reduction.

Unfortunately, all tactical moves have tactical penalties associated with them. With each succeeding year, increased volumes as well as extended demands for services will push the existing systems configuration to its limit. When and how this limit is reached depends largely on your industry and on the trade-offs available in your organization between escalating administrative costs, rising systems maintenance expense, increasing systems failure rate, and cost reductions attainable through a major strategic overhaul in the basic architecture of your information flow.

In Xerox we have just completed a three-year effort, culminating in two successive iterations of a 10-year plan, in looking at the basic information processing logistics for the end of the 1970's and early 1980's. We were confronted with an extraordinary increase in the number of on-line terminals desired to serve our info systems needs.

After elaborate design studies, we concluded that our needs would be best served in the future by departing from the current approach to a much more flexible information architecture with the following main components:

- A data base processor;
- An array of applications processors;
- Multiple communications and input/output processors;
- Communications concentrators;
- Local minicomputers, with local logic and files; and
- Microprocessor terminal cluster controllers.

According to this new architecture, a transaction may be directed to pass through at least six processors in and six processors out before being completed. We will be evolving into this architecture gradually, in carefully pre-determined stages so that each incremental move will yield to us discernible new savings without completely obsoleting the accumulated investments of the past.

I believe that this poly-centered approach to information systems architecture is just beginning to emerge. It will be calling for new and highly diversified management skills. The design processes to achieve the objectives of these new systems will be as different from current systems as multi-divisional enterprises are from small single proprietorships from which most of our industry has originated.

To summarize our vision of the evolving future of our information systems activities:

- Even though hardware flexibility may be our stated objective, its attainment can be approached only indirectly.
- Even though technology remains the force which unbalances the *status quo* and drives for an increased search for newer and newer options, the decisive variable remains our ability to plan, innovate and manage ventures with unprecedented complexity.

The history of industrial progress has been marked by the proliferation of technical and management skills which, at a prior time, were held only in the possession of a few enterprises. I see no reason why this trend should not be repeated on an accelerated basis within your own organizations. This means that you will have to start placing much higher demands on your information systems people to start engineering not only computer applications but also new environments capable of responding to new demands much more rapidly than heretofore■